NATIONAL EARLY INTERVENTION LONGITUDINAL STUDY
EXPENDITURE STUDY

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NEILS Data Report No. 4

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Executive Summary

Background

Part C of the Individuals with Disabilities Education Act (IDEA) provides federal funds to assist states in planning and implementing a system of early intervention services for children from birth to the age of three. The primary role of Part C is to facilitate the coordination of federal, state, and local early intervention resources to implement and enhance a state's system of early intervention services.

The National Early Intervention Longitudinal Study (NEILS), conducted at SRI International (SRI), is a longitudinal study of a nationally representative sample of children who are participating in early intervention services through Part C of IDEA. The focus of the overall study is to identify the characteristics of early intervention recipients, the services received and their costs, and the outcomes achieved by children and their families.

The expenditure study, a component of NEILS, was conducted through a collaboration between the American Institutes for Research (AIR) and SRI to bring together the expenditure, services, and outcomes data on early intervention. While the SRI main study traces the children, their families, and the services they receive, AIR's expenditure study estimates the expenditures associated with providing and supporting such early intervention services.

Objectives of the Study

The main objective of the study was to estimate the average monthly and total expenditures for the typical child receiving early intervention services in the United States. The analysis explored the range and variations of average monthly and total expenditures along several dimensions: by endowments (e.g., disability-related characteristic), social background, types of services received (e.g., direct service, administration and support), and the service environments in which they are provided (e.g., home or center-based services).

Another focus of the study was to explore the relationship between the level of spending on early intervention services and the outcomes experienced by children at age 36 months. The analysis focuses on outcomes data gathered by SRI, and evaluates to what extent variations in services or resources utilized by children and families can explain the outcomes of children at 36 months.

General Approach

This study used the "ingredients" approach or Resource Cost Model (RCM) to analyze early intervention expenditures. The RCM represents a bottom-up methodology for organizing and analyzing resource allocation data. Resources, or ingredients, are organized according to the way they are delivered to the client, in this case, the child and family. For example, in the present study, resources were identified by job title (e.g., infant/toddler specialist, speech therapist, psychologist, family counselor), by setting in which services are delivered (e.g., in the home, a center-based facility, a clinic, school, or hospital), and the size of the group within which the service is provided (e.g., the total number of children or families receiving service at the same time).

The expenditure analysis was based on a sample of 2,195 children who entered the early intervention program between September 1997 and November 1998. In developing the resource cost model, a data collection form that captured information about the nature of services provided in the previous six months was the centerpiece of the child-level expenditure analysis. This form was completed by the service provider identified by the program as most knowledgeable about the child's services. Each service record was analyzed to determine the type and amount of services received by the child, which environment each service was received in, and ultimately, the 'resource price' for each type of service received.

AIR's own data collection efforts focused on collecting additional fiscal information from the institutions responsible for providing early intervention services. The AIR study sample consisted of 200 early intervention agencies that were contacted of which approximately 160 responded. Important salary and budget information (e.g., hourly wage rates, fringe benefits, and overhead costs) were collected from these sites to form the main ingredients of the resource cost model.

Summary of Findings

Funding of Early Intervention

- **Sources of funding for early intervention -** Early intervention agencies use a blend of funding sources to finance the early intervention program. Data show that 86 percent of early intervention agencies reporting revenue receive funding from the state, 64 percent from federal government, and 47 percent from local sources.

Total and Monthly Per Child Expenditures in Early Intervention

- **Overall total and monthly per child expenditure** – The average monthly spending on a child who receives early intervention was $916. The average child stays in early intervention for 17.2 months[1] translating into a total spending of $15,740 for this child for the entire intervention period. This total spending includes $10,709 (or 68 percent) in direct services, and $5,031 (32 percent) in early intervention support services.

- **Variations in total per child expenditure** – The total per child spending varied across disability-related conditions due to the varying needs and length of stay in early intervention. Children with only speech delays generally have the shortest average duration in early intervention (9.7 months) and also the lowest average total expenditure ($6,228). On the other hand, a child with a diagnosed condition and who stays on average for over 20 months incurs a total expenditure of over $22,000. When multivariate regression analysis is used to control for duration, as well as other factors that may be related to both disability-related condition and total expenditure, the predicted differences in total average expenditure between those with a diagnosed condition, developmental delay and solely a speech delay decrease considerably while the relative differences between these groups and the at-risk category become larger. Factors that appear to be significant determinants of expenditure on early intervention include: disability-related characteristic, general health at entry into early intervention, participation duration, household income and parental composition of household. Further analysis shows that being in poor or fair health at entry into early intervention is a strong determinant of total and monthly expenditures for those with diagnosed conditions. In addition, the positive relationship between participation duration in early intervention and expenditures varies across disability-related condition.

- **Variations in monthly average expenditure** – The average monthly spending varies across disability-related conditions. For example, monthly expenditure ranges from $549 for a child considered at risk to $1,103 for a child with a diagnosed condition. Using multivariate regression analysis to control for factors that are potentially related to both disability-related condition and monthly expenditure produces similar results to the regression analysis describing total expenditures.

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[1] Based on the study sample who entered early intervention between birth and 31 months of age.

- **Expenditure patterns and service environments** – In terms of order of magnitude, the percentage share of expenditures spent in each environment is similar across the four disability-related characteristic groups. For every category, services delivered in the family home account for the largest share followed by those provided in center-based settings, clinics and offices, day care and preschool, and other settings. For the at-risk population a majority of the monthly expenditure is allocated to services provided within the family home (59 percent), with roughly an even split between that spent on center-based services and in a clinic or office (16 percent). This finding is in line with the fact that at-risk children enter early intervention at younger ages and younger children are more likely to be served in a home setting. In contrast, the expenditure composition of the speech-only and developmentally delayed groups, who are older when they enter early intervention, have smaller expenditure shares allocated to services in the home with a shift in resources devoted to center-based services.

Relationships Between Early Intervention Spending and Outcomes at 36 Months

- Findings regarding the relationship between expenditure and child functioning at 36 months showed that higher expenditures are associated with worse outcomes. This seems to be at odds with what one might expect. However, it is not appropriate to interpret this observed relationship as a suggestion that higher expenditures and corresponding elevated levels of service *cause* children to have lower functional levels. Rather, what is likely being observed is that the initial severity of a child's condition largely dictates the amount of resources allocated for early intervention services in addition to influencing the outcome at 36 months. That is, children entering with relatively high levels of need are likely to need higher levels of funding **and** are probably also more likely to show less improvement in health and/or functioning at 36 months of age. Children with the most serious needs showed improved outcomes relative to where they started but they were not functioning as well at 36 months as children with fewer needs.
- Ideally, in order to properly measure the efficacy of early intervention services and relate this to the cost of these services, it is desirable to conduct an experiment in which individuals are randomly assigned to varying levels of service. However, providing different levels of service to children *independent* of their needs is clearly illegal since states are required to ensure that appropriate services are provided to all infant and toddlers with disabilities and their families. Because of this, alternative estimation methods were necessary. This study adopts a second-best approach in which multivariate regression models are employed that account for severity of condition at time of entry into early intervention as well as additional factors likely to determine outcomes of early intervention recipients. In general, the multivariate models employed find little significant relationship between expenditures and a child's condition as measured at 36 months. In a very few cases, expenditures are negatively associated with a child's condition at 36 months, but the magnitude of the effect is negligible. For the most part, the results show that severity of need at entry was strongly related to severity of need at exit.

Chapter 1
Overview of Study

Background on Early Intervention

Part C (originally Part H of PL 99-457) of the Individuals with Disabilities Education Act (IDEA) provides federal funds to assist states in planning and implementing a system of early intervention services for children from birth to three years old. The primary role of Part C is to facilitate the coordination of federal, state, and local early intervention resources.

To receive federal Part C funds, states are required to comply with several provisions of IDEA, among which include a requirement to build a coordinated system of early intervention services with oversight from a state lead agency. This lead agency is also responsible for the overall administration and supervision of early intervention programs or services that receive Part C funds. In addition, the law requires states to define the eligible population and gives states the option of including at-risk children in their Part C-eligible population.

The implications of Part C are far reaching. By focusing on the support of infants and toddlers with disabilities and the family's need for early intervention services, Part C is intended to facilitate collaboration between families and early intervention professionals. It is also intended to improve the local delivery system of services through better coordination among agencies. In particular, the law assumes the quality of services provided to children with disabilities and their families will be enhanced through the development and adherence to an Individualized Family Service Plan (IFSP) and through provision of services in natural environments such as home or community settings.

The National Early Intervention Longitudinal Study (NEILS) — Program Expenditure Component

The NEILS, conducted at SRI, is a longitudinal study of a nationally representative sample of children and families who are participating in early intervention services through Part C of IDEA. The focus of the study is on describing the characteristics of the recipients of early intervention, the early intervention services received, and the outcomes children and families have experienced.

Because IDEA Part C revenue represents only a portion of the funding for early intervention services, other federal programs (e.g., Medicaid, Maternal and Child Health), state and local revenues, and private sources make up the rest of the funding needed to serve these children and families. Despite the economic impact of Part C, accurate data that show the amount spent on early intervention services have generally been lacking. Moreover, the present study represents the first national study conducted with support from the Office of Special Education Programs, in the U.S. Department of Education, to explore the patterns of spending on early intervention services and the relationship between spending, child characteristics, and program outcomes.

The program expenditure component of NEILS was conducted through collaboration between the American Institutes for Research (AIR) and SRI, and was designed to bring the expenditure and outcomes data on early intervention services together. While the SRI main study traces the children, their families, and the services they receive, AIR's expenditure study estimates the expenditures associated with providing and supporting such early intervention services. In addition to providing much-needed expenditure information for this program, the study also explores the relationship between expenditures and outcomes.

Research Questions

The study addresses the following four research questions:

- **What are the sources of funding for early intervention?** The Part C program is payor of last resort, i.e., Part C funds may be used to supplement the level of funds expended for infants and toddlers, and in no case, to supplant these funds. Because of this, revenues from both state and local sources play a particularly important role in the funding of early intervention services. To address this issue, the study provides a descriptive analysis of how funding for early intervention services is split between federal, state, and local sources. In addition, a more in-depth look is taken within each revenue source (federal, state, and local) to determine from which programs funding is drawn.

- **What is the average per child expenditure on early intervention services and how is this spent across types of service and service environments?** This question is addressed by analyzing the average total and monthly expenditures across children receiving early intervention services. A descriptive analysis explores the range and distribution of average expenditures broken down by disability-related characteristic, type of service (e.g., direct service versus administrative support) and service environment (e.g., home or center-based services), and duration of stay in early intervention.

- **How do expenditures vary across child and family characteristics?** The population of children who receive early intervention services represents a diverse range of needs that vary by disability-related condition, social background, and/or community. This piece of the analysis focuses on several factors that are likely to explain variation in early intervention expenditures. These include duration of stay in early intervention, the disability-related condition making the child eligible for participation in early intervention, and a variety of socio-economic and community characteristics that may impact a family's utilization of early intervention services. To isolate the impact of each child and community characteristic, a multivariate approach was used that controlled for the effects of all of the above-mentioned factors simultaneously.

- **What is the relationship between expenditures and outcomes of participants in early intervention at age 36 months?** This analysis explores the relationship between the level of spending on early intervention services for children and the overall benefits children have received from these programs at age 36 months. The analysis focuses on outcomes data gathered by SRI, and evaluates to what extent variations in services or resources

utilized by children and families can explain the variation in outcomes of children at 36 months.

Methodology and Data

Two innovative aspects of the report that merit discussion are the methodology used in the data collection process and the unique data set that has been accumulated. The following section provides important background information that will aid the reader in understanding the analyses that follow.

This study uses the "ingredients" approach, or the Resource Cost Model (RCM),[2] to estimate early intervention expenditures. The RCM is a "bottom-up" approach for organizing and analyzing data on resources and service delivery. Resources, or ingredients, are organized according to the way they are delivered to the client (in this case, the child or family). Expenditures are estimated by assigning a unit price (e.g., the hourly wage and benefit rate) to each specific ingredient or resource.

For the analysis presented in this report, the child's service data are organized around the specific professionals or resources (e.g., teachers, therapists and medical professionals) who provide services within various environments (e.g., the child's home, a child development center, a clinic or a hospital). Based on information provided during the data collection, AIR was able to assign each resource to a particular program type (e.g., a school district, community-based program, or hospital) and a location in order to capture all of the dimensions of expenditure associated with differential rates of pay, fringe benefits, program administration and overhead. The resource cost model constructed for this analysis also identified the patterns of services received over time by each child from the year in which the child entered the program to age three (or the point at which the child exited the program), and the expenditures associated with these services.

In developing the resource cost model, the Service Records[3] were the centerpiece of the child-level expenditure analysis. These were semi-annual reports from service providers on the specific services delivered to participating children and families. The surveys provide information on the type and amount of services delivered to the child, and the location or setting in which the service occurred.

Children varied in the number of service records available. The maximum number of service records a child in this sample could have is six. This is for a child who began early intervention shortly after birth and continued to receive services until 36 months of age. The minimum number of service records was one, for a child who entered near 30 months of age. Each service record[4] was analyzed to determine the type and amount of services received by the child, and ultimately, a "resource price" was established for each type of service received by the child.

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[2] For more detailed descriptions of the resource cost model applications, see Parrish (1994) and Chambers & Parrish (1994).

[3] The Service Records (SR-A, SR-B) were developed by SRI to collect child-level information on types and quantity of services received and are available at www.sri.com/neils.

[4] Each service record of the child was checked to verify the completeness of usable data in terms of quantity and types of service. Records without usable data were not included in the resource cost model.

The NEILS includes a nationally representative sample of 3,338 children who entered early intervention between September 1997 and November 1998.[5] The expenditure study is based on a sub-sample of 2,195 children who had sufficient data from the service records to allow a complete expenditure analysis.[6] Appendix F provides the detailed tables that support the expenditure analysis results presented in this report. This appendix demonstrates that there is no discernable bias in the sub-sample of children and families used for the expenditure analysis.

Due to non-response to questions in the Service Records and/or missing Client Service Records for certain children, imputation procedures were performed to obtain the best estimates of the expenditure history of each child. Appendix A provides an overview of the method used to impute these unavailable portions of the early intervention expenditure.

Aside from the data provided by the Client Service Record questionnaires, the study also incorporates several important data sources from SRI, including the following: *Program Director Survey*, *Service Provider Survey*, *Enrollment Form*, and *Family's Interviews*.[7] The *Program Director Survey* provided information to classify the types of programs (e.g., school district, community-based, or hospital) from which the child received services.

The *Service Provider Survey* provided information that AIR used to estimate pay rates and indirect hours ratios for various categories of service providers (e.g., teachers, therapists or medical professionals). The indirect hours ratio is an estimate of the total hours required by particular types of service providers to provide one hour of direct services to a child or family. That is, for every hour an infant development specialist spends in direct contact with children, he or she spends some additional time involved in preparation, documentation and reporting, and traveling (e.g., to and from the home).

The *Enrollment Form* and *Family Interviews* provided additional information about the child and family that is used in classifying the family and the child for purposes of analysis.

SRI's information sources represent a remarkable collection of child-level and institutional-level data. AIR's own data collection efforts focused on collecting additional fiscal information from the institutions responsible for providing early intervention services. This information collected by AIR supplements the SRI data and fills in the gaps to estimate total expenditures.

The AIR study sample consisted of 200 early intervention agencies that form a representative subset of the universe of agencies or programs that completed and returned the Program Director Survey across the 20 states included in the NEILS sample. These agencies were asked to complete three sets of self-administered expenditure surveys,[8] specifically designed to gather important salary and budget information to form some of the essential ingredients of the resource cost model.[9]

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[5] See the NEILS Methodology Report 1 by Javitz et.al. (2002) for a detailed description of the sampling process.
[6] The average child in NEILS had 75 percent of the service records returned by providers.
[7] Appendix B shows a description on how these different instruments were utilized.
[8] These surveys were *Expenditure Survey Part I: Payroll Information; Part II, Budget and Child Count Information; and Part III Professional Services and Clients Served by Setting*.
[9] Appendix C lists the design and purpose of these surveys.

These data were used to estimate appropriate fringe benefit rates and a series of multipliers to estimate expenditures on program administration and overhead. Appendix D provides a more detailed description of how the various surveys and data sources were organized to create the various calculations that underlie the expenditure estimates used to construct the resource cost model.

It should be noted that all data presented in this report are weighted to reflect population estimates. This means that the results are nationally representative of the estimated population of early intervention recipients and their families.

Organization of Report

The remainder of the report will be organized as follows: Chapter 2 provides a brief overview of the sources of funding for early intervention services. Chapter 3 follows with an investigation of the expenditures on early intervention services that includes both descriptive analyses and more in-depth multivariate regression analyses. An investigation of expenditures and subsequent outcomes associated with early intervention is contained in Chapter 4. The final chapter summarizes the results and offers some concluding observations.

Chapter 2
Sources of Federal, State and Local Revenue for Funding of Early Intervention Services

IDEA Part C funding is considered to be a payer of last resort, which means that this federal funding should generally not be used to pay for direct early intervention services when other sources of public and private funding are available. It is considered "glue" money to assist in the planning, implementation, and coordination of services in the states. States bear the largest burden in financing their early intervention systems, with the remainder being covered by a mix of federal and local revenues. Therefore, it is of interest to explore these three funding sources used to support early intervention programs. To this end, AIR collected budget and revenue data from 115 early intervention agencies and programs that participated in NEILS.[10]

This study reports the percentages of agencies that receive various sources of funding, rather than the actual amount of revenue received. This is because during the course of data collection, it became apparent that while most agencies could report the sources of funding (federal, state, local), they had difficulty reporting the precise amount of funding and/or breaking down the revenues by sources. Therefore, the revenues reported may not be reliable enough for a more detailed analysis.

Exhibit 2.1 shows the percentages of early intervention agencies that receive federal, state, and local revenue. It also shows the various *types* of federal, state, and local funding sources that early intervention agencies utilize to support their services. The percentages listed represent duplicate sources of funding, since an agency may receive revenue from more than one source.

The exhibit shows that 64 percent of the early intervention agencies reported receiving revenue funding from federal sources, 86 percent from state government sources, and 47 percent from local sources. It also shows several federal funding sources. Almost 40 percent of early intervention agencies receive federal IDEA Part C funding, followed by Medicaid (16 percent), and Civilian Health and Medical Program of the Uniformed Services (CHAMPUS)/TRICARE[11] (13 percent).

There was also a variety of state funding sources for early intervention. Seventeen percent of the early intervention sites reported receiving Medicaid Early Intervention System State Match, while 37 percent have "other" sources of state revenue.[12] Almost one out of ten (8.6 percent) of these sites indicated that they collect fees from privately managed care, Health Maintenance (HMO), Preferred Provider Organizations (PPO). Interestingly, 5 percent of the agencies reported that they receive funds under state initiatives.

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[10] The original sample of early intervention agencies consisted of 200 sites that were selected from the pool of over 600 that returned the Program Director Survey. Because it was not possible to estimate the total number of early intervention agencies across the nation, the current results were weighted to this "universe" of 600 sites. These agencies include those that serve the nationally representative sample of children used for the NEILS analysis.

[11] TRICARE is the US Department of Defense health care program for members of the uniformed services and their families. CHAMPUS is now part of the TRICARE medical program.

[12] A majority of respondents did not specify what sources the "other" categories included. It is quite possible that the blending of federal and state funds made it difficult for respondents to disaggregate these categories.

Fewer programs reported receiving funds from local sources. Twenty percent of early intervention programs collect fees from private insurance, 18 percent receive donations from philanthropic organizations or foundations, 17 percent receive locally raised revenue other than taxes, and 12 percent collect fees from the child's family to support their services.

Exhibit 2.1. Percentage of Agencies Receiving Revenue from Specific Federal, State, and/or Local Sources

Sources of Federal Revenue

Source	Percent
Federal (overall)	64.0%
IDEA Part C	39.0%
MEDICAID	16.0%
CHAMPUS/TRICARE	13.0%
Other	6.7%
Funds for Developmental Delay	1.3%
IDEA Part B	1.3%
S-CHIP (Title XXI)	0.9%
Ryan White CARE Act (AIDS Funds)	0.9%
Early Start	0.9%
Child Care Block Grants	0.9%
Title XX SSBG	0.7%
Early Head Start	0.6%
Funds for the Homeless	0.4%
Impact/Aid/DOE	0.2%

Sources of State Revenue

Source	Percent
State (overall)	86.0%
Other	37.0%
Medicaid EI System State Match	17.0%
HMO/PPO/IPA (private managed care)	8.6%
State Governor's Initiatives	4.6%
State Maintenance of Effort (TANF)	2.9%
Head Start	1.7%
IDEA Part B	1.5%
Healthy Families Initiative	0.5%

Sources of Local Revenue

Source	Percent
Local (overall)	47.0%
Private Insurance	20.0%
Philanthropic Organizations/Foundations	18.0%
Locally Raised Revenue Contributions	17.0%
Other	16.0%
Family Fee	12.0%
Locally Raised Tax Revenue	8.7%
Family Co-pay	4.2%
Provider Contributions	2.5%

Percent of Early Intervention Population

Exhibit 2.1 reads: 64 percent of early intervention agencies/programs received federal sources of revenue.

Chapter 3
Patterns of Expenditures in Early Intervention

This chapter presents the findings on the expenditure patterns for early intervention (EI) in the United States. The first section presents a descriptive analysis of how early intervention expenditures vary by disability-related condition, type of service (i.e., face-to-face services versus administration and support), duration in early intervention, social background such as race and household income, and service environment. This is followed by a more formal multivariate analysis that simultaneously estimates the effects of the various determinants of expenditures explored in the first section.

The NEILS dataset contains a wealth of information, from which factors thought to affect EI expenditures have been extracted. In addition, these data have been supplemented with information drawn from the 1990 U.S. Census to account for expenditure variations due to regional and/or demographic differences. The variables used in the regressions can be grouped into three categories: individual characteristics and duration, social background, and community/regional characteristics. Clearly, the characteristics of the child related to health and disability should determine his or her need for EI services. Social background may also play an important role in the use of, and subsequent expenditure on, EI services. Finally, due to regional variation in EI delivery systems, quality of services, and costs, it is also prudent to include controls for various regional factors. The variables associated with the three clusters are as follows:

- Individual characteristics and duration in EI
    1) Disability-related characteristic (DRC) (i.e., at-risk, speech-only, developmental delay and diagnosed condition)
    2) Child's general health at entry to EI (i.e., excellent, very good, good, and poor/fair)
    3) Birth vulnerability index (BVI) – A composite index of the child's birth history based on gestational age, birth weight, and time in intensive care after birth, ranging from 0 (no difficulties) to 3 (most difficulties)
    4) Duration in EI (calculated in months)
    5) Gender of child

- Social background indicators
    1) Race (white, African American, Hispanic/Latino, Native American, Asian, and other)
    2) Maternal education level (less than high school/GED, high school/GED, college with no degree, bachelor's degree, or higher)
    3) Household income (less than or equal to $15,000, between $15,001 and $25,000, between $25,001 and $50,000, between $50,001 and $75,000, and above $75,000)
    4) Parental composition of household (only one adult in child's household, two biological/adoptive parents, one parent and his/her partner, and one parent with other non-partner adult(s) in household)

- Regional characteristics and indicators
    1) Percentage of county population uninsured
    2) County per capita income
    3) Percentage of county population above 18 with high school education
    4) Percentage of county population below poverty line
    5) County infant deaths per 1,000 births

Due to the longitudinal nature of the expenditure data presented in this study, all expenditures are expressed in present values. In other words, the time cost of money is taken into account, reflecting the fact that a dollar spent next year or the year after is not worth as much as a dollar spent today. This is important because many of the children included in the sample for this study received early intervention services over a period lasting as long as three years.

Because of non-response for certain items on the surveys or simply missing services records, expenditure histories were incomplete for some children in the sample. Where necessary, imputation procedures were used to fill in missing values necessary to create complete expenditure histories for as many children as possible. Appendix A provides an overview of the method used to impute these unavailable portions of expenditure.

Child Characteristics, Duration, and Expenditure

Children in early intervention represent a diverse range of needs. Based on information provided by service providers and parents at the time the child began early intervention, 38 percent of the children had a diagnosed condition, 31 percent had a developmental delay (without any diagnosed condition), 17 percent had only a speech or communication delay (without a diagnosed condition or any other delays) and 14 percent were at-risk of developmental delay. Children with these different disability-related characteristics begin early intervention services at different ages and stay in early intervention for different lengths of time. For additional information about how these four classifications were determined, see Spiker et al (2004).

Exhibit 3.1 shows the average age at which a child's IFSP was completed and average duration in early intervention, both over the full sample of early intervention recipients and broken out by disability-related condition. The chart shows the average age at IFSP for children receiving early intervention services to be 15.7 months.[13] However, this number may be misleading due to the variance in age of entry across different conditions. Children at risk of developmental delay and with diagnosed conditions tended to be identified earlier and receive early intervention services for a longer period of time than those with a developmental delay or with a speech delay. For instance, children characterized as being at risk enter early intervention at an age of 8.1 months on average, while those having a diagnosed condition enter at 12.5 months on average. Children with developmental delays or only speech impairments are generally identified at an older age, because these conditions are not readily recognizable at an early age when the child is not expected to have attained these developmental competencies, and subsequently enter early intervention at a later age (18.3 and 24.2 months for "developmental delay" and "speech only," respectively).

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[13] Figure is based on the study sample who entered early intervention between birth and 31 months of age.

Turning to the duration figures, the exhibit illustrates the (negative) relationship between age at IFSP and duration in early intervention. Children who enter the early intervention program later spend less time in the program.[14] For example, children with speech delays stay in the program for an average of 9.7 months. On the other hand, children with risk conditions who are diagnosed relatively early remain in the program for almost 2 years (23.2 months). At least in part, this results from the fact that children are no longer eligible for early intervention upon turning 3 years of age.

Exhibit 3.1 - Average Age at IFSP & Duration in Early Intervention by Disability-Related Characteristic
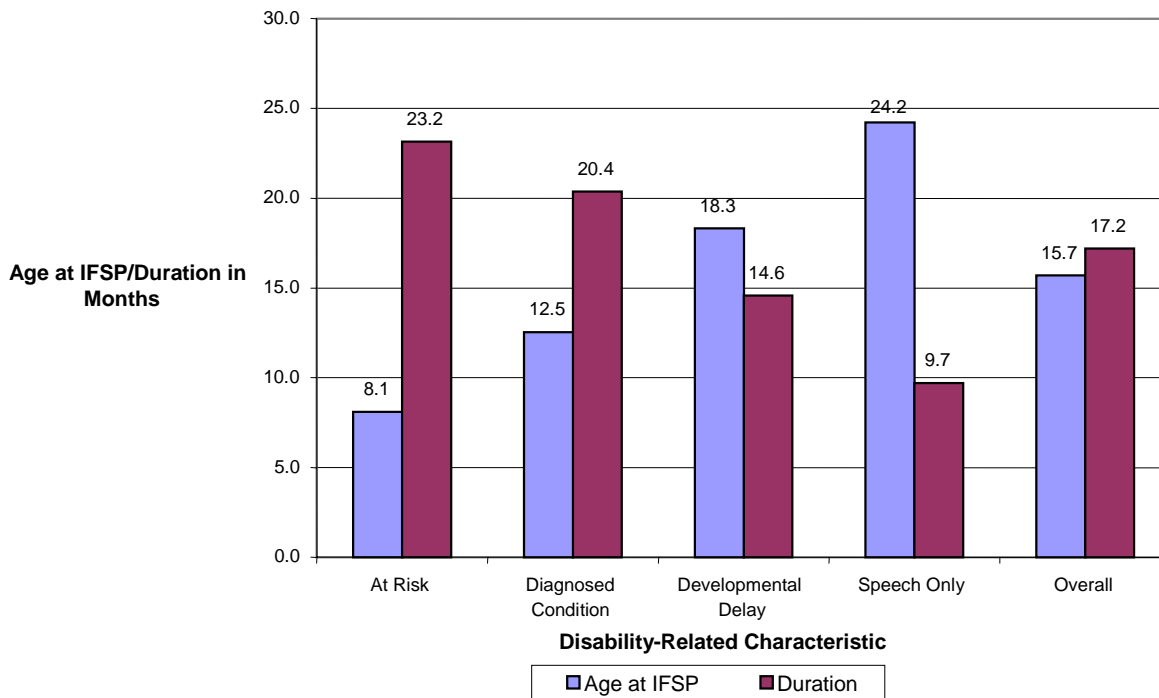
Exhibit 3.1 reads: The average child entered early intervention at 15.7 months and received services for 17.2 months. Children with diagnosed conditions entered at 12.5 months on average and stayed for an average of 20.4 months (full output including standard errors and numbers of observations can be found in Appendices F-1 and F-2).

Exhibit 3.2 presents formal t-tests of the differences in early intervention duration between the various disability-related characteristic categories (i.e., the differences between the second bar in each set in Exhibit 3.1). The results show that the children eligible for early intervention services due to being at risk stay, on average, 13.5 and 8.6 months longer than those with a developmental delay and a speech-only delay, respectively. Speech-only individuals receive services, on average, 4.9 and 10.7 months less than those with a developmental delay and diagnosed condition, respectively. Those with a developmental delay stay 5.8 months less than their counterparts with a

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[14] A more formal investigation of this relationship shows an almost perfect negative correlation between these two variables (–0.94).

diagnosed condition. There is no statistically significant difference in the average duration of children who are at risk versus those with a diagnosed condition.

Exhibit 3.2 – Tests of Differences in Duration Between Disability-Related Characteristic Categories (P-Value of Pairwise T-Tests in Parentheses)

	At Risk	Speech-Only	Developmental Delay
Speech-Only	13.5 (0.0319)**		
Developmental Delay	8.6 (0.0543)*	-4.9 (0.0791)*	
Diagnosed Condition	2.8 (0.1567)	-10.7 (0.0341)**	-5.8 (0.0689)*

Exhibit 3.2 reads: The difference in average duration between those deemed at risk and with only a speech or communication disability was 13.5 months. Alternatively speaking, on average EI participants categorized as at-risk participated in the program 13.5 months longer than those with a speech-only disability. Figures represent differences between weighted-averages specific to column and row categories. T-tests based on standard errors calculated using balanced repeated replication weights.
* significant at 10%; ** significant at 5%.

Exhibits 3.1 and 3.2 provide a good picture of how age at IFSP and the related duration in early intervention vary *across* different conditions, but it is important to recognize that there is a significant amount of variation *within* these categories and that the amount of variation itself varies across categories. To provide more information on the distribution of duration within these categories, Exhibit 3.3 presents the duration in the program for the quartiles (i.e., 25th, 50th, and 75th percentiles) for each disability-related condition.[15] In general, children with only speech delays or risk conditions have the lowest variation in the duration of the intervention, which suggests that the children in each of these categories probably enter early intervention at a similar age and/or follow similar service programs in terms of duration. For those in the speech-only group, the small variation is more than in part due to the older age at which speech disabilities can be identified, which clearly restricts the age range in which these children are eligible for early intervention services. In contrast, duration in early intervention for those with developmental delays or diagnosed conditions is more spread out, indicating larger differences in the age at which these individuals enter and/or in duration of their service programs. This finding is most likely due to a relatively greater heterogeneity in the latter categories that result in greater variation in services within their programs.

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[15] The duration variable covers the *actual* period over which a child is in early intervention, while age at IFSP merely measures the *potential* amount of time a child might have received services; in what follows we restrict the analysis to the former, which is more closely related to expenditures.

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Exhibit 3.3 - Distribution of Duration at Entry by Disability-Related Characteristic
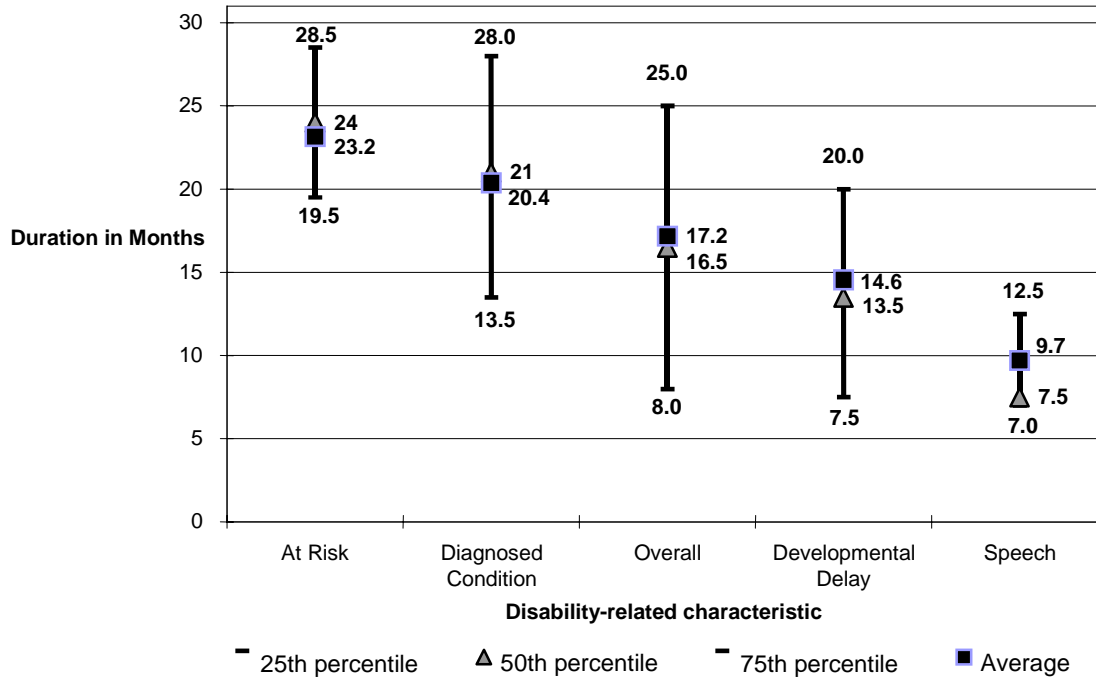
Exhibit 3.3 reads: Among children deemed at risk, the median or 50th percentile of duration (i.e., the duration at which 50 percent of the population stays longer and 50 percent stays shorter) was 24 months. The 25th percentile of duration for this group (i.e., where 25 percent of the population has shorter duration and 75 percent have longer) was 19.5 months.

The results thus far show significant differences in the duration spent in early intervention across the various disability-related characteristics. It follows then that average total expenditure per child on intervention services should also vary across child characteristics. With this in mind, Exhibit 3.4 shows the average total expenditure by disability-related condition broken out into the amounts spent on face-to-face services versus support services. In addition, the table provides the average duration and average monthly expenditure across the disability categories. Face-to-face service is defined as that portion of service that involves direct contact with the child and/or family. Face-to-face services include various types of early intervention services such as family support, physical therapy, and service coordination. The category of support services to early intervention reflects expense items such as program management, staff training, supervision and travel time, and general assessment or eligibility determination. It also includes the administrative responsibilities performed by direct service providers. It should be noted that the data collection methodology was not well suited to isolate the costs of service coordination. Service costs associated with face-to-face contact with the family are included in the face-to-face service costs. Other costs associated with service coordination such as telephone calls or paperwork are included in the category of

support services. Interestingly, the proportion of resources spent on face-to-face services versus administration and support is very stable across disability-related conditions.[16]

So, how much is spent on the average child who receives early intervention? The average total spending, expressed in present value terms, across all children receiving early intervention services amounts to $15,740.[17] The average child continues to receive early intervention services for 17.2 months. Spread over this average duration yields an average monthly expenditure of $916. Of the total expenditure, face-to-face services account for $10,709 (or 68 percent of the total), while $5,031 (or 32 percent of the total) is spent on administration and support.

Note that the descriptive analysis in this chapter only investigates the simple individual relationships between expenditures and various child, family, and community characteristics. Later in this chapter, the findings from a more complex multivariate regression analysis that controls for all of the mentioned factors simultaneously will be presented. *Unconditional* t-tests of differences in average expenditures (i.e., only conditioning for differences in expenditures across groups defined by the one variable under scrutiny) are not presented in favor of *conditional* tests (i.e., controlling for all observed factors simultaneously) of differences in the effects of belonging to a specific group, estimated using the multivariate approach. Readers interested in calculating unconditional (univariate) t-tests are referred to the tables in Appendix F for the full output of the calculated average expenditures across disability-related characteristics and other factors including their standard errors and numbers of observations.

Exhibit 3.4 - Average Total and Monthly Expenditure and Duration of Stay in Early Intervention by Disability-Related Characteristic

Disability-Related Characteristic	Total Per-Child Expenditure			Duration (months in EI)	Average Monthly Expenditure
	Average Total Expenditure	Face-to-Face Service Expenditure	Support Services to Early Intervention		
Overall	$15,740	$10,709	$5,031	17.2	$916
Speech-Only	$6,228	$4,228	$2,000	9.7	$642
Development Delay	$13,804	$9,385	$4,419	14.6	$948
Diagnosed Condition	$22,475	$15,289	$7,187	20.4	$1,103
At-Risk	$12,708	$8,682	$4,026	23.2	$549

Exhibit 3.4 reads: The average total expenditure for children with just a speech disability was $6,228, of which $4,228 was spent on direct services and $2,000 on administrative support. These children remained in early intervention for an average of 9.7 months over which $642 was spent on average per month. Due to rounding, the product of monthly expenditure and duration might not exactly match the total spending.

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[16] See Appendix F-3 for further details including the standard errors of the average expenditure.
[17] All dollar figures are discounted to the period over which the sample of children were selected: that is, September 1997 through November 1998.

In general, total average expenditure tends to rise as the duration of stay in early intervention increases. Exhibit 3.5 graphically depicts this relationship by charting the average total expenditure across disability-related condition, sorted by the average duration of the respective categories. The exhibit shows that children with only a speech delay have, on average, the lowest duration in early intervention (9.7 months) and also the lowest total expenditure ($6,228). As the duration increases the total average expenditure also rises, however, not perfectly. The exception is the total average expenditure on children in the at-risk category. They receive, on average, early intervention services for 23.2 months, but have a total average expenditure of $12,708 per child. This figure is lower than what is spent on the average child with a developmental delay or a diagnosed condition, both of whom stay in early intervention for shorter periods on average (14.6 and 20.4 months, respectively).

Exhibit 3.5 - Average Total Expenditure on Early Intervention Across Disability-Related Characteristic
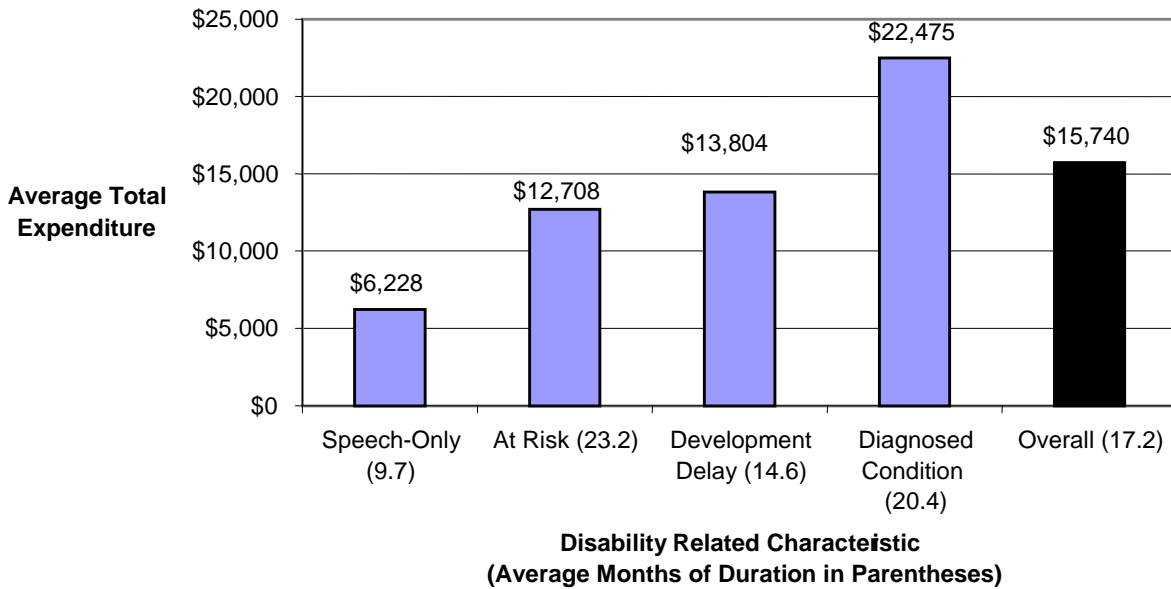
Exhibit 3.5 reads: The average total expenditure for children with only a speech or communication delay was $6,228, while the average total expenditure over all early intervention recipients was $15,740.

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To better illustrate the positive expenditure/duration relationship, Exhibit 3.6 shows the average total expenditure per child for children with varying durations of early intervention services. Each curve displayed in Exhibit 3.6 corresponds to a different disability-related category and each point along a given curve represents the average total expenditure per child for children whose duration of services corresponds to each of the duration categories (i.e., 6 to 12 months, 13 to 18 months, and so on). The curve of the profiles suggests that average total expenditure increases exponentially with duration. In addition, after breaking out the condition-specific average total expenditures by duration, the profile for at-risk children lies below the others.[18]

Exhibit 3.6 - Average Total Expenditure in Early Intervention by Disability-Related Characteristic and Duration

Exhibit 3.6 reads: The average total expenditures for children with a diagnosed condition who stay less than 6 months in early intervention was $4,834, while the average expenditure for children of the same category staying for more than 30 months in early intervention was $40,615.

This analysis illustrates the importance of looking at expenditures per child in combination with the duration of services in providing an accurate picture of the variations in expenditure across disability-related conditions. It also suggests the value of focusing on average monthly spending. As we have seen, some conditions are associated with longer/shorter periods in early intervention, which generally translate into higher/lower total per-child expenditures. To this end, it is more appropriate to proceed with the descriptive analysis by concentrating on average monthly expenditures. This approach allows a comparison of early intervention expenditures across disability-related categories while controlling for duration of stay in early intervention, which will impact any assessment of total expenditures.

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[18] Due to their unreliability, average expenditures of sub-samples with less than ten individuals have been omitted from the exhibit. Detailed output of the data used to produce the exhibit, including numbers of observations and standard errors, can be can be found in Appendix F-4.

Exhibit 3.7 presents the average monthly expenditure by disability-related category. As indicated previously, the overall average spending per month is $916. However, the average monthly expenditure ranges from $549 for children who are at risk to $1,103 for those with a diagnosed condition, which suggests that a child with an at-risk condition is about half as expensive as one who has a diagnosed condition. This perhaps is not surprising, since children with a diagnosed condition presumably will require more intensive early intervention services on a monthly basis than those who are deemed at risk but have not yet evidenced any identifiable disability. Also of interest is the relative monthly average expense of the disability-related conditions compared to the totals found in Exhibit 3.5. While Exhibit 3.5 above suggests that those with only a speech or communication problem are the least expensive in absolute terms, once expenditures are broken down by months of duration it is found that monthly expenditures are lowest for those children with at-risk conditions. This result stresses the importance of how expenditures are evaluated (i.e., in absolute levels over the full course of early intervention vs. per month of early intervention services).

Exhibit 3.7 - Average Monthly Expenditure by Disability-Related Characteristic
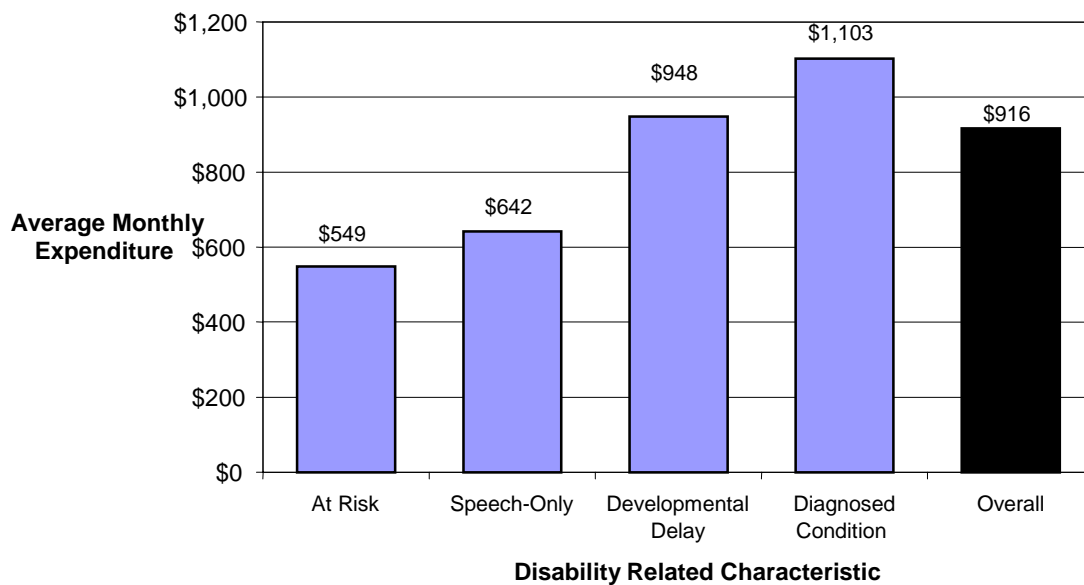
Exhibit 3.7 reads: The average monthly expenditure for at-risk children was $549, while the average monthly expenditure over all early intervention recipients was $916.

Average monthly expenditure also varied considerably *within* each disability-related category. Exhibit 3.8 presents this variation. This exhibit shows that for all categories the mean expenditure is always larger than the median (i.e., 50th percentile), which indicates that these distributions are

Exhibit 3.8 - Variations in Monthly Expenditure by Disability-Related Characteristic
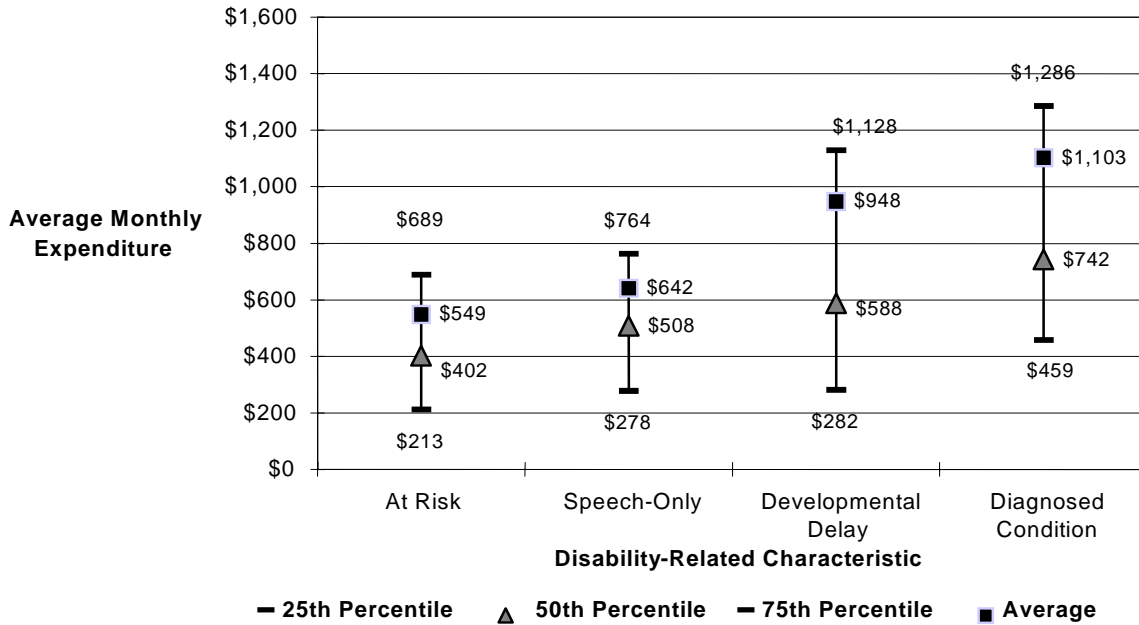
Exhibit 3.8 reads: The average monthly expenditure for at-risk children was $549. The average monthly expenditure at the 25th percentile was $213, $402 at the median (50th percentile), and $689 at the 75th percentile. Detailed output of the data used to produce exhibit including numbers of observations and standard errors can be found in Appendix F-5.

skewed to the right (i.e., a few very high-cost children pull up the average). Also noteworthy is the extent to which the distributions are skewed. The differences in the calculated median expenditure across categories are smaller than the differences in their averages. This implies that the expenditure distributions of some of these categories are more strongly skewed than others. In particular, the exhibit shows that the difference between the median and average monthly expenditure for the developmentally delayed and diagnosed condition categories are greater than for the at-risk and speech-only groups. For example, the difference in median expenditure for children with diagnosed condition versus at-risk children is $340 ($742 minus $402) per child per month (a relative difference of 85 percent using the at-risk figure as the base), while the mean expenditure difference is $554 ($1,103 minus $549) per child per month (a relative difference of 101 percent using the at-risk figure as the base). This implies that there are some high-cost developmentally delayed or diagnosed children responsible for generating the differences in monthly average expenditure across the groups shown in Exhibit 3.7.

As shown previously, there is generally a positive relationship between total per child expenditure and duration of stay in early intervention. However, average *monthly* expenditure may also be associated with the length of stay in early intervention. Children who have more severe disability-related conditions may require a higher intensity or more expensive services for an extensive period of time, resulting in a consistently high monthly expenditure over the entire intervention period. Similarly, children who have mild or moderate conditions might generate a lower monthly average expenditure over a shorter program stay. Alternatively stated, a child's needs and hence intensity of services may be positively related to duration in the program. More formally put, there may exist a significant *positive correlation* between duration and average monthly expenditures.

Exhibit 3.9 shows the average monthly expenditure by disability-related category for different sub-samples defined by duration of stay.[19] The reader is reminded that by definition, children on the right side of the graph have entered early intervention at very young ages (i.e., it is the only way to stay in early intervention for 30 months) whereas children on the left side of the graph can enter across the birth to 30-month age span. As shown in the exhibit, there is a noticeable upward trend in monthly expenditure as duration increases. Also, for all categories except diagnosed condition, the average monthly expenditure either stays flat or drops in the first segment of the profile. For example, "at-risk" children who stay between 6 months and one year in early intervention have an average monthly expenditure of $342, while those who stay from 13 to 18 months have an average expenditure of $292 per month. Those at-risk children that receive services over a longer term, say over two years, have average monthly expenditures on the order of $622 and higher. The initial decreasing pattern is most prominent for children with developmental delays, who experience a drop from $1,271 to $733 in the first segment of their profile. However, the later increasing trend is not as smooth compared to the at-risk and speech-only profiles, with a second modest lull in expenditures appearing between 19 and 24 months.

Exhibit 3.9 - Average Monthly Expenditure in Early Intervention by Disability- Related Characteristic and Duration

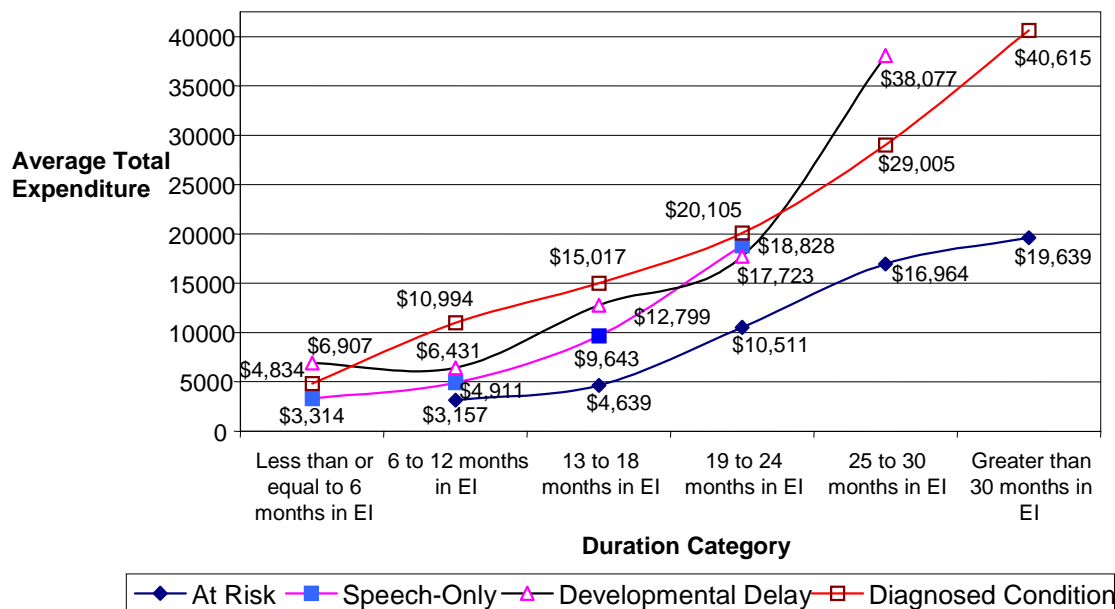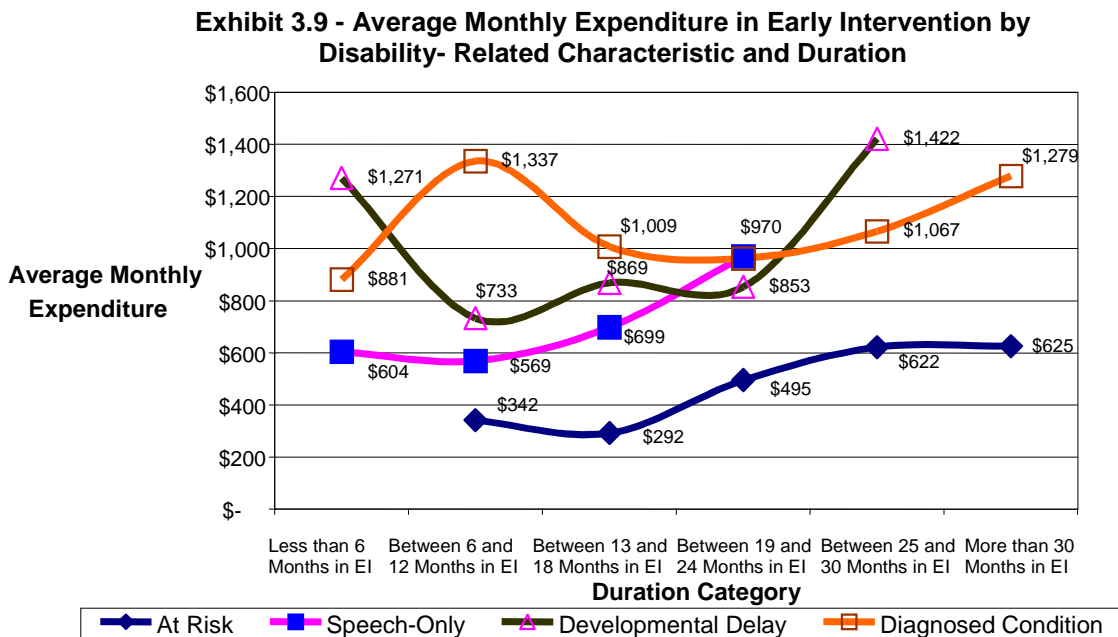**Exhibit 3.9 reads**: The average monthly expenditure for children with a diagnosed condition who stay less than 6 months in early intervention is $881, while the average expenditure for children in the same category staying more than 30 months in early intervention is $1,279. Detailed output of the data used to produce exhibit including numbers of observations and standard errors can be found in Appendix F-4.

Interestingly, the average monthly expenditure profile for short-term early intervention recipients (i.e., less than one year) with diagnosed conditions behaves quite the opposite of the others. While those staying for less than six months cost $881 on average, the profile shows a peak in average monthly expenditures at $1,337 for the group that receives services from six months to one year. This finding suggests that the amount and/or type of services received on average each month by the latter group are relatively greater and/or more expensive.

General Health at Entry and Early Intervention Expenditures

A disability-related condition is only one type of child descriptor. The general health of a child might also determine the amount of services he or she requires and the subsequent outlay of expenditures to provide those services. Exhibit 3.10 displays average monthly expenditures by the general health of a child at entry into early intervention. The illustration depicts exactly what one would expect; worse health at the time of entry is related to higher monthly average expenditures. For instance, programs spend $1,252 per month on services for the average child in poor or fair health at entry, whereas this figure drops to $793 for those with excellent health.

Exhibit 3.10 - Average Monthly Expenditure on Early Intervention by Health at Entry
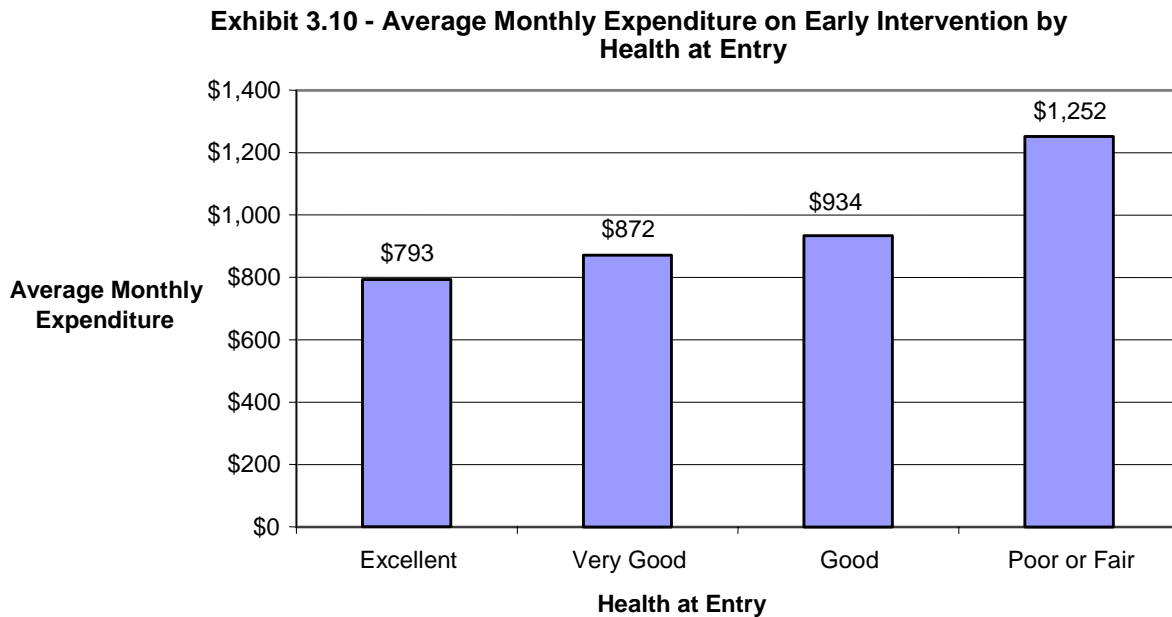
Exhibit 3.10 reads: The average monthly expenditure for children that were in excellent health at entry into early intervention was $793.

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[19] Due to their unreliability, monthly averages of sub-samples with less than or equal to ten individuals have been omitted from the descriptive presentation.

Social Background and Early Intervention Expenditures

The pattern of expenditure is potentially influenced by a variety of factors in addition to child characteristics (i.e., disability-related conditions and general health). Social background indicators might also play a role in the amount of resources spent on a child in early intervention. This section provides a descriptive overview of how average monthly expenditures vary over several measures of social background including race/ethnicity of the child, gender, household income, maternal education, and parental composition of the household.

Race/Ethnicity

The chart in Exhibit 3.11 shows how average monthly expenditure varies across different races. Average monthly expenditures are found to be the smallest ($826) among the combined group of Native Americans, Asians, Pacific Islanders, and Mixed. Expenditures on white children and those of mixed races are higher by $77 and $113 per month, respectively. The largest average monthly expenditure ($962) was for African American children.

Exhibit 3.11 - Average Monthly Expenditure on Early Intervention by Race of Child
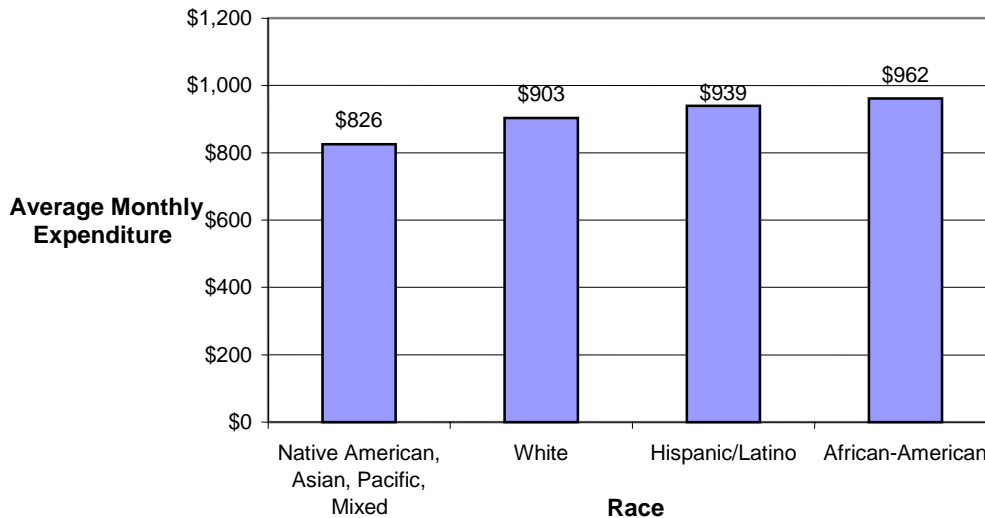
Exhibit 3.11 reads: The average monthly expenditure for children of African American descent was $962.

Maternal Education

Exhibit 3.12 depicts the association between maternal education and average monthly expenditures. The data show a somewhat U-shaped relationship between expenditures per month and mothers' education. While the average expenditure per month for a child whose mother has less than a high school diploma (or its equivalent) was $1,011, the average for those with mothers who did complete high school was $849. Among the groups of individuals whose mothers attended college the average monthly expenditure lies in between these two figures, hovering around $930.

Exhibit 3.12 - Average Monthly Expenditure by Maternal Education
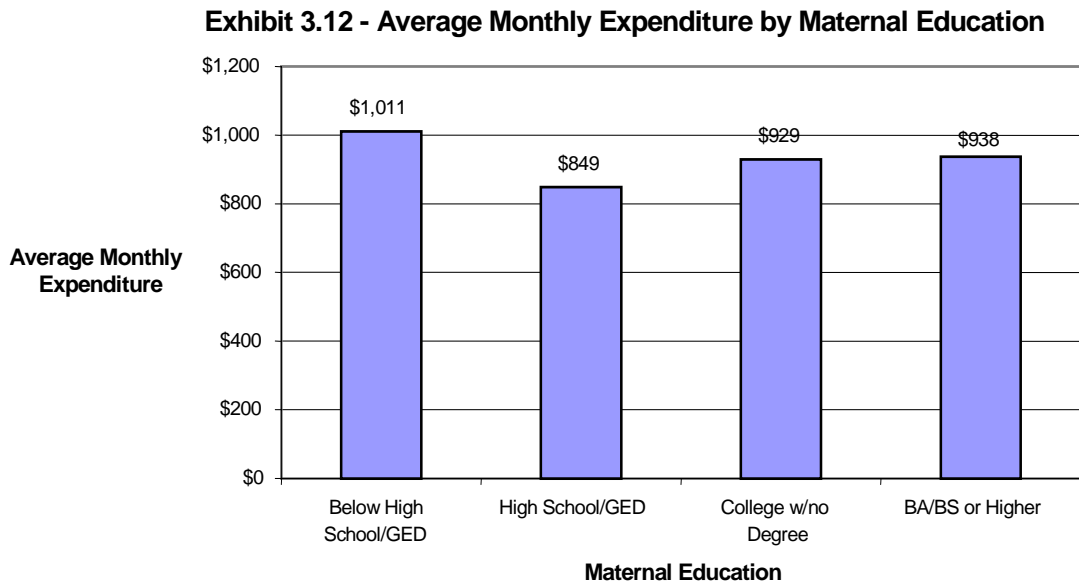
Exhibit 3.12 reads: The average monthly expenditure for children whose mother had below a high school education or its equivalent was $1,011.

With respect to maternal education, the expected nature of the relationship to expenditures is unclear. There could be several forces influencing the relationship between maternal education and expenditures. First, more educated parents may tend to have healthier children, resulting in lower expenditures on early intervention.[20] On the other hand, more highly educated parents might also be better informed and have access to more and better information concerning the availability of early intervention services and their eligibility for these programs. Also, these parents may be more demanding of their service providers, seeking more comprehensive service plans or more frequent services. Under this scenario, higher maternal education would result in higher expenditures.

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[20] Note this argument also brings into play the expenditure variation with respect to general health analyzed above. This relationship between general health/parental education and expenditures illustrates the complexity of an analysis that looks at multiple determinants which may be related to one another and the necessity for using a methodology that can account for these multiple relationships such as regression analysis.

Household Income

It is reasonable to assume that household income could play a role in the amount that is spent on early intervention services for the same reasons described above with regard to maternal education. Exhibit 3.13 shows how average per-month expenditure varies across yearly household income. The exhibit depicts a rather peculiar pattern of expenditures across the various ranges of household income. For households earning up to $50,000 the average monthly expenditure is between $900 and $936. This figure drops to $829 for household with incomes from $50,001 to $75,000. Finally, for the most prosperous households (earning more than $75,000 per year) the average spent per month increases to $1,028.

Exhibit 3.13 - Average Monthly Expenditure by Yearly Household Income
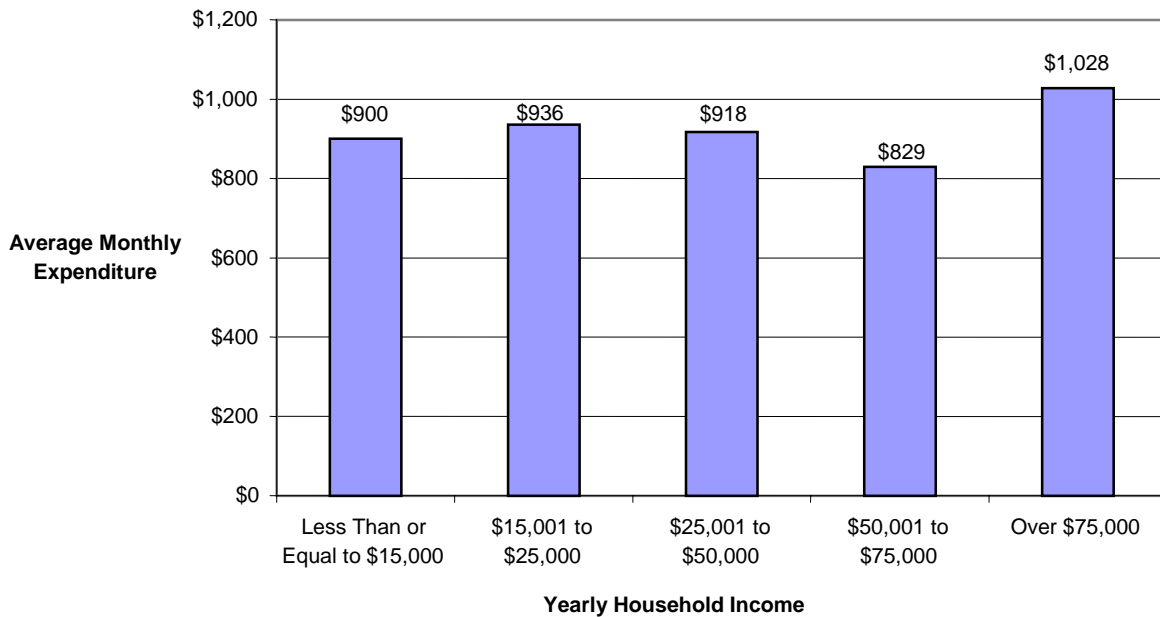
Exhibit 3.13 reads: The average monthly expenditure for children living in a household with a yearly income less than or equal to $15,000 was $900.

Family Structure

As a final indicator of social background, the variation in expenditure across parental composition of household was considered. Exhibit 3.14 presents average monthly expenditures on early intervention services for children with the following categories of parental composition of household: two biological or adoptive parents present (68 percent of children in early intervention), the respondent and his or her partner present (7 percent), only the respondent and at least one other adult present (11 percent), or only one adult in household (14 percent). The graph shows substantial variation in expenditures across the categories. The average expenditure per month on a child from a household with a respondent and his or her partner is $658. The average per-month expenditure

for children from households where there was a respondent with other adults present or where both parents (biological or adoptive) were present was between $904 and $925. For children with only one adult present in the household, average monthly expenditure was $1,002.

Exhibit 3.14 - Average Monthly Expenditure by Family Structure
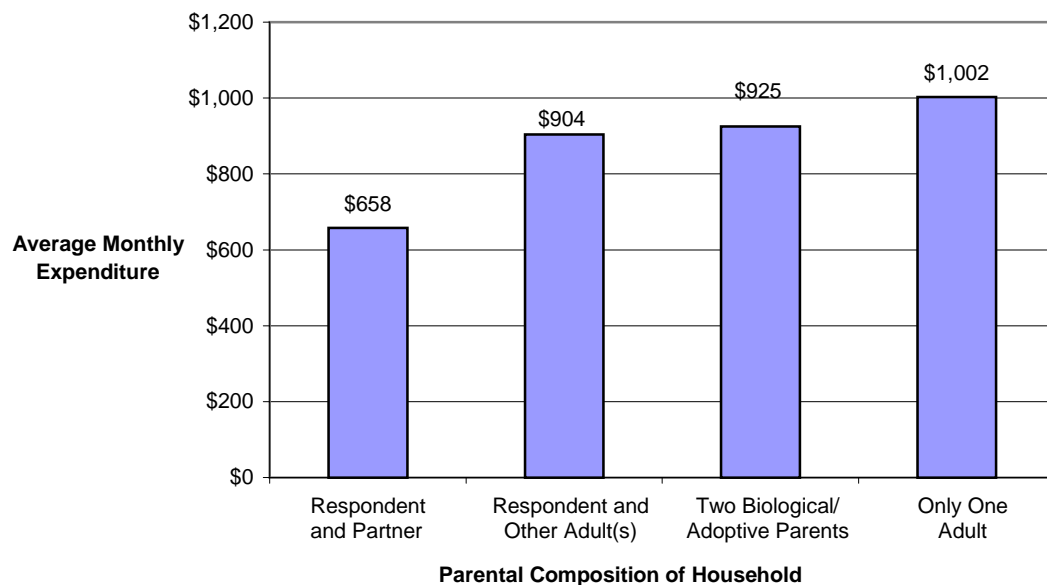
Exhibit 3.14 reads: The average monthly expenditure for children living in a household with a parent and his/her partner was $658.

Multivariate Regression Analysis

The variation in EI expenditures can be a function of a variety of factors. The exhibits presented previously provided a general picture as to how expenditures varied with disability-related conditions and family characteristics, when factors were considered one at a time. However, a more precise method should be used to isolate the individual determinants of EI expenditures. The mechanism driving expenditures is far more complex than what the simple descriptive analysis suggests. Namely, there is good reason to believe that there exist multiple relationships between many of the factors presented above and expenditures, which may confound any interpretation of the simple relationships presented above. For instance, it was shown that average monthly expenditure was lowest for at-risk children. However, better health at entry into early intervention was also shown to be associated with less spending. If children with better health also tend to be those categorized as at-risk, then the simple analysis above does not distinguish which of these factors the lower expenditures are attributed to. Therefore, to disentangle the effects of these multiple relationships, it is necessary to employ a method that can simultaneously account for the potentially related factors thought to affect expenditures. To this end, the following section presents a multivariate regression analysis that controls for the factors explored above in the descriptive analysis.

Controlling for Duration

The findings presented in the descriptive analysis above show that concentrating solely on total expenditures ignores differences in participation duration across different conditions and is therefore likely to influence the determination of which types of children are more or less expensive. Average monthly expenditures provided a more meaningful assessment of expenditures. In the same vein, in the multivariate analysis of total expenditure that follows, we also control for duration by including months of participation in the regression.

Before delving into the regression results, it is helpful to review the specification of the estimated model. Specifically, the graph of the total expenditure profiles with respect to duration previously presented in Exhibit 3.6 displayed non-linear relationships between the two measures for all disability related characteristic (DRC) categories. Namely, total expenditures tended to grow more or less exponentially as duration increases. This non-linearity lends insight into how to properly specify the model. The model makes use of the following log-linear specification to account for the suspected non-linearity of total expenditures in duration, which will tend to "smooth out" the exponential relationship:

$$Log\left(Expenditure\right) = f\left(Child\ Characteristics, Duration, Social\ Background, Community\ Factors\right)$$

In addition to controlling for much of the non-linear relationship between average monthly expenditures and duration, use of a log-linear specification is also practical in that the estimates can be easily transformed into percentage effects on the dependent variable (expenditures in our case).

Results of the regressions of total early intervention expenditures using all of the variables described above are reported in Exhibits 3.15a to 3.15c. Each exhibit contains the effects on total expenditure associated with individual characteristics and duration, social background, and regional characteristics/indicators, respectively. It is important to understand that because many of the variables in the model are categorical variables, the estimated effects of these factors are relative to a representative individual (i.e., the expenditure effect of being African American is relative to being white, the reference group for the race indicators). The reference individual in this regression is a white male who enters EI in excellent health, is characterized as being at risk, whose mother has less than a high school diploma, lives in a household with an income less than $15,000, and has only one adult in his household.

The figures in each of the exhibits show the effects of the various factors on total early intervention expenditures.[21] Regressions have also been run for the average monthly measures of expenditures found in the descriptive analysis. For the most part, the estimated monthly effects are quite similar in terms of significance and magnitude to those associated with total expenditures. For the sake of brevity, the following discussion has been limited to only those results pertaining to total

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[21] As mentioned, for easier interpretation the regression effects displayed have been transformed into percentage changes in expenditures. For complete regression output, including the original untransformed estimates, the reader is referred to Appendix F-11.

expenditures.[22] These multivariate regressions explain almost 39 percent of the variance in the natural log of total expenditure per child on early intervention services.

Child Characteristics, Duration and Expenditures

The column of figures in Exhibit 3.15a shows the effects of individual characteristics and duration on total EI expenditures. The first five rows contain the effects on a child's total expenditures of the disability-related characteristic that rendered him or her eligible for EI services. Immediately one notices that the effects for all disability-related conditions are large and highly significant. Relative to at-risk children (the reference group), children who were receiving early intervention because of only a speech or communication need, because of developmental delay, or because of diagnosed conditions are expected to have 69 percent, 83 percent and 110 percent more spent on them throughout their stay in EI, respectively, after controlling for the other individual, social, and community factors. All three individual disability-related characteristic effects are highly significant (at the 1%-level). Furthermore, formal tests of whether the disability-related characteristic effects substantially differ from one another reveal significant differences between speech-only and diagnosed condition (at the 10 percent level), and between developmental delay and diagnosed condition (at the conventional 5 percent level).[23] Not surprisingly, a collective test of significance (i.e., a test of whether all disability-related characteristic effects are equal to zero) shows that the four disability-related characteristic effects are also jointly highly significant (at the 1 percent level). It is important to note that duration in EI is controlled for and therefore any influence on expenditures due to the correlation between length of stay and the specific disability-related characteristic has been effectively filtered out of these estimates.

The next set of effects corresponds to a child's health at entry into EI. Although they are not as pronounced as those found with respect to disability-related characteristics, there exist significant general health effects on EI expenditures. While there seems to be no difference between entering EI in very good versus excellent health (the reference group), being in good health or fair/poor health relative to those who are perfectly healthy is expected to add 23 percent and 35 percent, respectively, to the total expenditure bill. Again, pair-wise tests of equality between the individual health category specific effects show significant differences between "very good" and the other two groups, "good" and "fair or poor," at the 10 percent and 1 percent levels, respectively.

The following row contains the estimated effect of the birth vulnerability index (BVI) or birth history on expenditures. At first glance, the estimate of the BVI effect is at odds with what one would normally expect. The negative sign of the effect suggests that those individuals that had the most difficult birth histories tended to have smaller total expenditures on EI. However, further inspection of the estimate shows that it is of a very small magnitude and does not significantly

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[22] Complete regression results related to average monthly expenditures, including original point estimates, corresponding standard errors and the percentage transformations can be found in Appendix F-13, with selected tests of coefficient equality and joint significance following in Appendices F-14.a through F-14.d.

[23] Selected tests of coefficient equality and joint significance can be found in Appendices F-12.a through F-12.d.

differ from zero.[24] Therefore, it can be concluded that birth history does not significantly affect total EI expenditures (at least while controlling for the other factors in our model).

Finally, the last row in the exhibit documents the effect of participation duration in EI on total expenditures. The figure suggests that total expenditures are expected to increase by an average of 8.9 percent for every additional month a child participates in EI. Note that the effect of duration is highly significant at the 1 percent level.

Exhibit 3.15a – Main Effects of Individual Characteristics and Duration on Total Early Intervention (EI) Expenditures

Category	Variable	Percent effect on total EI expenditures
Disability-related characteristic (DRC)	At-risk (reference group)	N/A
	Speech	69.0%***
	Developmental delay	82.8%***
	Diagnosed condition	110.2%***
	Undetermined	41.3%
General health at entry in EI	Excellent (reference group)	N/A
	Very good	5.6%
	Good	22.9%**
	Fair or poor	35.1%***
	Missing	-2.6%
Birth vulnerability index (BVI)	BVI (0=no difficulties, 3=most difficulties)	-4.7%
	Missing	-9.7%
Duration of EI Participation	Months	8.9%***
Observations		2,195
R-squared		0.3897

Exhibit 3.15a reads: The total EI expenditure for an otherwise representative child was 69 percent higher for those with a speech delay only relative to an at-risk condition. Total EI expenditure for the representative child increased by an average of 8.9 percent for every additional month he/she participated in EI.
Percentage effects based on results from regression of logarithm of total EI expenditures on controls related to child characteristics, social background, geographic location and demography of county of residence (see Appendix F-11 for full regression output). Note that -0.0 percent denotes a negative effect smaller in absolute value than 0.1 percent. Imputed missing values of DRC and general health set to "at-risk" and "excellent", respectively. Imputed missing values of BVI set to sample mean (0.566785).
* significant at 10%; ** significant at 5%; *** significant at 1%.

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[24] For example, even if the estimate were significant, a one-point increase in the index (approximately 20 standard errors) would only reduce total expenditures by a scant 4.7 percent (just under 0.6 standard errors).

Social Background and Expenditures

Exhibit 3.15b provides estimates of the social background effects on total EI expenditures. With respect to race, none of these estimates prove to be even marginally statistically significant. Similarly, none of the estimated effects of maternal education prove to be significant at conventional levels.

The following set of estimates show interesting results with respect to household income. Relative to coming from a household with less than $15,000 in income, children from households with incomes of $15,001 to $25,000 have, on average, 23.2 percent higher EI expenditures. The next category ($25,001 to $50,000) is associated with average expenditures that are 19.5 percent larger than those of the poorest households.[25] This decreasing trend continues, with the estimated effect of household income ranging from $50,001 to $75,000 at only 10.3 percent. For children coming from a household with more than $75,000, this figure is 21.2 percent. However, children from the later two household income categories exhibit expenditures that are not statistically different from those on children from the poorest households, all else equal.

With respect to family structure, the level of expenditure for early intervention was lower for children from two-parent households. Specifically, the first result shows that EI expenditures for children who live with both parents are expected to be 18.6 percent lower compared to those who live with only one parent. Children who live with a couple where neither are their parent are expected to have 30.9 percent lower EI expenditures, though this difference is not significantly different from the 18.6 percent lower EI expenditure for two-parent households.[26] The last category, having only one guardian with no partner in the household, yields an expected decrease in expenditures of 15.7 percent, but does not significantly differ from zero.

The last reported effect is that of gender, which shows no significant difference between expenditures on male and females.

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[25] Both effects are individually significant at the 10 percent level but do not statistically differ from each other.
[26] While these two estimates prove to be individually significant at the 10 percent level, they fail to significantly differ from each other.

**Exhibit 3.15b – Main Effects of Social Background on Total
Early Intervention (EI) Expenditures**

Category	Variable	Percent effect on total EI expenditures
Race	White (reference group)	N/A
	African American	-7.0%
	Hispanic/Latino, Native American or Asian	3.0%
	Mixed	-1.5%
	Missing	-4.9%
Maternal education	Less than high school/GED (reference group)	N/A
	High school/GED	-5.5%
	College w/no degree	4.2%
	BA/BS or higher	-4.1%
	Missing	19.7%
Household income	Less than or equal to $15,000 (reference group)	N/A
	$15,001 to $25,000	23.2%*
	$25,001 to $50,000	19.5%*
	$50,001 to $75,000	10.3%
	Over $75,000	21.2%
	Missing	-9.2%
Family structure	Only one adult in child's household (reference group)	N/A
	Two biological/adoptive parents in child household	-18.6%*
	Respondent and partner in child household	-30.9%*
	Respondent and other adult(s) in child household, no partner	-15.7%
	Parental composition of child household is missing	8.3%
Gender	Male (reference group)	N/A
	Female	13.0%
Observations		2,195
R-squared		0.3897

Exhibit 3.15b reads: The total EI expenditure for an otherwise representative child was 18.6 percent lower for children with one parent and a partner in the household relative to those with one adult living in the home. Percentage effects based on results from regression of logarithm of total EI expenditures on controls related to child characteristics, social background, geographic location and demography of county of residence (see Appendix F-11 for full regression output).

Imputed missing values of race, maternal education, household income and parental composition of household set to "white", "high school/GED", "less than $15,000", and "two biological/adoptive parents in child household", respectively.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Regional Characteristics and Expenditures

Exhibit 3.15c displays the results related to the various demographic characteristics (at the county level). The sole demographic factor that is significantly related to EI expenditures is the percentage of the county population age 18 or above with a high school education. For every 1 percent increase in the number of above-18 individuals in the county with at least some high school education, the average total EI expenditure is expected to decrease by 2.7 percent.[27] The other demographic factors prove to be relatively small and do not significantly differ from zero.

Exhibit 3.15c – Main Effects of Demographic/Geographic Indicators on Total and Monthly Early Intervention (EI) Expenditures

Category	Variable	Percent effect on total EI expenditures
County level demographics	Percent of county population uninsured	-0.5%
	County per capita income (in thousands of dollars)	-0.1%
	Percent of county population above 18 with some high school education	-2.7%*
	Percent of county population below poverty line	-0.2%
	County infant deaths per 1,000 births	-0.0%
	County census data missing	-20.9%
Observations		2,195
R-squared		0.3897

Exhibit 3.15c reads: The total EI expenditure for the representative child decreases by an average of 2.7 percent for every one percent of the county population with a minimum of a high school diploma.
Percentage effects based on results from regression of logarithm of total EI expenditures on controls related to child characteristics, social background, geographic location and demography of county of residence (see Appendix F-11 for full regression output).
Imputed missing values of census variables set to sample means.
* significant at 10%; ** significant at 5%; *** significant at 1%.

It is useful to compare the estimated percentage differences in total expenditures across disability-related condition before and after controlling for the available factors related to individual characteristics, social background, and community. Exhibit 3.16 presents the controlled (for individual, social background, and regional factors) and uncontrolled "raw" measures of the percentage difference in average total expenditures between the group of at-risk children and other disability-related characteristic categories.[28] The graph shows incredible changes when going from the uncontrolled to controlled expenditure differences.

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[27] A 1 percent increase in the county population 18 and above with some high school is equivalent to approximately 1.75 standard errors in this variable.

[28] The percentage differences for the uncontrolled percentage differences were calculated using the "raw" average total expenditure figures in Exhibit 3.4 and the following formula: $(\text{Expenditure}_{\text{Comparison Category}} - \text{Expenditure}_{\text{At Risk}})/\text{Expenditure}_{\text{At Risk}}$. The controlled differences are simply taken from the regression results in Exhibit 3.15a.

First, expenditures for all of the comparison categories relative to the at-risk group increased significantly. For instance, while the comparison of raw differences suggested that having a speech or communication problem relative to being at risk was associated with 51 percent lower expenditures, after controlling for individual, social background, and community characteristics, expenditures due to being in the speech-only category were expected to be 69 percent higher than those for the at-risk condition. An important factor contributing to the shift for the speech only and children with risk conditions is the duration in early intervention which, when included, makes the children with risk conditions less expensive than the speech-only children. Similarly, the expected expenditure premium for the developmental delay category relative to the at-risk category increased from 8.6 to 82.8 percent. A more modest increase in the relative premium from 76.9 to 110.2 percent was found for the diagnosed-condition group, suggesting that factors other than disability-related characteristic have far less influence on average total expenditures for this comparison group.

Second, controlling for the various factors cause the relative differences between the speech-only, developmental delay, and diagnosed condition groups to drop considerably. While the differences between the speech-only versus developmental delay and diagnosed condition *before* controlling for the influence of other factors were 59.6 and 127.9 percent, respectively, these differences shrank to 13.8 and 41.2 percent after being purged of the other effects. Similarly, the average difference between those with a developmental delay and diagnosed conditions declined by over one-half (from 68.3 to 27.4 percent). Therefore, the differences in total expenditures between the three groups attributable solely to group membership were much smaller than initially suggested by the raw averages while the relative difference between the three groups and the at-risk category were actually much larger.

Exhibit 3.16 - Percentage Difference in Total Average Expenditures on Early Intervention by Disability-Related Characteristic (Relative to At-Risk Children)
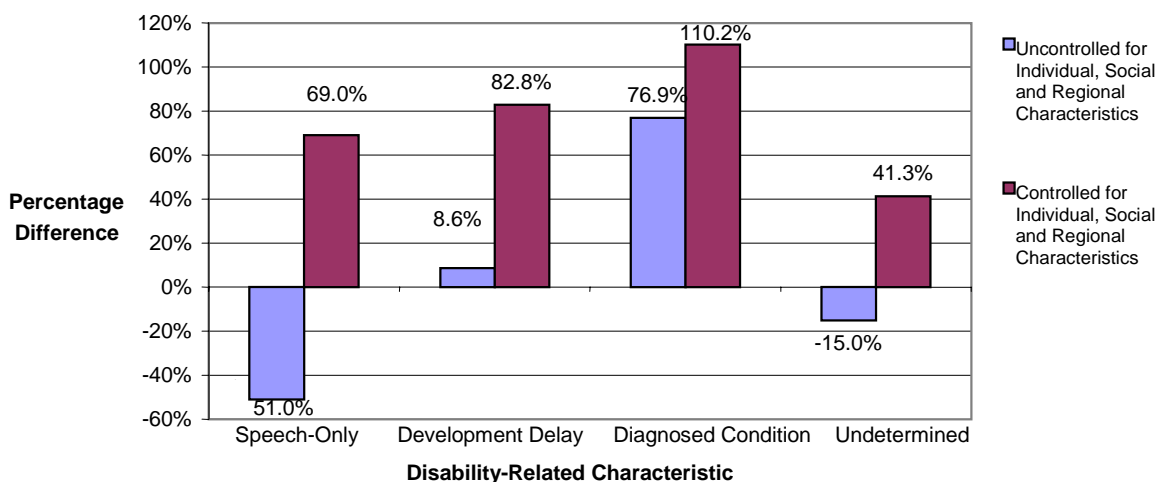
Exhibit 3.16 reads: The average total expenditure for children with only a speech or communication disability, uncontrolled for the effects of individual, social, or regional characteristics, was 51 percent lower than that of at-risk children. After controlling for individual, social and regional characteristics, the average total expenditure of the speech-only category was 69 percent greater than for the at-risk group.

Note that these results should **not** be seen as evidence that the other three groups have been receiving too little or the at-risk group too much in the way of expenditures. Rather, a more accurate interpretation is that children deemed at risk have other significant factors, such as duration, that put upward pressure on expenditures. This method simply isolates the relative difference in expenditures solely due to disability-related condition versus the other factors that may influence patterns of expenditure.

Independent Effects Across DRC

From the discussion above it is quite evident that individual characteristics related to a child's disability at entry into early intervention are strong determinants of the subsequent expenditures on services. In particular, disability-related characteristics, general health at entry, and duration were found to have the most prominent effect on early intervention outlays. One argument against the analysis put forth above is that it may be unduly restrictive in that it constrains these effects to be equal across the various disability-related categories. While the above procedure provides a good impression of the average effects of general health, duration, and the other characteristics over the whole sample, there is little reason to believe that these effects are constant across disability-related characteristics.

For example, it is possible that general health at entry may have a relatively larger effect on the expenditures of children with diagnosed conditions compared to those in other disability categories. Similarly, although the regression above captures the average effect of an additional month of participation in early intervention, the model disregards the fact that a month of participation for a child who has, for instance, a diagnosed condition is on average far more expensive than for those children that are deemed at risk. Instead, the model as specified estimates the average expenditure for an additional month of early intervention over **all** children, regardless of their disability-related characteristics. To this end, an alternative procedure has been implemented where separate regressions are run for each disability-related category. While this method imposes fewer constraints by allowing independent effects of all variables across the four disability-related categories, there is a trade-off in terms of the amount of variation in expenditures the four new models are able to explain.[29]

Exhibits 3.17a through 3.17c contain the results to the disability-related characteristic specific regressions of total expenditures.[30] Each of the four columns contains the results of a separate regression for children with at-risk conditions, speech delays only, developmental delays, and diagnosed conditions, respectively. The first significant result

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[29] For instance, the new procedure explains roughly 29.4 percent of the total expenditures for the developmentally delayed group, whereas the explained variation of the pooled model was 39 percent. In addition, we have taken the liberty of tailoring the specifications with respect to the duration variables so that only the developmental delay category contains a quadratic and cubic term. This was done after several stepwise regressions that determined the higher order terms were insignificant for the at-risk, speech-only, and developmentally delayed groups.

[30] Appendix F-15 contains the full output for these regressions, including the original point estimates and standard errors. Complete regression results pertaining to the average monthly expenditures, including original point estimates, corresponding standard errors, and the percentage transformations, can be found in Appendix F-17.

suggested that the effect on expenditures of general health at entry applies only to children with diagnosed conditions. Relative to children with a diagnosed condition who were in excellent health (the reference group), otherwise identical individuals with fair or poor health were expected to have 44 percent higher expenditures.

Birth vulnerability had no significant effect on total expenditures for any of the four groups. Duration in EI, on the other hand was highly significant. Each additional month of duration was expected to increase expenditures by an average of 8.6 percent (diagnosed condition) to 12.9 percent (speech-only). Because the duration effects for children with developmental delays included higher-order terms, they are not as easily described. The graph in Exhibit 3.17b depicts this relationship. In short, expenditures are lowest for children with developmental delays who participate from 5 to 6 months, then increase over the 6 to 28 month range, and decline thereafter.[31] Note that this is in line with the results reported in the descriptive analysis (see Exhibit 3.6).

Gender still had no significant effect on total expenditures. Race, on the other hand, seems to be related to expenditures for children with a diagnosed condition. In particular, total expenditures on African American children with a diagnosed condition were 34.7 percent less than for their white counterparts. Turning to Exhibit 3.17c, we find significant effects of household income on expenditures for those with only a speech or communication disability. Relative to speech-only children in impoverished households (i.e., with less than $15,000 in income per year), those in households with $15,001 to $25,000 and over $75,000 per year were 41.3 percent and 43.6 percent less expensive, respectively.[32]

Effects of the county demographics are listed in Exhibit 3.17d. However, none proved to be significant at conventional levels.

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[31] The duration effect index is calculated using the estimated duration coefficients from the developmental delay regression results in Exhibit 3.17a (column three) and setting 6 months of duration equal to the index base of 100. Data for the graphed profile of the duration effect index across the duration range (4 to 32 months) of developmentally delayed children can be found in Appendix F-16.

[32] Note, the –30.2 percent and –40.1 percent estimates for the other categories, $15,001 to $25,000 and $50,001 to $75,000, are significant at the 14 percent and 12 percent levels, respectively.

Exhibit 3.17a – Effects of Individual Characteristics, Duration, Gender and Race on Total Early Intervention (EI) Expenditures by Disability-Related Characteristic

Category	Variable	At-risk	Speech-only	Developmental delay	Diagnosed condition
General health at entry in EI	Excellent (reference group)	N/A	N/A	N/A	N/A
	Very good	-19.3%	-4.2%	9.9%	10.0%
	Good	-7.7%	11.8%	41.0%	13.8%
	Fair or poor	30.1%	-7.2%	11.7%	44.0%**
	Missing	-59.3%	-7.0%	-2.1%	14.3%
Birth vulnerability index (BVI)	BVI (0=no difficulties, 3=most difficulties)	-0.2%	-4.4%	-3.2%	-6.0%
	Missing	-20.9%	31.9%	-31.4%	4.4%
Duration of EI participation	Months	9.4%***	12.9%***	-19.8%**	8.6%***
	Months squared	N/A	N/A	2.1%***	N/A
	Months cubed	N/A	N/A	-0.0%***	N/A
Gender	Male (reference group)	N/A	N/A	N/A	N/A
	Female	37.7%	1.2%	10.7%	12.9%
Race	White (reference group)	N/A	N/A	N/A	N/A
	African American	0.4%	-8.2%	-2.1%	-34.7%***
	Hispanic/Latino, Native American or Asian	-26.3%	-10.1%	-1.1%	-15.6%
	Mixed	-30.4%	-22.3%	4.4%	9.4%
	Missing	76.3%	1.2%	-55.3%	-4.8%
Observations		241	377	660	879
R-squared		0.3488	0.3271	0.2936	0.3276

Exhibit 3.17a reads: The total EI expenditure for an otherwise representative child was 44 percent higher for diagnosed children that entered EI in fair/poor health relative to excellent general health; The total EI expenditure for the representative at-risk child increased by an average of 9.4 percent for every additional month he/she participated in EI.

Percentage effects based on results from regression of logarithm of total EI expenditures on controls related to child characteristics, social background, demography of county of residence (see Appendices F-15 for full regression output).

Imputed missing values of general health, gender and race set to "excellent", "male", and "white", respectively. Imputed missing values of BVI set to sample mean.

 * significant at 10%; ** significant at 5%; *** significant at 1%.

**Exhibit 3.17b - Effect of Duration on Total Early Intervention
Expenditures of Developmentally Delayed Children (6 Month Duration = 100)**
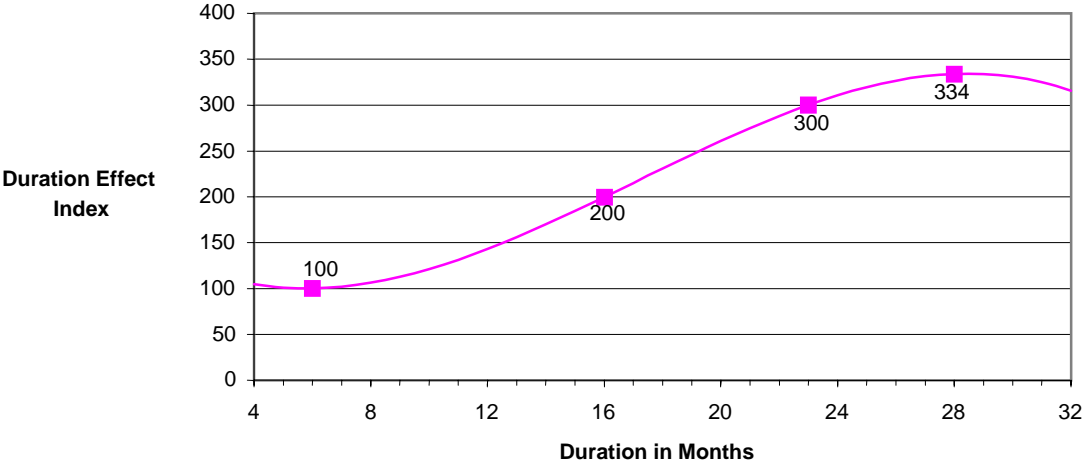
Exhibit 3.17b reads: On average, total expenditures on a developmentally delayed child that participated in early intervention for 16 months was 100% higher than that on an otherwise similar child who only stayed for 6 months. Similar comparisons yield expenditures differentials of 200% and 234% between individuals that participated for 5 months and those who stayed for 23 and 28 months, respectively.

Exhibit 3.17c – Effects of Maternal Education and Household Characteristics on Total Early Intervention (EI) Expenditures by Disability-Related Characteristic

Category	Variable	At-risk	Speech-only	Developmental delay	Diagnosed condition
Maternal education	Less than high school/GED (reference group)	N/A	N/A	N/A	N/A
	High school/GED	-17.4%	-18.0%	-1.5%	21.9%
	College w/no degree	-23.0%	-3.6%	7.0%	30.7%
	BA/BS or higher	-1.4%	-8.1%	10.8%	15.9%
	Missing	933.7%	92.4%	17.3%	-39.1%
Household income	Less than or equal to $15,000 (reference group)	N/A	N/A	N/A	N/A
	$15,001 to $25,000	113.0%	-30.2%	30.2%	7.7%
	$25,001 to $50,000	27.9%	-41.3%*	17.0%	14.7%
	$50,001 to $75,000	-0.4%	-40.1%	1.5%	15.5%
	Over $75,000	60.0%	-43.6%**	21.5%	2.1%
	Missing	0.1%	-30.3%	-4.7%	0.7%
Family structure	Only one adult in child's household (reference group)	N/A	N/A	N/A	N/A
	Two biological/adoptive parents in child household	-6.2%	-6.0%	-16.9%	-19.0%
	Respondent and partner in child Household	21.5%	-40.0%	-0.8%	-49.3%
	Respondent and other adult(s) in child household, no partner	-12.8%	-3.8%	0.7%	-7.9%
	Parental composition of child household is missing	-59.2%	-62.9%	-7.8%	121.0%
Observations		241	377	660	879
R-squared		0.3488	0.3271	0.2936	0.3276

Exhibit 3.17c reads: The total EI expenditure for an otherwise representative child was 41.3 percent lower for diagnosed children who lived in households with an income of $15,001 to $25,000 relative to those with an income less than or equal to $15,000.

Percentage effects based on results from regression of logarithm of total EI expenditures on controls related to child characteristics, social background, demography of county of residence (see Appendices F-15 for full regression output).

Imputed missing values of maternal education, household income and parental composition of household set to "high school/GED", "less than $15,000", and "two biological/adoptive parents in child household", respectively. Imputed missing values of BVI set to sample mean.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Exhibit 3.17d – Effects of Individual Characteristics and Duration on Total Early Intervention (EI) Expenditures by Disability-Related Characteristic

Category	Variable	At-risk	Speech-only	Developmental delay	Diagnosed condition
County level demographics	Percent of county population Uninsured	-0.3%	2.6%	1.1%	2.1%
	County per capita income (in thousands of dollars)	0.7%	2.1%	1.2%	1.9%
	Percent of county population above 18 with high school education	-1.5%	1.0%	-0.2%	-0.5%
	Percent of county population below poverty line	-0.4%	0.2%	1.0%	-0.0%
	County infant deaths per 1,000 births	-3.9%	0.8%	0.9%	3.0%
	County census data missing	196.3%	13.9%	75.6%	23.5%
Observations		241	377	660	879
R-squared		0.3488	0.3271	0.2936	0.3276

Exhibit 3.17d reads: For children with only a speech or communication problem the total EI expenditure for an otherwise representative child was 2.6 percent higher for every one percent of his/her county population that was uninsured.
Percentage effects based on results from regression of logarithm of total EI expenditures on controls related to child characteristics, social background and demography of county of residence (see Appendices F-15 for full regression output). Note, -0.0 percent denotes a negative effect below -0.1 percent.
Imputed missing values of census variables set to sample means.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Expenditure Patterns and Service Environments

Children receive early intervention services in a variety of service environments including the family home, day care programs or schools, centers, and clinics or offices. Therefore, it is of interest how early intervention expenditures are spread out over these settings. The data presented in this section show that, in terms of resources allocated, the family home is by far the most prominent service environment with the center-based programs being second. However, there are some slight variations in the patterns of utilization of the family home versus center across disability-related characteristics and duration of the program (i.e., the length of time the child receives early intervention services).

Exhibit 3.18a presents the monthly expenditure per child broken out by disability-related characteristic and environmental setting.[33] The last bar in the chart specifies how the average monthly expenditure was allocated across service environments over all children receiving early intervention services (i.e., over <u>all</u> disability-related characteristics). On average, slightly over half of monthly expenditures were allocated to services provided in the home setting while another 30 percent was accounted for by those received in a center-based environment. Far smaller proportions of expenditure were spent on services received in clinics or offices (11 percent) and day care or preschool settings (5 percent).

In general, the composition of monthly expenditure with respect to environmental setting was similar across disability-related characteristic. That is, there was a similar ordering of the setting-specific expenditure shares in the overall breakdown as well as for each individual disability category where the family home accounts for the largest share followed by center-based settings, clinics and offices, day care and preschool, and other settings.[34] However, there were some differences in the magnitude of the expenditure shares across the disability categories. For instance, compared to the overall average, expenditures on center-based services for at-risk children accounted for far less of this group's average monthly outlays. While a majority of the expenditure was still allocated to services provided within the family home (59 percent), there was roughly an even split between that spent on center-based services and in a clinic or office (16 percent). Again, a relatively smaller proportion of the average at-risk child's monthly expenditure went to services provided in a day care or preschool (8 percent).

For children characterized by only a speech or communication disability, much of the relative expenditure was shifted from services provided in the home, accounting for 43 percent of average monthly expenditure, to those received in a center-based environment making up 35 percent of the monthly average, and to a lesser extent to day care/preschool and clinic/office settings (each with increased shares of 2 percent). A similar expenditure pattern was found for the average developmentally delayed child with respect to the shares of spending attributable to center-based services (36 percent) and those delivered in the home (49 percent), while the share associated with clinics and office settings was 3

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[33] Full output of the descriptive statistic used in Exhibits 3.18a through 3.18e including standard errors and raw and weighted counts of observations can be found in Appendix F-18a through F-18-e.

[34] The exception to this was for at-risk children whose average monthly expenditure in center-based settings was a scant $1 less than in clinics and offices.

percent lower (8 percent) than the overall average (11 percent). The composition of expenditure shares with respect to setting for the average child with a diagnosed condition most resembled the overall average with no setting-specific share differing by more than 2 percent.

Exhibit 3.18a - Average Monthly Expenditures on Early Intervention by Disability Related Characteristic and Service Environment
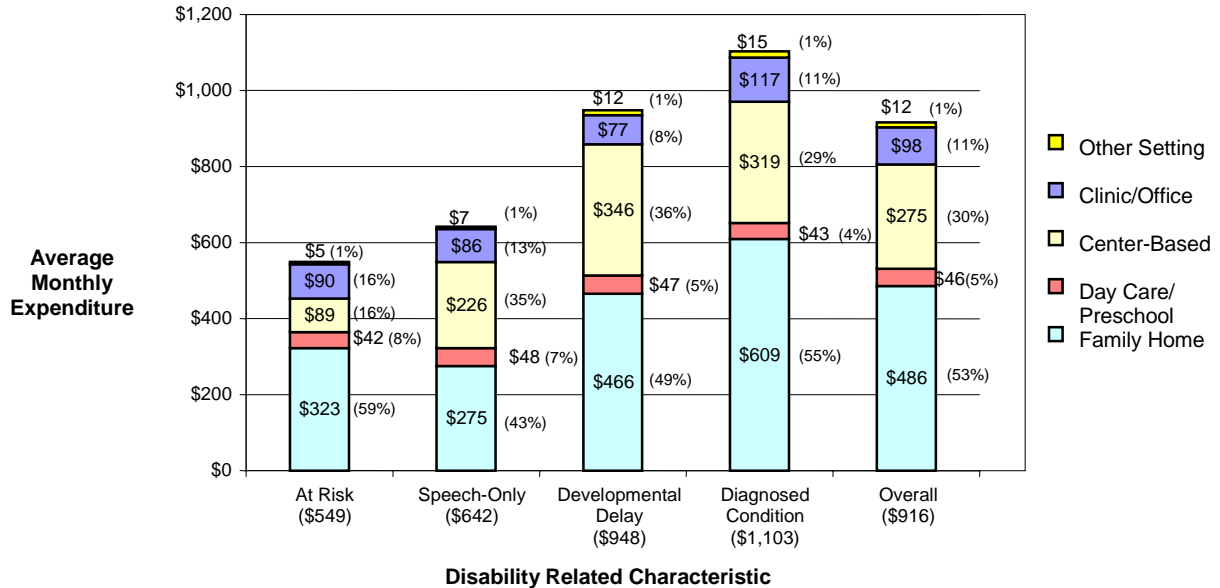
*Average monthly expenditure across all environments appears in parenthesis below Duration Category.

Exhibit 3.18a reads: Of the $549 spent on average per month on at-risk children, $323 (59%) was spent for services in the home, $42 (8%) for services in a preschool, $89 (16%) for center-based services, $90 (16%) for clinics or offices, and $5 (1%) for services in other settings.

As mentioned above, children up to the age of 36 months were eligible to receive early intervention services so that the average enrollment age (age at IFSP) and subsequent duration in a program varied both across and within disability-related characteristic. Early intervention programs should be tailored to children based in part on their age. To the extent that this is the case, we might expect to find systematic patterns of spending across different amounts of time children have participated in early intervention. In order to explore this possibility, charts of average monthly expenditures across service environments broken out by six-month duration categories for each disability-related characteristic group have been created.[35]

Exhibit 3.18b depicts the spread of average monthly expenditure for at-risk children across environmental settings for children who entered the program at different ages and spent different amounts of time in the early intervention programs (i.e., with different durations). For children participating in early intervention for over one year, the proportion of expenditures allocated to services received in the family home appear to have increased with the duration of time spent in the early intervention program.

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[35] Environment-specific spending components accounting for $10 or less per child per month are not labeled on charts.

However, children who spent 12 months or less in early intervention programs are the exception to this pattern of increasing proportion of expenditures on services delivered in the home: that is, for this group of children by far the greatest percent of expenditures (78 percent) were spent on services delivered within the home. Services provided in a day care or preschool setting only accounted for significant monthly expenditures (i.e., $10 or above) for individuals participating in early intervention for more than 18 months and followed no obvious trend. Similarly, shares of average monthly expenditures on services delivered in a clinic or office showed no consistent increasing or decreasing trend with respect to duration.

Exhibit 3.18b - Average Monthly Expenditure of At-Risk Children by Service Environment and Duration in Early Intervention
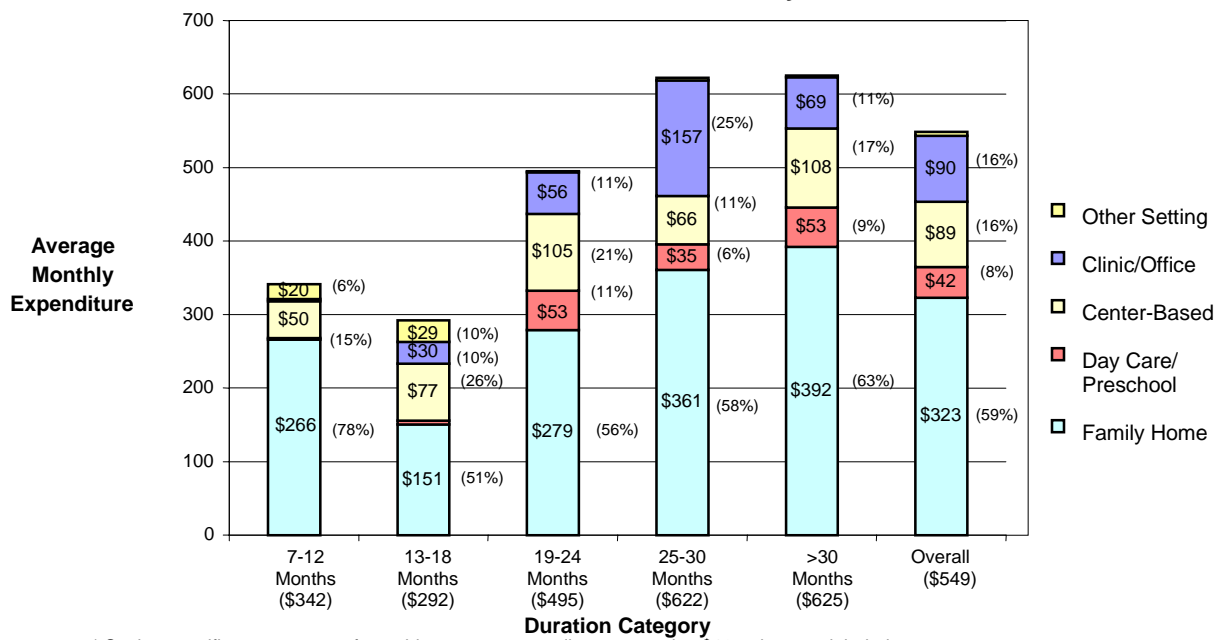
* Setting-specific components of monthly average expenditure measuring $10 or less not labeled.
**Average monthly expenditure across all environments appear in parenthesis below Duration Category.

Exhibit 3.18b reads: The average monthly expenditure on early intervention services for at-risk children who participated in early intervention for 25 to 30 months was $622 of which $361 (58%) was spent in the home environment, $35 (6%) in a day care or preschool, $66 (11%) in centers, $157 (25%) in clinics or offices, and $4 (1%) in other settings (not labeled on chart).

The monthly average expenditure breakdown by setting and duration for children with a speech or communication disability only is included in Exhibit 3.18c. The chart shows a decline with respect to duration in the proportion of average monthly expenditures spent on services in the home. Just over half (52 percent) of the average monthly expenditure on children enrolled for a short period (i.e., 0 to 6 months) was spent on services delivered in the home, whereas for longer term children (i.e, 19 to 24 months), this figure dropped to just under one-quarter (24 percent). In addition, the chart shows a strong increasing pattern with respect to duration in the relative expenditure spent on center-based services, ranging from 18 percent of average monthly expenditures in the lowest duration category to a 62 percent share in the highest. Therefore, the numbers suggest that the mix of environment-specific average monthly expenditures shifted from a relatively high (low) proportion of services provided in the home (center-based environments) for children with lower durations to low (high) proportions of expenditure

spent on services in a home (a center) for those with higher durations. Also notable is that the relative expenditure on services provided in day care or preschool settings declined (from 13 to 5 percent) with higher levels of duration until 18 months and then experienced a sharp increase for children in the highest duration category. Finally, the resources allocated to clinic or office-based services tended to decline with longer durations.

Exhibit 3.18c - Average Monthly Expenditures of Children With Only Speech or Communication Disability by Environmental Setting and Duration in Early Intervention
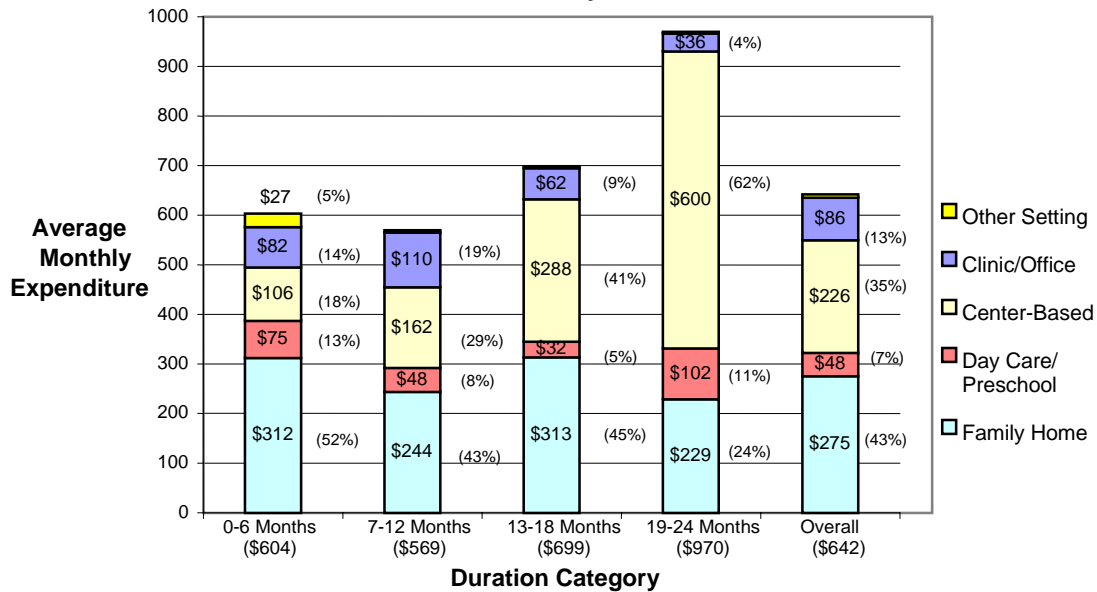
* Setting-specific components of monthly average expenditure measuring $10 or less not labeled.
** Average monthly expenditure across all environments appear in parenthesis below Duration Category.

Exhibit 3.18c reads: The average monthly expenditure on early intervention services for children with a speech or communication disability only participating in early intervention for up to 6 months was $604 of which $312 (52%) was spent in the home environment, $75 (13%) in a day care or preschool, $106 (18%) in centers, $82 (14%) in clinics or offices, and $27 (5%) in other settings.

For children with developmental delays, Exhibit 3.18d shows an increasing relative expenditure on services received in the home as duration becomes longer with the share spent in this environment growing by more than a factor of two (30 to 61 percent) from the lowest to highest duration category. This is due to the fact that children entering early intervention at a young age tend to receive services within the home. An opposite decreasing tendency was found for expenditures in the day care/preschool setting although the magnitude of these shares was much smaller ranging only from 10 (for the 0 to 6 month category) to 3 percent (for the 25 to 30 month group). The expenditure shares attributed to center-based services and clinics or offices do not seem to follow any obvious trend across the various duration categories.

Exhibit 3.18d - Average Monthly Expenditure on Children With Developmental Delays by Environmental Setting and Duration
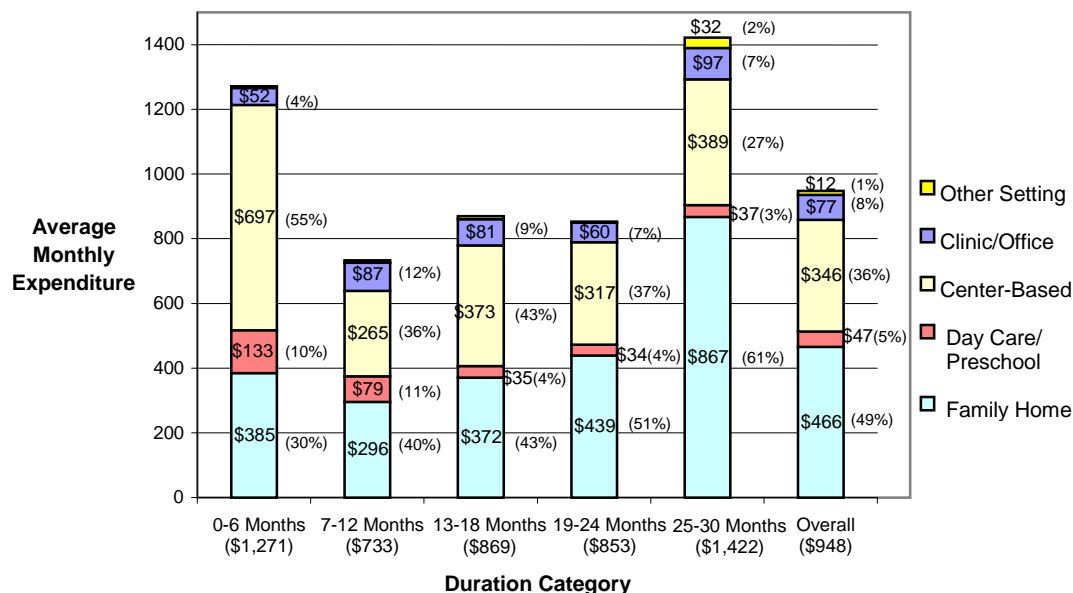
*Setting-specific components of monthly average expenditure measuring $10 or less not labeled.
** Average monthly expenditures across all environments appear in parenthesis below Duration Category.

Exhibit 3.18d reads: The average monthly expenditure on early intervention services for developmentally delayed children who participated in early intervention for 25 to 30 months was $1422 of which $877 (61%) was spent in the home environment, $37 (3%) in a day care or preschool, $389 (27%) in centers, $97 (7%) in clinics or offices, and $32 (2%) in other settings.

The last exhibit (Exhibit 3.18e) displays the expenditures for children with a diagnosed condition. Relative expenditures for services delivered in the home setting showed no clear relationship with regard to duration. In addition, the share of monthly expenditure attributed to home-based services ranged from 46 (for the 13 to 18 month duration category) to 60 percent (for the 25 to 30 month group), a span of only 14 percent. Resources spent on services in day care or preschool tended to increase with duration, which probably reflects the setting where children would typically be found as they get older. However, the magnitude of these shares was quite small. For the "middle" duration categories (i.e. from the categories 7 to 12 months through 25 to 30 months) there was a decreasing pattern in the share of monthly expenditure spent in center-based environments, but again the magnitude of this drop was somewhat small (12 percent from the categories 7 to 12 months to greater than 30 months). The results pertaining to the amount of resources spent in clinics/offices offered no apparent relationship with respect to duration.

Exhibit 3.18e - Average Monthly Expenditures on Children With Diagnosed Conditions by Environmental Setting and Duration
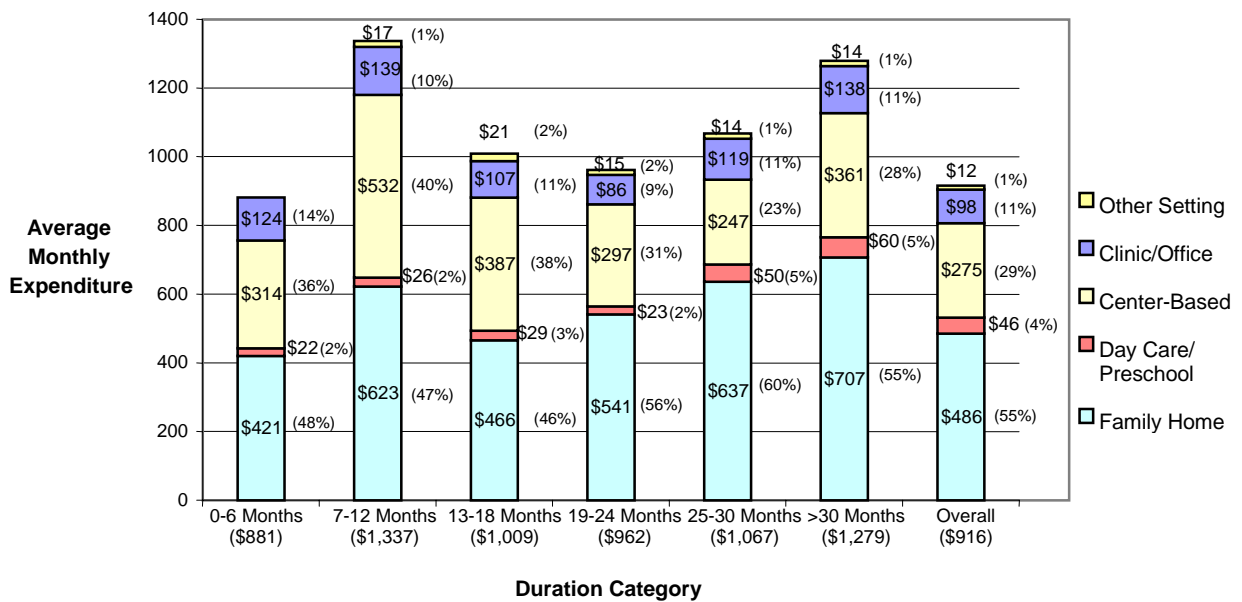
Duration Category

* Average monthly expenditures across all environments appear in parenthesis below Duration Category.

Exhibit 3.18e reads: The average monthly expenditure on early intervention services for children with a diagnosed condition who participated in early intervention for 7 to 12 months was $1,337 of which $623 (47%) was spent in the home environment, $26 (2%) in a day care or preschool, $532 (40%) in centers, $139 (10%) in clinics or offices, and $17 (1%) in other settings.

Summary

How much is being spent on children who receive early intervention? This chapter has sought to shed light on how much is being spent on early intervention services and how these expenditures vary over individual characteristics, social background, and regional and environmental setting. In-depth descriptive and multivariate regression analyses have been performed to describe the expenditure patterns on early intervention in the United States.

The main findings from the descriptive analysis can be summarized as follows:
- The average total expenditure for children in early intervention was found to be $15,740. The average length of time a child and family receives early intervention was 17.2 months, yielding an average monthly expenditure of $916.
- Total expenditures varied for children with different disability characteristics ranging from $6,228 (Speech-Only) to $22,475 (Diagnosed Condition).
- The average duration in early intervention varied significantly across disability-related characteristic ranging from an average of 23.3 months (At Risk) to 9.7 months (Speech-Only).

- Monthly average expenditures varied for children with different disability-related characteristic ranging from $549 (At-Risk) to $1,103 (Diagnosed Condition).
- Both total and monthly expenditures are higher for children who stay in early intervention longer.
- Programs spent more per month on average on children who began early intervention in poor or fair health compared to children who began in better health.
- There is little evidence that average monthly expenditures on early intervention differed by race, maternal education or household income.

Although the descriptive analysis provided a good general view of how expenditures varied separately with disability-related characteristics, duration in EI, general health at entry into early intervention, and a host of social background indicators, they cannot account for possible multiple relationships between many of the factors presented above and expenditures. Therefore, several multivariate regressions were employed that simultaneously controlled for these potentially related factors. The main findings of the regression analyses were as follows:
- Individual characteristics such as disability-related condition and general health at entry into early intervention are strong determinants of total expenditures on early intervention.
- Controlling for the various individual characteristics, social background and regional factors account for much of the variance in expenditures across disability related conditions developmental delay, speech-only delay and diagnosed condition, while increasing the expected expenditure difference between these categories and the at-risk category.

A final analysis considered not only *who* receives early intervention services, but also in which *setting* these services are delivered. In addition, changes in the composition of expenditure with respect to setting across duration categories was investigated with the following results:
- With respect to order of magnitude, environment-specific expenditure shares were similar across the four disability-related characteristic groups. For every category, services delivered in the family home accounted for the largest share of expenditures followed by those provided in center-based settings, clinics and offices, day care and preschool, and other settings.
- For the at-risk population, a majority of the monthly expenditure was allocated to services provided within the family home (59 percent), with roughly an even split between that spent on center-based services and those in a clinic or office (16 percent). In contrast, the expenditure composition of the developmental delay group showed a smaller expenditure share allocated to services in the home with a higher proportion expended on center-based services for children who entered early intervention as infants.
- For the at-risk population participating in early intervention for longer than one-year, average monthly expenditures on services provided at the family home and in centers accounted for a rising share of expenditures as duration increases.

Chapter 4
Expenditure-Outcome Analysis

Early intervention services are intended to enhance the development of infants and toddlers with special needs and prevent or minimize the emergence of additional developmental problems. There is a general consensus in the field that appropriate early intervention services will result in improved development for young children with disabilities, developmental delays or who are at risk for delay and that the earlier these services are provided, the greater the potential benefit. As we have seen thus far, there is considerable variation in the amount of resources expended on early intervention and much of this variation is related to the nature of the reason the child is receiving early intervention.

The functional and developmental status of children at the end of early intervention is a topic of much policy interest. It is a difficult area to adequately address because early intervention is designed to enhance the *future* development of children whose early development has been compromised at an early age by disability, who are developing atypically, or who are at risk for a delay because of conditions associated with poor development. Early intervention is not likely to ameliorate the disability or the delay for every participating child. The realistic assumption is that early intervention services will allow the child's development at a subsequent point in time to be better than it would have been without such services. How does one determine whether early intervention has in fact enhanced development above and beyond what would have resulted without early intervention? This challenge is made even greater by the fact that, as demonstrated earlier in this report, children receive different levels of early intervention service intensities and this is related to the nature of why they are receiving early intervention. The relationship is not perfect but, in general, children with more needs (e.g., those with diagnosed conditions compared to children who have only a speech or communication problem) have more resources expended on them.

A highly touted research approach to studying the effect of an intervention is to randomly assign children to various levels of intervention services including a non-treatment condition. This methodology is not appropriate for the study of early intervention services and expenditures for legal and ethical grounds. It is also important to remember that NEILS is not an experiment but rather a descriptive study of the nature of early intervention services being provided across country. The relationship between outcomes of early intervention and the extent of resources expended can be explored with the NEILS data. There are serious limitations to the study's ability to disentangle many of the relationships likely to be observed between the severity of the child's needs, the type of services provided, the expenditures associated with those services, and the outcomes experienced by the child. If Part C is being implemented appropriately, we would predict that children with the greatest need would be the children on whom the most resources would be expended. Child development theory would predict that, no matter how good these services are, the children whose development is most compromised when services began will also be the children whose development is most comprised 30 months, 60 months or 10 years into the future. This relationship is depicted in Figure 4.1. Early

intervention (or special education) cannot cure disability. Children with serious disabilities will still have serious disabilities at 36 months of age. The intended outcome of early intervention services is to enhance development.

Figure 4.1 - Hypothesized Relationship Between Severity of Child's Condition When Services Begin, Expenditure for Early Intervention, and Outcomes at 36 Months
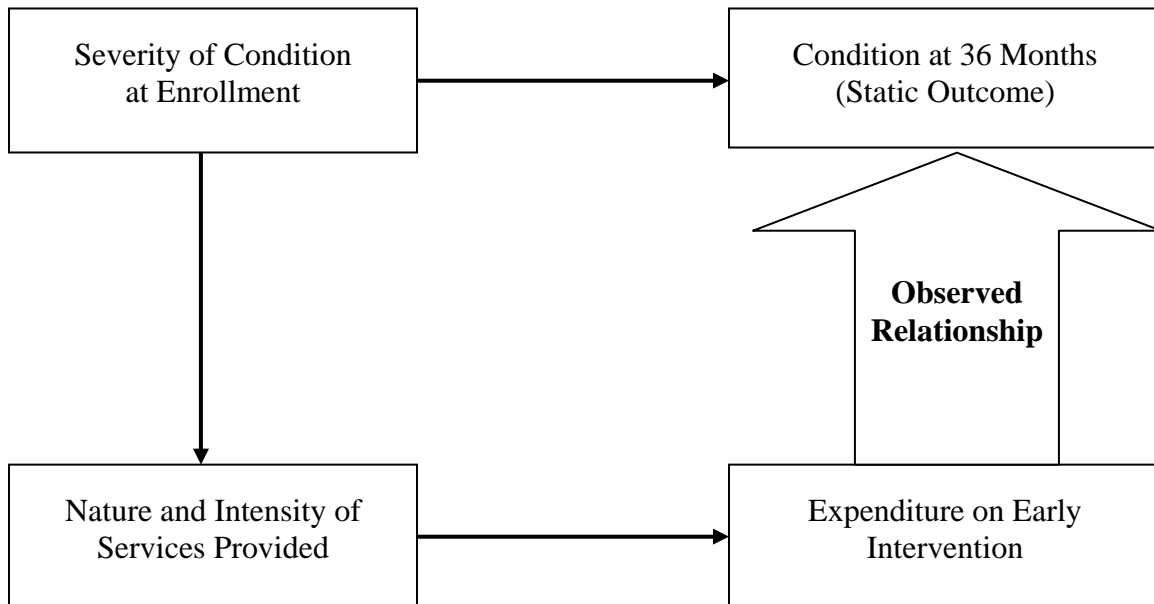
This chapter will examine the relationship between expenditures and several types of child outcomes at 36 months of age. Besides the methodological challenges identified above, the analyses are further constrained by the measures available. Although the measures address a variety of functional areas and developmental domains, they are very global, as will be explained below. Indeed, the ability of these measures to reveal marginal changes in a child's condition or development, associated as they might be with early intervention services, is limited.

The Relationship between Expenditures and Child Functioning at 36 Months

Early intervention outcomes encompass a wide range of short and long-term child and family experiences (e.g., attainment of family goals, changes in parent-child relationship and interaction, patterns of exit, changes in overall health, and functional status). At the time this report was written, the available "functional" outcome dimensions most appropriate to be used in the analysis were as follows:

- General health
- Functional communication: A child's ability to make his or her needs known
- Articulation: How well a child's speech can be understood
- Sensory systems: Status of vision and hearing
- Functioning of limbs: Use of legs/feet and arms/hands

- Attainment of developmental competencies in four domains: motor, independence, communication skills, and cognition [36]

Information on each of these outcomes was obtained from the family interview conducted when the child was between the ages of 36 and 40 months. These measures provide a global indication of the child's health and development. For example, the health measure is a 5-point scale ranging from "poor" to "excellent." The functional use of limbs is a 4-point scale ranging from "not at all" to "as well as other children." The competencies are summarized based on the number of age-appropriate competencies the child had mastered. Based on this, each child's development in a domain was classified as "near age appropriate," "below age appropriate," or "far below age appropriate." This measure is referred to as the Index of Developmental Competency (IDC). These characterizations are sufficient to differentiate some of the variations in status at entry and at 36 months *among* early intervention participants but they might not be sufficiently granular to capture change within an individual child over time.

Exhibits 4.2a through 4.2f show the relationship between average monthly expenditures and a child's categorical *level* of health, functioning, or developmental attainment at 36 months of age.[37] There is clearly a consistent pattern across all the graphs presented. Higher levels of expenditure are associated with lower levels on the outcome measurement at 36 months, and the differences in spending are quite large. For example, Exhibit 4.2b shows that the average monthly expenditure for children that have a lot of trouble communicating their needs at 36 months ($1,402) is over double that of children who were able to communicate their needs with no trouble ($688). Note that the expenditure figures are associated with each category of children as opposed to a particular type of service. In the example above, the expenditure data are not a measure of services to solely address communication needs. The figure is the average monthly expenditure for that category of children for all early intervention services received. To continue with the example, children with no trouble communicating needs were probably not receiving services for communication but for other needs and children who had trouble communicating could have been receiving services to address their communication needs as well as needs in other areas.

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[36] The milestone attainment indices are derived from answers primary caregivers provided when asked to describe their child's performance on a number of basic developmental competencies expected of infants and toddlers. Documentation of the methodology and data collection of the IDC's can be found in Spiker et al. (2004).

[37] Full output including standard errors as well as raw and weighted numbers of observations are included in Appendices G-1a through G-1k.

Exhibit 4.2a - Average Monthly Expenditure by General Health at 36 Months

Average Monthly Expenditure

- Excellent/Very Good: $823
- Good: $1,031
- Poor or Fair: $1,476

General Health at 36 Months
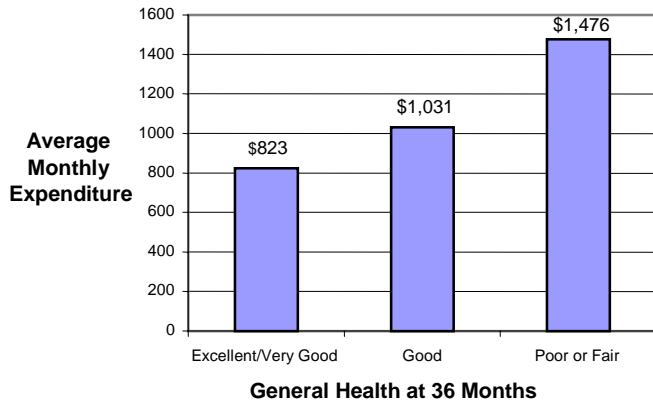
Exhibit 4.2b - Average Monthly Expenditure by Ability to Make Needs Known at 36 Months

Average Monthly Expenditure

- Communicates needs well: $688
- Communicates needs with a little trouble: $995
- Communicates needs with much trouble: $1,402

Ability to Make Needs Known at 36 Months
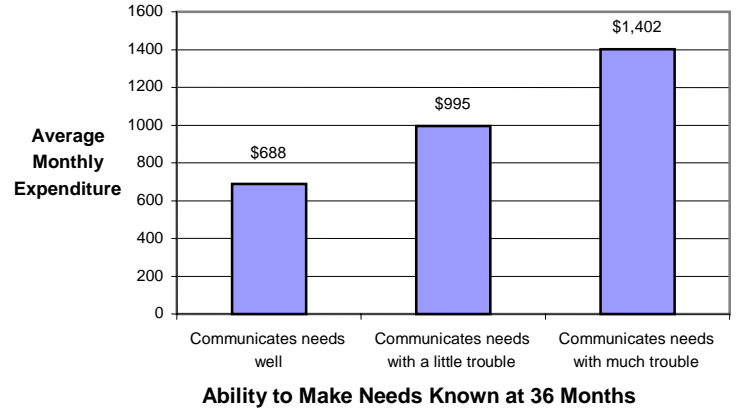
Exhibit 4.2c - Average Monthly Expenditure by Understanding of Child's Speech at 36 Months

Average Monthly Expenditure

- Speech understood very easily: $568
- Speech understood fairly easily: $722
- Speech understood somewhat easily: $946
- Very difficult to understand speech: $997

Understanding of Child's Speech at 36 Months
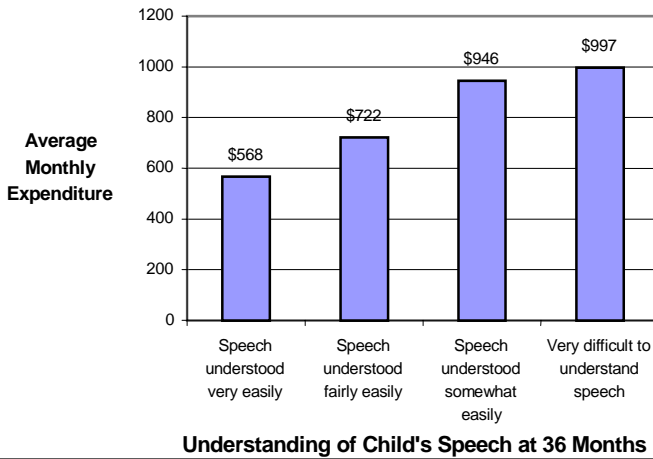
Exhibit 4.2d - Average Monthly Expenditure by Milestone Attainment Index Measures at 36 Months

Average Monthly Expenditure

Milestone	Near age-appropriate	Below age-appropriate	Far below age-appropriate
Motor	$747	$1,137	$1,860
Indpendence	$611	$717	$1,329
Communication Skills	$716	$1,020	$1,640
Cognition	$766	$1,294	$1,714

Milestone Attainment Index at 36 Months

■ Near age-appropriate ■ Below age-appropriate □ Far below age-appropriate
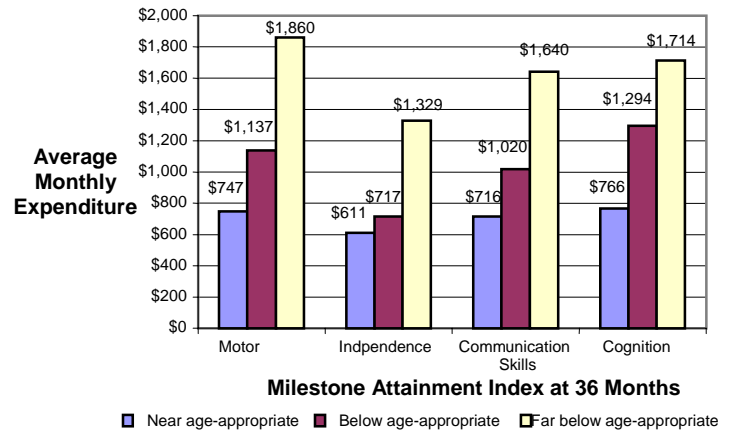
Exhibit 4.2e - Average Monthly Expenditure by Status of Hearing and Vision at 36 Months

Average Monthly Expenditure

	Normal	Problem
Hearing	$895	$1,297
Vision	$880	$1,309

Status of Hearing and Sight at 36 Months

■ Normal ■ Problem
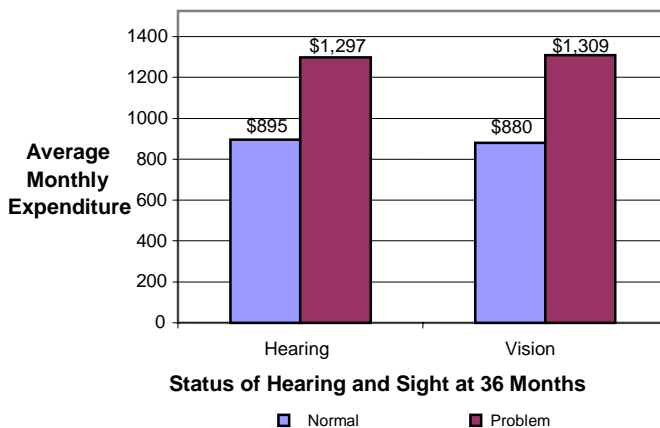
Exhibit 4.2f - Average Monthly Expenditure by Use of Arms/Hands and Legs/Feet at 36 Months

Average Monthly Expenditure

	Uses both normally	Use with a little trouble	Use with lots of trouble
Arms/Hands	$789	$1,296	$1,849
Legs/Feet	$747	$1,232	$1,824

Use of Arms/Hands and Legs/Feet at 36 Months

■ Uses both normally ■ Use with a little trouble □ Use with lots of trouble

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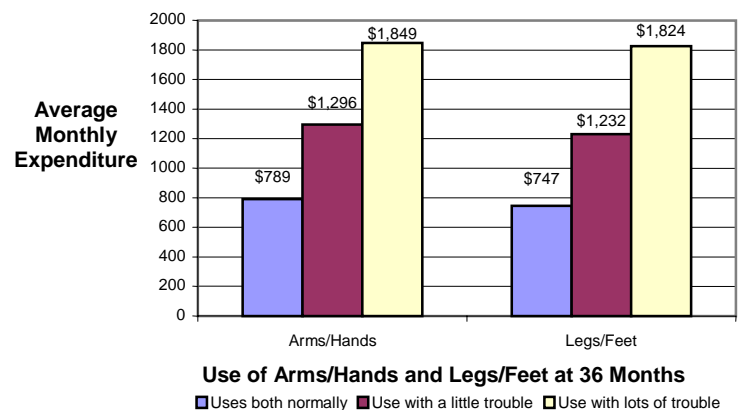
Exhibit 4.2a reads: The average monthly spending on children who have excellent or very good general health at 36 months is $823, while for those that are in poor or fair health this figure is $1,476. For more details including standard errors and (un)weighted numbers of observations, see Appendices G-1a through G-1k.

At first glance, these patterns of expenditure and child functioning at 36 months appear to be at odds with what one might expect. If one did not understand the nature of the population served in early intervention and the nature of service provision, one might expect that higher expenditures should be associated with better outcomes rather than poorer outcomes. As explained above, it is highly likely that what is being observed is that the initial severity of a child's condition largely dictates the amount of resources expended for early intervention services. The child's status at entry into early intervention is also likely to be a predictor of outcomes at 36 months. That is, children entering in a relatively poor condition are likely to need higher levels of service and funding **and** are probably also more likely to have worse health and/or functioning at 36 months of age. This relationship was depicted in Figure 4.1 and is consistent with the data observed.

The Relationship between Expenditures and Changes in a Child's Functioning

The analysis above examined the relationship between outcomes at 36 months and expenditures. An alternative analysis of the relationship between expenditure and outcomes at 36 months is to consider the average monthly expenditures across *changes* from enrollment in early intervention to 36 months of age. This analysis addresses the question of how expenditures are related to changes between the two time points.
To examine change between entry and 36 months, a change measure was computed for each of the outcome measures. Since these measures had only 3 to 5 points on a scale, a change score could not reasonably be computed. Rather each child was assigned to one of the following four categories bases on their entry and 36-month status:

* Change for the better
* No change, entry into early intervention with less-than-normal condition
* No change, entry into early intervention with normal condition
* Change for the worse

For example, a child who was "below age appropriate" in the communication index of developmental competency at entry to early intervention and was "near age-appropriate" at 36 months would be categorized as a change for the better. The use of the phrase "no change" does not imply the child did not acquire developmental skills over his or her time in early intervention. Rather, it means the child's status relative to typically developing children did not change.

Exhibit 4.3 graphs, for each functional dimension, average monthly expenditures broken out by the four categories of change. Given the multi-dimensional nature of growth and development and the myriad of reasons for which children receive early intervention services, there is a proportion of children in each outcome area who were experiencing no difficulty in this area at entry and at 36 months. Again, the reader is reminded that the expenditure averages are for children overall and do not indicate whether the child received services in this outcome area. Notice that in this formulation of outcomes we have distinguished between two types of individuals who experienced no change in

Exhibit 4.3 - Average Monthly Expenditure and Changes in Outcomes From Early Intervention Entry to 36 Months

Average Monthly Expenditure

Functional Dimension	No change, normal	Change for better	Change for worse	No change, not normal
General Health	$794	$1,020	$1,190	$1,154
Understanding Speech	$461	$875	$1,104	$1,205
Make Needs Known	$860	$803	$947	$1,323
idc Communication	$714	$957	$941	$1,449
Hearing	$899	$875	$1,229	$1,370
Sight	$874	$809	$1,030	$1,597
IDC Cognitive Ability	$739	$930	$1,190	$1,807
IDC Independence	$601	$918	$889	$1,597
Arm/Hand	$742	$1,055	$1,279	$1,679
Leg/Feet	$718	$1,002	$1,343	$1,585
IDC Motor	$751	$993	$999	$1,611

Exhibit 4.3 reads: The average monthly spending on children who experienced improvement in general health was $1,020, whereas the average monthly spending on a child who showed a decline in health status was $1,181. For more details including standard errors and (un)weighted numbers of observations, see Appendix G-2.

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outcome over the course of early intervention: those who entered with normal versus those who entered with less-than-normal functioning or development.

The child outcomes presented in Exhibit 4.3 are organized by type of outcome beginning with general health. Following general health, there are three measures of change in communication functioning (a child's ability to make needs known, understanding of a child's speech, and the index of developmental competency, or IDC measure, of communication ability), two IDC measures of the child's independence and cognition, two measures related to a child's senses (hearing and sight), and three measures describing change in motor skills (use of arms/hands, use of legs/feet, and the IDC motor measure).

Four main results emerge from this analysis of expenditure and change in outcome status First, for most of the measures (8 out of 11), children who entered early intervention with typical development or functioning and who were functioning normally at 36 months had markedly lower average monthly expenditures. This suggests that these groups of children had relatively mild conditions at both entry and 36 months and that overall the amount of resources expended on them was relatively small.

Second, average monthly expenditures were highest for children who began early intervention with less than normal health, functioning or development and were still that way at 36 months (no change, entry into early intervention with less that normal condition). This suggests that children entering early intervention with less-than-normal functioning require and receive greater levels of services to address their condition(s) and/or additional areas of need were discovered after entry. Because of the types and amount of services received, these children have the highest expenditures of any of the four outcome groups. These data are consistent with several hypotheses. First, these children did show improvements over the course of their time in early intervention relative to typically developing peers but the measures were not sufficiently sensitive to capture this change.[38] Second, without early intervention these children would have shown a decline and early intervention prevented that decline. Third, early intervention services had no impact on their development. Additional analyses of the NEILS 36-month outcomes will provide insight as to which of these hypotheses is most reasonable.

Third, children who enter with difficulties and change for the better have less expended on them than those who enter with difficulties and do not change. This is reasonable because presumably as these children improve, the amount of service would be lessened so the overall monthly expenditure over their entire time in early intervention would be less.

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[38] It should be noted that nearly all of the children show improvements in the developmental competencies because they are getting older but to show improvement on the MAI, the child must change categories, e.g., move from being below normal in attainment to near normal. Similarly, children's use of limbs improves over time but to be categorized as an improvement the child had to show improvement in status relative to other children his age. For example, a child who has a little trouble using his legs and feet at 18 months and still had a little trouble at 36 months would be classified as no change because relative to the reference group, normal children, the child was still having trouble.

Finally, children who changed for the worse had less expended on them than children who entered with difficulties and did not change, and more or the same as children who changed for the better. This is consistent with the hypotheses presented in the first point above, i.e., that early intervention can ameliorate the negative impacts of a disability that results in worsening of a child's functioning relative to his or her age peers over time. However, the group of children with more limited expenditures and poorer outcomes, the amount expended on early intervention was not sufficient to offset the negative impacts of the disability. This indicates there may well be a threshold investment that is necessary for early intervention to prevent negative outcomes. It is also possible that the intensity of service to these children was increased over time as the failure to make expected progress was noted. This mixture of more and less expensive services would result in a mid-average range of monthly expenditure.

The Relationship between Expenditures and Outcomes: A Multivariate Approach

The interpretation of the descriptive analysis has been hampered by a pervasive problem in assessing outcomes in the face of selective resource allocation. As noted previously, to properly estimate the effect of resources on an outcome, the most rigorous approach would be to randomly assign individuals to treatment (i.e., being provided services) and control (i.e., no services provided) groups *independent* of severity of condition. This is not feasible in early intervention research and would have undermined the purpose of NEILS to examine the services and outcomes of Part C as they are occurring across the country.

The crux of the problem lies in the difficulty in separating out the effect on outcomes due to severity of condition (individual need) from that due to the level of services provided, because the two almost by definition are intimately related. Indeed, the measure of expenditures on early intervention services is arguably the **best** measure of severity of condition and subsequent need for services. Because the children were not randomly assigned to services and expenditures, one is forced to explore the relationship between expenditures on outcomes at 36 months while controlling for severity of condition at entry. This is achieved by employing multivariate regression models that include variables that denote severity of condition at time of entry into early intervention as well as additional factors likely to determine outcomes such as child, social, and regional characteristics.[39] Note that the relationship between high expenditure and poor outcomes will be maintained unless the study can completely capture the variation in children's needs at entry. To the extent that need is captured in services and not child/family characteristics and thus reflected in expenditures, even in multivariate analyses, the children with the poorest outcomes will continue to be those with the greatest expenditures.

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[39] Yet another approach would be to estimate a fixed-effects model, which exploits observations of a given set of individuals at several different moments in time in order to isolate the effect of exogenous portion of expenditure (the part of expenditure independent of inherent condition severity). Unfortunately, the data at hand does not support the use of such a method (i.e., it is necessary to have multiple observations on each child).

The multivariate models are briefly introduced and a detailed description of the results of the analysis presented in Appendix H. Because of the complexity and technical nature of this analysis, only a summary of the results is presented here.

Most of the multivariate models employed found no statistically significant relationship between expenditures and a child's condition as measured at 36 months. In a very few cases, expenditures are negatively associated with a child's condition at 36 months, but the magnitude of the effect is negligible. For the most part, the results show that condition at 36 months is strongly related to condition at entry.

Unfortunately, even these more sophisticated statistical models are subject to problems that result from the simultaneous determination of the level of resources devoted to a child, the observed level of a child's need, and other characteristics of the child, the family, and the community in which the child lives. For example, children with more severe conditions at entry required greater levels of services and hence higher levels of expenditures. At the same time, higher income communities are likely to exhibit better access to early intervention services, while at the same time requiring lower levels of need for services. That is, community and family characteristics are inextricably linked to the levels of child need and the access to early intervention resources and services, and all of these factors taken together complicate our ability to disentangle the impact of marginal differences in expenditures on child outcomes at 36 months. Moreover, the lack of data in the study to fully describe a child's needs at entry into the early intervention prevents one from completely controlling for this factor in measuring the impact of expenditures on outcomes. Finally, it is difficult to measure the full impact of early intervention on a given child who exhibits a multidimensional set of needs and outcomes. The models we have developed at this point represent these various dimensions one at a time as if they were entirely separable, when in fact it is highly unlikely they are independent of one another. Both outcomes and needs are more complex than this set of independent measures can begin to represent.

Summary

The main objective of early intervention is to promote cognitive and developmental growth for those individuals with disability-related conditions. By providing early intervention services that address needs specific to an individual's condition(s), the hope is that the negative effects of a child's disability on his or her development will dissipate over the course of service. It is therefore natural to ask how participation in early intervention affects those receiving services and whether any variation in outcomes can be explained by the level of resources provided. To this end, the preceding investigation attempted to explore the relationship between expenditures on early intervention and the subsequent outcomes for the recipients of services.

A simple descriptive analysis of average monthly expenditures and individual condition at 36 months of age (i.e., static outcome) showed a consistent negative relationship between spending on early intervention services and positive outcomes across all functional dimensions (general health, understanding of child's speech, child's ability to make needs known, hearing, vision, use of arms/legs and hands/feet, and four IDC measures of communication, cognitive ability, independence, and motor skills). In light

of the negative relationship between expenditures and condition at 36 months, the strongest causality likely runs from initial severity of need (and subsequent expenditure) to outcome due to the compensatory nature of the early intervention system in allocating services. That is, individuals with the most severe conditions at entry are likely to be allocated a larger number of services and/or more expensive services in addition to having a higher probability of exiting the program in worse condition.

As an alternative approach that attempted to control for severity of condition, average monthly expenditures were compared across categories marking the change in condition from early intervention enrollment to 36 months (i.e., dynamic outcomes). The results suggested that average monthly expenditures for children who began in early intervention with a typical development in a given area (e.g., motor) were generally lower than for those who entered with atypical development. Expenditures were consistently higher among those individuals entering with atypical development who did not improve over their time in early intervention. It is surmised that the increased expenditure on this group of individuals was necessary to maintain or improve their functioning. A final observation is that expenditures on individuals whose condition worsened were generally higher than for those that saw improvement. It was concluded that controlling for severity condition by changing the focus to dynamic outcomes did not adequately control for all of the child's individual needs over the early intervention program.

To control for all available factors in addition to expenditures that may be associated with outcomes at 36 months, the study turned to multivariate analysis. In general, after including a host of variables, including initial severity of condition, the effect of expenditures was found to be negligible. For the most part, the effect of expenditures did not differ from zero, while in the instances that a significantly negative expenditure effect was found, its size was incredibly small. Equally interesting are the other factors that significantly affected outcomes. Most notable is the effect general health at entry had on individual condition at 36 months; being in poor/fair health at enrollment was associated with worse expected outcomes at age 3.

In conclusion, the exploratory analysis of the outcome-expenditure relationship demonstrates the extreme difficulty in assessing the effects of resource allocation on outcomes. When multiple correlations exist such that the level of resource provision and expected outcomes are both dependent on condition severity, standard methods such as mean comparisons across different outcome groups provide results that are incredibly difficult to interpret and of little general use. Therefore, the exploratory analysis at hand begs for further research that employs alternative methodologies better suited to measuring the relationship between expenditures and outcomes. Although beyond the scope of the current study, several available methods lend themselves as possibilities for further research:
- Perform a randomized field experiment whereby individuals are assigned to varying levels of early intervention treatment *independent* of their condition severity.
- Identify and exploit *natural experiments* or naturally occurring mechanisms that mimic the random assignment of individuals to varying levels of early intervention services.

- Employ a fixed-effects model where data on individuals at several points in time are used to isolate the effect of expenditures on outcomes that are independent of condition severity.

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Appendix A - Reconstructing Missing Portions of Individual Expenditure Histories

Due to non-response for certain questions and/or whole service record questionnaires, we did not have the complete expenditure history for all the individuals in our sample. This next section provides an overview of the method used to reconstruct or impute these missing portions of expenditure over the child's entire time in early intervention. The first subsection gives an overview of how the duration in early intervention over which we imputed expenditures was determined for a given child.[40] The part that follows describes the methodology employed to estimate imputed expenditures at the service level, which was then used to fill in the periods of missing expenditures.

Overview of How to Calculate Imputed Durations

This section documents the two tasks in imputing missing expenditures: calculation of the number of months of missing expenditures we must "fill in" (the *imputation duration*) and estimation of the per-month expenditure to apply to these missing gaps. Before diving straight into how we calculated the imputation duration, let us define two distinct types of missing durations: those periods that occur in the "middle" of a child's available EI history (i.e., "bounded" by periods with available expenditures) and those that are missing at the "end" of an EI career (i.e., those with no periods of available expenditures that follow).

Consider the following representation of a given child's stay in early intervention where there are both "types" of periods in which we did not have expenditures:

Period		I	II	III	IV	
Age=0	6	12	18	24	30	36
Available or Missing		*Available*	*Missing*	*Available*	*Missing*	
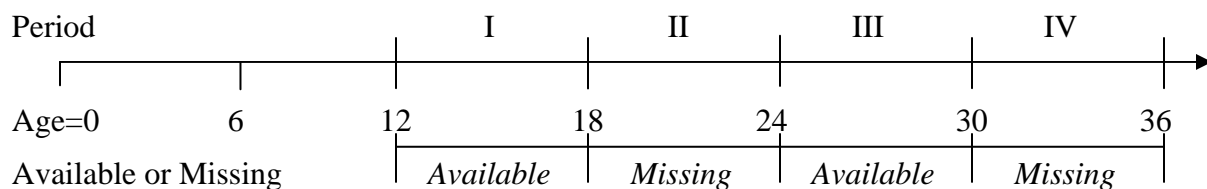
The first "bookend" case, where a period of missing expenditure data is in the middle of the child's EI history, is depicted by the missing Period II, which is bound by available expenditure periods both before and after. For these individuals our work is already done. The available periods before and after allow us to identify definitive start and end dates of the unknown gap yielding the number of months that must be imputed.

In contrast, the second "open-ended" case (represented by Period IV) is much more difficult to deal with. Here, we know up until what point these individuals participated in EI, however, their history is cut off or truncated. To this end, we have formulated a

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[40] A more in-depth step-by-step guide to calculating imputation durations across various sources of information for when a child exited early intervention using the method put forth here is available upon request from AIR.

method to provide a best estimate of how long these individuals stayed in EI past their last available participation date.

The key to calculating imputation durations for the open-ended cases is in knowing how to estimate the duration over which we *observe* expenditures (*available duration*) and the *potential* amount of time (*potential duration*) over which a child can be receiving EI services. It is from these two pieces of information that we calculate an imputed duration for each individual. The following figure will help us understand how these two measures are calculated:

Potential Duration

Age at IFSP = 11   Age at Potential = 36

0   6   12   18   24   30   36

Potential Duration = 25 Months

Available Duration   Age at Last
Age at IFSP = 11   Service Record = 29

0   6   12   18   24   29   36

Available Duration = 18 Months

*Residual
Duration* = 7 Months
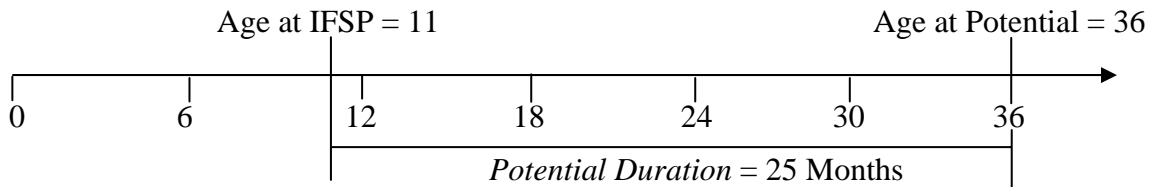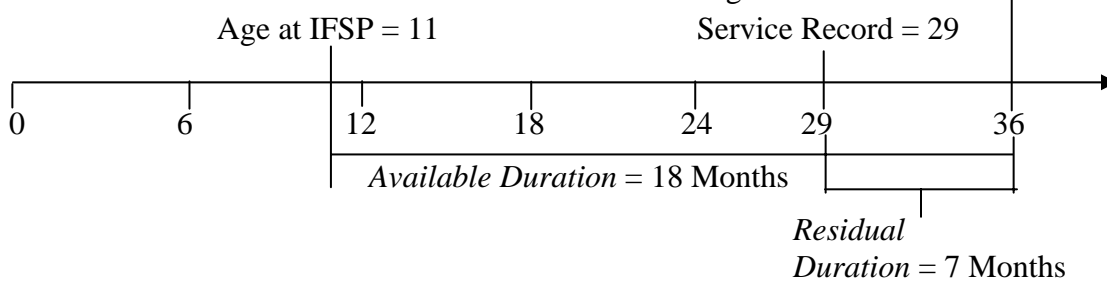
The figure illustrates the hypothetical EI history of a child who entered EI at 11 months of age (i.e., had their individualized family service plan (IFSP) completed at this age). The top half of the picture depicts the potential duration this individual could participate in EI. *Potential duration* is simply defined as the difference between 36 months (the oldest age one can be eligible for the program) and age at IFSP (the assumed age of entry). Clearly, *potential duration* equals 25 months for this individual (i.e., 36 – 11 = 25).

The lower portion of the figure shows the amount of time over which we observe EI expenditures for this child. *Available duration* is defined as the age at which the child received the last completed service record and the child's age at IFSP. For this particular individual the *available duration* equals 18 months (i.e., 29 – 11 = 18). We then define *residual duration* as the difference between *potential duration* and *available duration*.[41]

Once *residual duration* is calculated, we apply a rule to determine imputation durations whose purpose is twofold. First, in order to obtain the most accurate estimates of total expenditures over the sample, it is desirable to minimize the probability of over- or underestimating the duration length over which we are imputing. Second, we would like to limit the overall duration length so that we do not "fabricate" a relatively large

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[41] Although it is obvious that we could have just subtracted the age at last service record from 36 to provide the *residual duration*, it was necessary to calculate the *available duration* in order to formulate the variable *total imputed duration* for these individuals (see below).

proportion of an individual's expenditure history. With these two objectives in mind we use the following rule to define the *imputation duration*:

- Define the *imputation duration* as one-half the *residual duration*.

- Keep all individuals in the sample provided their calculated *imputation duration* is less than or equal to one-quarter of their *available duration*.

Finally, for those that pass the constraint that makes up the second part of our rule, we can construct the variable *total imputed duration* by simply adding the *imputation duration* to *available duration*.

Mathematically speaking, the rule is as follows:

$$imputed\ duration = 0.5 \times residual\ duration$$

$$\text{subject to}\ \ \frac{available\ duration}{residual\ duration} \geq 2$$

otherwise,

$$total\ imputed\ duration = not\ available$$

Imputing Whole Service Records

Consider a sequence of a maximum of six service records (SR's), each denoting episodes that are six (6) months in duration:

Episode	I	II	III	IV	V	VI
Age in Months	0 6	12	18	24	30	36

Our problem arises when whole service records vital to the calculation of the various expenditures over the child's career in early intervention (EI) are not reported, resulting in "missing values" for these measures.

The method we have devised to fill in or *impute* the missing values for these episodes uses multivariate regression analysis to estimate the expected value of individual expenditures based on all information pertaining to one's available expenditures over their EI career, controlled for family/social background, community setting, region, and age.

Instructions on How to Impute Total Expenditures for a Given Service Record

In simple terms, the "cookbook" recipe to this imputation method for missing values of total expenditure in a given service record (episode) is as follows:

1) Determine which individual service records for which you wish to impute values for the missing total expenditure variable. Calculate a new variable that, for **every** service record (including those you do not wish to impute), contains the average expenditure for an individual over all other available service records.

2)   For all individuals that were determined as *not to have missing values* for the service record-specific expenditure(s) under scrutiny, regress the available expenditure for this episode on the average expenditure calculated in 1), family/social background, community setting, region, and age.

3)   For those individuals found to have *missing* values for the episode-specific expenditure being imputed, use the parameters estimated in 2) in conjunction with the calculated average expenditure from 1) and the data on the respective family/social background, community setting, region, and age.

An Example

The table below represents the expenditure history of four children that have been receiving EI. Individuals 2 and 3 have each participated in four of the possible six-month service records. However, for individual 2, the first and third service records are missing, while individual 3 is missing his/her second and fourth service records. Clearly, this makes it impossible to directly calculate the total expenditure over their EI histories. To this end, we implement the imputation method set forth above.

Individual	Service Record (Episode)	Service Record Expenditure	Average Service Record Expenditure*
1	1	100	250
1	2	200	200
1	3	300	150
2	.	.	150
2	2	200	100
2	.	.	150
2	4	100	200
3	1	100	100
3	.	.	100
3	3	100	100
3	.	.	100
4	1	200	100
4	2	100	133.33
4	3	100	133.33
4	4	100	133.33

* Average expenditure is the average taken over all Service Record Expenditures **excluding** the service record for whose average you are calculating.

First, for *every* individual-specific service record in the sample, we calculate the average expenditures over *all other* available service records. Each average service record expenditure is calculated by taking the average of the service record-specific expenditures over all of the individual's service records **except** that for the service record whose average you are calculating. For example, for individual 1, we take the average expenditure for the other periods (2 and 3), which equals (200+300)/2 or 250. Note that we must also calculate these values for the service record-specific expenditures that are missing (i.e., for individual 2, service records 1 and 3, and individual 3 service records 2

and 4); also take notice that the calculated average expenditures associated with service records that need to be imputed will always be the same for a given individual (you need only calculate it once and fill the value in for all of the individual's missing service records).

Next, using only those individuals for whom we observe a total expenditure for the service record we wish to impute, we run a regression of this variable on family/social background, community setting, region, and age (not shown in table above) as well as the calculated average expenditure variable (the subscripts i and j refer to individual and service record, respectively):

$$TotalExpenditure_{ij} = \theta + FC'_i\alpha + G'_i\beta + A_{ij}\delta + AverageExpenditure_{ij}\chi$$

Using the estimated parameters $(\hat{\alpha}, \hat{\beta}, \hat{\delta}, \hat{\chi})$ and the data from individual 2, we can predict the total expenditure for this individual and use this value to impute the missing service record expenditures.

A Generalized Notational Exposition

Let the subscript i denote individuals and the subscript j represent one of the possible six service records. Next, consider the following variable definitions:

FC_i = set of variables pertaining to family background, social background, and community setting
G_i = set of indicator variables pertaining to region
A_{ij} = age of individual i in episode j
E_{ij} = expenditure of individual i in episode j

We first must calculate the average total available expenditure at each individual service record j as follows:

$$\overline{E}_{ij} = \frac{1}{K}\sum_{k \neq j}E_{ik}$$

for all available k (i.e., not missing), where K equals the number of available service records minus one. This is the average expenditure of individual i across all service records except for j.
Then, using only individual service records for in which the total expenditure we wish to impute is not missing, we run a regression equation of the following form:

$$E_{ij} = \theta + FC'_i\alpha + G'_i\beta + A_i\delta + \overline{E}_{ij}\chi + \varepsilon_i$$

Finally, using the estimated parameters $(\hat{\alpha}, \hat{\beta}, \hat{\delta}, \hat{\chi}_l)$ and the data pertaining to family/social background, community setting, region, age, and average expenditure for the observations with missing values, we can then calculate the average of the expected expenditures for the period(s) in question.

Transforming Service Record Expenditures to Monthly Expenditures

Now that we have determined the length over which we want to impute expenditures (imputation duration) and estimated missing expenditures at the service record level, we can now combine the two by applying our estimated expenditures to the missing cases that are "open-ended" or truncated. In contrast to the "bookend" cases where we are usually missing a whole six-month service record, the imputation duration for those histories that are truncated is generally shorter than the six-month period covered by a service record. Therefore, we must take the calculated imputation duration (measured in months) and divide it by six (total months in a service record) to yield the proportion of the service record covered by the gap. The total expenditure to be imputed for this abridged period is simply calculated by multiplying the imputed service record expenditure by the proportion of the service record covered.

Imputing Expenditures by Service Environment or Spending Component

It is also necessary to impute the portion of expenditures attributable to each service environment (i.e., home, clinic, preschool, etc.) or spending component (administration and support versus direct services). Because expenditures for missing service records are imputed, this will cause an increase above the total available expenditure over the EI careers of those individuals with missing service records. To this end, should we be interested in examining their total expenditures broken out by service environment or spending component, it is also necessary to devise some imputing scheme for these portions of expenditures. Again, information contained in the available service records is used.

As a first step, individual-specific expenditures by service environment for the available service records are calculated, yielding an environment-specific expenditure for each individual.[42] Next, these are summed providing the total available expenditure for each individual. Dividing each environment-specific expenditure by this sum yields the share of available total expenditure associated with each environment. Under the plausible assumption that spending patterns with respect to service environment remain fairly constant over a child's EI career, we choose to preserve the environment-specific share of an individual's total expenditure. In terms of calculation, this amounts to simply multiplying the imputed total expenditure by the environment-specific shares, yielding the imputed environment-specific expenditures.

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[42] For sake of brevity, henceforth, we only refer to the imputation of environment-specific expenditures. However, the methodology for imputing spending components is identical.

An Example

Suppose we have a child missing his/her third service record, for which we imputed the expenditure, so that the total expenditure is also (partially) imputed:

Individual	Service Record (Episode)	Total Expenditure	Expenditure in Environment 1	Expenditure in Environment 2
1	1	100	75	25
1	2	200	150	50
1	3	300 (imputed)	.	.
Sum of Total Expenditure		600 (imputed)	225	75
Total of Observable Expenditures			300	
Share of Total Observable Expenditures			.75	.25
Imputed Values of Total Environment-Specific Expenditures			450	150

Our job is to impute the missing values for environment-specific expenditures. Following the description above, we first total the available environment-specific expenditures (225 and 75 for environments 1 and 2, respectively). Next, we sum these to give us the total of observable expenditures (equal to 300) and calculate the expenditure shares of this sum attributed to each environment (.75 and .25 for environments 1 and 2, respectively). Finally, multiplying the total imputed expenditure by each environment-specific share provides us with our imputed expenditures for environments 1 and 2 (450 and 150, respectively).

Appendix B - SRI International Data Sources

The following describes the other SRI data sources that AIR used and incorporated in various stages of the expenditure study.

- **Program Director Survey:** A one-time survey of program directors of early intervention programs which includes questions such as type and size of the agency/program, number and types of clients served, and types of services provided. The information provides important substantive and demographic dimensions that AIR used to develop the stratification and sample selection strategies for the study sample data collection.
- **Service Provider Survey:** A one-time survey of service providers who worked with the child in the first six months of services that collects information about their background, training, and service delivery responsibilities and activities. Salary data were used to estimate salaries for all service providers in each of the venues covered by the sample of children for whom service records were collected. The data was then used to cost out services for individual children and their families.
- **Family Interviews:** These telephone interviews with families contain valuable information about the child and family characteristics as well as outcomes data at 36 months. The information about children and families obtained through the **Service Records** and the **Family Interview Surveys** helps discern the relationships between child and family needs, types and quantity of services provided, and outcomes.

Appendix C - AIR Data Collection: The Program Expenditure Survey

The NEILS Expenditure Study at AIR collected budget and fiscal data from a sample of 200 early intervention programs/programs from January through August 2000. The sites were selected from the universe of between 600 and 700 agencies and programs that completed and returned the Program Director Survey (previously administered by SRI which provided essential demographic and substantive information for the stratification sampling procedure). The sample was stratified by type of agency or program and agencies were selected with probabilities proportional to size (i.e., larger agencies had a greater likelihood of being selected).

The sample of early intervention sites selected for the study represented a diverse range of public and private organizations, agencies, and programs. Early intervention services are provided in a variety of settings and institutional contexts, including schools, hospitals, social service agencies, therapy clinics/office facilities, and families' homes.

There were three self-administered surveys in the expenditure study. Respondents could respond by completing the paper copy of the survey, or they could complete the electronic surveys published on an AIR Expenditure Study website. Approximately 80 percent of the 200 agencies completed one or more of the three sets of surveys, or have provided data files or reports in EI in lieu of completing the surveys.

- **NEILS Expenditure Survey Part I: Payroll Information.** This questionnaire requested payroll information on salaries and benefits of early intervention personnel.
- **NEILS Expenditure Survey Part II: Fiscal and Child Count Information.** This survey collected information on budgetary/fiscal information (e.g., total expenditures on salaries and benefits, contracted service providers, transportation, non-personnel, and overhead costs). Other data items requested included revenue by funding source and child count information.
- **NEILS Expenditure Survey Part III: Professional Services and Clients Served by Setting.** This questionnaire requested information on the types of direct services provided in various environments (e.g., early intervention center) and the number of hours working staff spent among various early intervention activities and environments.

Appendix D - Multipliers and Ratios Used in the Resource Cost Model

To establish a 'resource price' for a unit of service received by the child, it was necessary to gather all the requisite cost ingredients to be included in the resource cost model. Below is a brief illustration of some of the important variables and multipliers that were developed from both AIR and SRI data sources. These were applied to the child's records in the resource cost model.

Estimating the Resource Price of an Hour of Direct Service

To calculate the resource price of an hour of direct contact time for a service, the following formulas were used:

$$TC_{ij} = (C_{ij} \times H_{ij}) = \text{total cost of service i to child j}$$

and

$$C_{ij} = [(1+I_{ip}) \times (1+N_p) \times (1+T_{ik}) \times (1+A_{ik}) \times w_k \times (1+B_k)] / G_{ij}$$

where

C_{ij} = cost per hour of contact time for service i for child j

TC_{ij} = total cost of service i for child j

H_{ij} = hours of service i scheduled for child j

I_{ip} = overhead/indirect rate on labor (operations and administrative costs) by program

G_{ij} = size of group in which service i is commonly provided to child j.)

T_{ik} = ratio of total time required for service i by personnel category k per hour of contact time. For example, if a psychologist requires an average of one hour of time for travel, preparation, debriefing, etc. for each hour of contact time with the client, then t =2

A_{ip} = the ratio of dollars (wages and benefits) required of administration or clerical support time for service i per dollar spent on client contact time (wages and benefits) for personnel in program p;

W_k = hourly wage of personnel category k

B_p = the benefit rate of personnel by program type p; and

N_p = the ratio of dollars of non-personnel expenditure required for service i in program p

These various expenditure ratios were broken down by program/agency types (e.g., community-based program) or by personnel type (by job title). This approach lends to the improved precision of expenditure estimates due to the inherent differences in the way resources may be organized along program or personnel types.

I. **Average Base Hourly Rate (w_k).** This refers to the base salary rate of an hour of direct service received by the child. The base hourly rate or annual/monthly salary figures provided by the service providers in SRI's Service Provider Survey (item #18) was one of the main variables used in estimating the direct expenditures of the child by service type. When such salary data were missing for a particular provider, AIR staff used multivariate regression analysis to estimate the hourly rates. In other words, staff estimated the expected hourly rate based on available information (e.g., job title, years of experience, educational background) on file for that person.

I. Hourly Rate By Job Title

Job Title	Average	Standard Error	Number of observations
Audiologist	$ 24.32	$ 1.12	39
Child Development/Infant Specialist	$ 16.56	$ 0.39	279
Family Support Specialist/Parent Liaison	$ 15.10	$ 0.98	27
Family Therapist/Mental Health Professional/Behavior Therapist	$ 21.11	$ 2.12	10
Nurse	$ 20.08	$ 0.57	62
Nutritionist	$ 23.10	$ 1.61	23
Occupational Therapist	$ 25.57	$ 0.62	236
Paraprofessional or Aide	$ 10.49	$ 0.58	27
Pediatrician	$ 58.92	$ 5.59	27
Physical Therapist	$ 28.07	$ 0.62	242
Physical Therapist Assistant/Occupational Therapist Assistant	$ 21.96	$ 1.91	22
Physician (Other then Pediatrician)	$ 72.99	$ 9.36	15
Psychologist	$ 29.75	$ 3.02	31
Service Coordinator	$ 16.48	$ 0.27	523
Social Worker	$ 17.90	$ 0.59	97
Special Educator	$ 21.43	$ 0.59	210
Speech/Language Therapist	$ 23.60	$ 0.46	382
Vision Specialist	$ 29.16	$ 2.56	29
Other	$ 20.98	$ 0.60	355

II. **Fringe Benefit Rate (B_k).** In most organizations, a person's gross compensation includes a base salary and a fringe benefit package that covers benefits such as health insurance. In the Resource Cost Model, a fringe ratio was applied to the hourly rates of

pay for each type of agency in order to estimate the gross hourly compensation for each service provider. The fringe ratio was derived from the Expenditure Study Payroll Questionnaire by type of agency.

II. Fringe Benefit Rate			
Agency Type	**Average**	**Std Error**	**Number of observations**
Community Based for All Ages with Disabilities	20.8%	0.2%	860
Community Based for Young Children with Disabilities	19.7%	0.2%	966
Hospital or Other Health Care Agency	20.8%	0.5%	219
Other (inc. Preschool, Multiple Response, Missing)	26.2%	0.2%	313
School or School District	23.0%	0.4%	369
Social Services (or Mental Health) Agency	22.1%	0.2%	1003

III. **Non-Direct Hours (T_{ik}).** For every hour of direct service provided by an early intervention service provider, there is additional time involved in activities such as preparation, travel, record-keeping, and program evaluation. The non-direct hours ratio translates each direct hour of service reported on the client service records into the total hours of work required to provide that direct service hour. The non-direct hours ratio was derived from item 17 of SRI's Service Provider Survey.

III. Non-Direct Hours By Job Title			
Job Title	Average Non-Direct Hours	Standard Error	Number of observations
Audiologist	1.80	0.17	41
Child Development/Infant Specialist	2.25	0.09	273
Family Support Specialist/Parent Liaison	3.03	0.66	25
Family Therapist/Mental Health Professional/Behavior Therapist	1.99	0.42	11
Nurse	2.30	0.26	57
Nutritionist	1.92	0.15	29
Occupational Therapist	1.84	0.04	270
Occupational Therapist Assistant	1.70	0.08	13
Paraprofessional or Aide	2.32	0.33	27
Pediatrician	1.27	0.07	26
Physical Therapist	1.94	0.08	269
Physical Therapist Assistant	1.49	0.17	10
Physician (Other then Pediatrician)	1.71	0.59	15
Psychologist	3.21	0.54	31
Service Coordinator	2.87	0.21	496
Social Worker	2.81	0.29	94
Special Educator	2.26	0.10	213
Speech/Language Therapist	2.06	0.09	431
Vision Specialist	2.52	0.27	31
Other	2.31	0.26	36

IV. **Program Administration and Support Ratio (A_{ik}).** AIR staff combined the salaries and fringe data from the Expenditure Study Payroll Questionnaire and the time management information from the Service Provider Survey (item 17) to estimate the expenditures on program administration associated with each dollar expended on direct service personnel.

To determine the administrative and direct service components of a service provider's earnings, AIR staff calculated the percentage of time this staff spent in administrative activities (e.g., paperwork, training, supervision, administrative and support) versus other direct services, and apportioned the expenditure accordingly. For example, if a program director earns $40,000 a year, and spends half (50 percent) of his/her time in administration activities, and another half (50 percent) in direct services, the administration expenditure will be $20,000, and the direct service expenditure will be $20,000. This means that for each dollar of direct services another dollar is spent on administration to support the direct activity.

IV. Program Administration and Support Rate By Agency Type			
Agency Type	Average Rate	Standard Error	Number of observations
Community Based for all Ages with Disabilities	47.2%	2.3%	39
Community Based for Young Children with Disabilities	48.9%	3.8%	36
Hospital or Other Health Care Agency	42.7%	5.4%	14
Other (inc. Preschool, Multiple Response, Missing)	50.2%	10.2%	11
School or School District	39.8%	5.9%	18
Social Services (or Mental Health) Agency	47.7%	4.3%	32

V. **Non-personnel Rate (N_p).** AIR staff utilized the budget information derived from the Expenditure Study Budget and Child Count Questionnaire (item 5) to estimate the dollars of non-personnel expenditures associated with each dollar of direct expenditures. The non-personnel expenditures include items such as supplies, materials, professional development, travel, and capital outlay necessary to support the early intervention services provided to the child.

V. Non-Personnel Rate by Agency Type

Agency Type	Average rate	Std Error	Number of observations
Community Based for All Ages with Disabilities	7.7%	1.3%	39
Community Based for Young Children with Disabilities	6.7%	1.1%	36
Hospital or Other Health Care Agency	5.6%	1.1%	14
Other (inc. Preschool, Multiple Response, Missing)	8.0%	2.4%	11
School or School District	6.7%	1.1%	18
Social Services (or Mental Health) Agency	7.7%	1.6%	32

VI. **Indirect/Overhead Rate.** The indirect rate reflects overhead expenditures related to operating an early intervention program, such as general administrative and fiscal support provided to smaller agencies operated within larger agencies such as hospitals or clinics. The indirect expenses were estimated from the information collected from the Expenditure Study Budget and Child Count Questionnaire (item 6).

VI. Indirect Rate by Agency Type

Agency Type	Average Indirect Rate	Std Error	Unweighted
Community Based for all Ages with Disabilities	8.3%	2.1%	25
Community Based for Young Children with Disabilities	7.0%	1.9%	25
School or School District, Including Preschool, Others	7.4%	1.7%	17
Social Services (Hospital, Healthcare, or Mental Health) Agency	12.0%	2.1%	36

VII. **Average Group Size (G_{ij}).** Most early intervention services are provided on a one-to-one basis. However, some early intervention services are provided in centers or settings in which multiple children are served at the same time. The group size information was derived from SRI's Service Records (items 11, 17, 24, 31). When the service record contained ambiguities with respect to group size information (e.g., missing values or multiple responses), AIR staff used several procedures to estimate the group sizes for various types of service providers in certain settings. For example, in a home setting, children were assumed to be served one-on-one. In settings other than a home environment, AIR staff examined the caseload or group size patterns by personnel and by types of environment to derive the best estimates of these measures.

VI. Average Group Size by Job Title

Job Title	Average Group Size
Audiologist	1.0
Behavior Therapist	1.0
Child Development/Infant Specialist	4.7
Family Support Specialist/Parent Liaison	1.0
Family Therapist/Mental Health Professional	3.4
Nurse	1.0
Nutritionist	1.0
Occupational Therapist	1.0
Occupational Therapist Assistant	1.0
Orientation/Mobility Specialist	1.0
Paraprofessional or Aide	2.6
Pediatrician	1.0
Physical Therapist	1.0
Physical Therapist Assistant	1.0
Physician (Other then Pediatrician)	1.0
Psychologist	1.0
Service Coordinator	1.0
Social Worker	2.6
Special Educator	6.7
Speech/Language Therapist	1.0
Vision Specialist	1.0
Other	1.0

Example:
Estimating the resource price of an hour of direct service from an audiologist who is employed by a school district:

Base salary = $24.32
Fringe = 23%
Program Administration and support = 39.8%
Non-personnel = 6.7%
Non-direct hours = 1.8
Group Size = 1
Indirect rate = 7.4%

The total resource price for an hour of direct service =
($24.32 * 1.23 * 1.398 * 1.067 * 1.8 * 1.074) / 1 = $86.26

Other Measurement Variables

Program type: Each type of early intervention service in the service record is associated with a program type of an early intervention agency.[43] SRI provided the linkage file that allows this matching. In the resource cost model, each type of service received by a child is matched to a provider, which is then matched to an early intervention agency, for which the program type is identified. If direct linkage was not possible, AIR staff developed several procedures to assign a program type to the service based on supplementary information available through the service records. For example, if the child received specialized center-based early intervention services as indicated on his/her service records, then the program type for this child was a 'community-based program for young children.' On the other hand, if such information was not available (e.g., a child is served in a home environment), AIR then examined the existing program type information that was available on that child to determine the predominance of a program type. For example, if existing information indicated that the child received most services from a community-based program it was assumed that the child received its other services from a community-based program.

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[43] The program type information is obtained from item 2b of the Program Director Survey. If the response to this item is missing, or if the Program Director Survey was not returned to SRI, the program type information is supplied by SRI after researching into the organizational structure of the agency.

Appendix E - Sources of Funding for Early Intervention

Appendix E-1 - Sources of Federal, State, and Local Funding

Source of revenue	Percent of agencies receiving this source of revenue	Std Error	Unweighted N	Weighted N
Federal (Overall)	**64.0%**	**7.3%**	**115**	**703**
IDEA Part C	39.0%	7.0%	115	703
IDEA Part B	1.3%	0.6%	115	703
MEDICAID	16.0%	4.7%	115	703
S-CHIP (Title XXI)	0.9%	0.7%	115	703
CHAMPUS/TRICARE	13.0%	5.9%	115	703
Impact/Aid/DOE	0.2%	0.2%	115	703
Early Start	0.9%	0.9%	115	703
Early Head Start	0.6%	0.6%	115	703
Funds for Developmental Delay	1.3%	1.3%	115	703
Title XX SSBG	0.7%	0.7%	115	703
Funds for the Homeless	0.4%	0.4%	115	703
Child Care Block Grants	0.9%	0.7%	115	703
Ryan White CARE Act (AIDS Funds)	0.9%	0.9%	115	703
Other	6.7%	2.8%	115	703
State (overall)	**86.0%**	**3.4%**	**115**	**703**
Medicaid EI System State Match	17.0%	6.1%	115	703
State Part C Appropriation	41.0%	7.3%	115	703
State Maintenance of Effort (TANF)	2.9%	1.4%	115	703
IDEA Part B	1.5%	1.1%	115	703
Healthy Families Initiative	0.5%	0.4%	115	703
Head Start	1.7%	1.8%	115	703
HMO/PPO/IPA (private managed care)	8.6%	3.5%	115	703
State Governor's Initiatives targeted to young children	4.6%	2.5%	115	703
Other	37.0%	7.5%	115	703
Local (overall)	**47.0%**	**6.4%**	**115**	**703**
Family Fee	12.0%	3.8%	115	703
Family Co-pay	4.2%	1.8%	115	703
Private Insurance	20.0%	4.5%	115	703
Locally Raised Tax Revenue	8.7%	3.2%	115	703
Provider Contributions	2.5%	1.2%	115	703
Locally Raised Revenue Contributions	17.0%	3.7%	115	703
Philanthropic Organizations/Foundations	18.0%	4.2%	115	703
Other	16.0%	4.0%	115	703

Appendix F - Duration and Expenditures on Early Intervention

Appendix F-1 - Average Age at IFSP by Disability-Related Characteristic

Disability-related Characteristic	Average age at IFSP	Standard Error	unweighted N	weighted N
At Risk	8.1	0.5	401	23,296
Speech	24.2	0.4	579	28,864
Development Delay	18.3	0.5	985	51,745
Diagnosed Condition	12.5	0.3	1,232	64,323
Undetermined	13.0	7.6	3	128
Overall	15.7	0.6	3,200	168,356

Appendix F-2 - Average Duration in Early Intervention, by Disability-Related Characteristic

Disability-Related Condition	Average Duration	Std Err	unweighted N	weighted N
At Risk	23.2	0.4	241	22,119
Speech	9.7	0.3	377	27,126
Developmental Delay	14.6	0.3	660	50,614
Diagnosed Condition	20.4	0.3	879	65,165
Undetermined	15.8	2.3	38	3,195
Overall	17.2	0.5	2,195	168,218

Appendix F-3- Total and Average Monthly Expenditure
by Disability-Related Characteristic

Disability - Related Conditions	Expenditures				Standard Errors				Number of Observations	
	Average Total Expenditures	Total Direct Service Expenditure	Total Administration and Support Expenditure	Average Monthly Expenditure	Total Expenditures	Direct Service Expenditure	Administration and Support	Average Monthly Expenditure	Unweighted N	Weighted N
Overall	$15,740	$10,709	$5,031	$916	$ 1,277	$901	$418	$ 93	2,195	168,218
Speech-Only	$6,228	$4,228	$2,000	$642	$ 687	$473	$229	$ 65	377	27,126
Development Delay	$13,804	$9,385	$4,419	$948	$ 1,507	$1,045	$499	$ 118	660	50,614
Undetermined	$10,798	$7,358	$3,440	$685	$ 3,130	$2,224	$1,007	$ 139	38	3,195
Diagnosed Condition	$22,475	$15,289	$7,187	$1,103	$ 2,520	$1,768	$821	$ 128	879	65,165
At-risk	$12,708	$8,682	$4,026	$549	$ 1,504	$1,068	$477	$ 63	241	22,119

Appendix F-4 - Average Total and Monthly Expenditure by Disability-Related Characteristic and Duration

Disability-Related Characteristic	Duration	Average Total Expenditure	Std. Err. Total	Average Monthly Expenditure	Std. Err. Monthly	Unweighted N	Weighted N
At-risk	Less than 6 Months in EI		*	$300	*	2	990
	Between 6 and 12 Months in EI	$3,157	$670	$342	$61	13	14,979
	Between 13 and 18 Months in EI	$4,639	$1,064	$292	$67	33	40,804
	Between 19 and 24 Months in EI	$10,511	$1,791	$495	$86	78	157,993
	Between 25 and 30 Months in EI	$16,964	$3,469	$622	$130	69	173,251
	More than 30 Months in EI	$19,639	$3,565	$625	$115	46	124,363
Speech	Less than 6 Months in EI	$3,314	$449	$604	$83	65	25,840
	Between 6 and 12 Months in EI	$4,911	$700	$569	$74	196	126,764
	Between 12 and 18 Months in EI	$9,643	$1,085	$699	$83	105	96,482
	Between 18 and 24 Months in EI	$ 18,828	$2,856	$970	$149	11	14,188
Developmental Delay	Less than 6 Months in EI	$6,907	$1,993	$1,271	$362	67	33,737
	Between 6 and 12 Months in EI	$6,431	$1,023	$733	$136	187	137,525
	Between 12 and 18 Months in EI	$12,799	$1,864	$869	$121	194	186,320
	Between 18 and 24 Months in EI	$17,723	$3,880	$853	$188	137	195,118
	Between 24 and 30 Months in EI	$38,077	$6,912	$1,422	$255	65	149,591
	More than 30 Months in EI	$12,601	$2,473	$399	$75	10	34,881
Diagnosed Condition	Less than 6 Months in EI	$4,834	$942	$881	$169	36	16,478
	Between 6 and 12 Months in EI	$10,994	$2,631	$1,337	$280	125	91,513
	Between 12 and 18 Months in EI	$15,017	$2,216	$1,009	$149	168	157,518
	Between 18 and 24 Months in EI	$20,105	$4,813	$962	$235	167	264,456
	Between 24 and 30 Months in EI	$29,005	$3,117	$1,067	$117	248	502,317
	More than 30 Months in EI	$40,615	$3,651	$1,279	$115	135	295,820
Undetermined	Less than 6 Months in EI		$1,772	$856	$328	7	2,575
	Between 6 and 12 Months in EI		$2,122	$445	$193	9	7,193
	Between 12 and 18 Months in EI		$4,094	$606	$276	8	10,450
	Between 18 and 24 Months in EI		*	$645	*	7	12,049
	Between 24 and 30 Months in EI		*	$1,724	*	3	6,558
	More than 30 Months in EI		*	$318	*	4	11,569

Appendix F-5 – Variation in Monthly Expenditure
by Disability-Related Characteristic

Disability-Related Condition	25th Percentile	50th Percentile (median)	75th Percentile	Average	Unweighted N	Weighted N
At-risk	$212.80	$401.90	$689.10	$548.60	241	22,119
Speech-Only	$278.20	$508.20	$763.80	$641.70	377	27,126
Developmental Delay	$282.30	$588.20	$1,128.40	$947.80	660	50,614
Diagnosed Condition	$458.50	$742.00	$1,285.70	$1,102.80	879	65,165
Undetermined	$263.60	$1,279.70	$371.00	$684.50	38	3,195

Appendix F-6 – Average Monthly Expenditure
by General Health Status at Entry into Early Intervention

Health Status	Average	SE	Unweighted N	Weighted N
Excellent	$793.49	$88.86	886	1,087,347
Very Good	$871.59	$103.84	499	681,541.7
Good	$934.06	$129.19	493	673,846.1
Poor or Fair	$1,251.84	$183.34	317	448,587.2

Appendix F-7 – Average Monthly Expenditure
by Race

Race	Average	SE	Unweighted N	Weighted N
Hispanic/Latino,Native American,Asian	$825.74	$220.80	135	198,077.3
White	$903.07	$84.34	1230	1,644,432
Mixed Race	$939.26	$186.56	391	419,651.5
African American	$961.67	$96.04	439	629,160.4

Appendix F-8 – Average Monthly Expenditure
by Maternal Education

Maternal Education	Average	SE	Unweighted N	Weighted N
High School/GED	$849.13	$95.83	706	1,003,922
College w/no Degree	$929.10	$122.59	606	785,159.1
BA/BS or Higher	$937.56	$104.69	570	660,127.5
Below High School/GED	$1,010.89	$99.46	313	442,112.6

Appendix F-9 – Average Monthly Expenditure
by Yearly Household Income

Yearly Household Income	Average	SE	Unweighted N	Weighted N
Less Than or Equal to $15,000	$900.44	$129.65	499	759,314.2
$15,001 to $25,000	$936.26	$146.54	301	419,766.5
$25,001 to $50,000	$918.09	$69.13	745	947,798.1
$50,001 to $75,000	$829.41	$111.03	368	427,162.8
Over $75,000	$1,027.66	$132.88	282	337,280

Appendix F-10 – Average Monthly Expenditure
by Parental Composition of Household

Parental Composition of Household	Average	SE	Unweighted N	Weighted N
Respondent and Partner	$657.98	$116.19	132	192,394.8
Respondent and Other Adult(s)	$904.10	$139.30	229	326,844.9
Two Biological/Adoptive Parents	$924.71	$83.00	1561	195,6608
Only One Adult	$1,002.26	$132.96	273	415,474.2

Appendix F-11 – Regressions of Logarithm Total Expenditures in Early Intervention (EI)

	Coefficients
Disability-related characteristic is speech	0.525 (0.146)***
Disability-related characteristic is developmental delay	0.603 (0.149)***
Disability-related characteristic is diagnosed condition	0.743 (0.137)***
Disability-related characteristic is undetermined	0.346 (0.304)
Duration of early intervention participation in months	0.085 (0.004)***
Birth vulnerability index (1=Least Vulnerable, 3=Most Vulnerable)	-0.049 (0.029)
Birth vulnerability index is missing	-0.102 (0.130)
General health at entry in EI very good	0.055 (0.056)
General health at entry in EI good	0.207 (0.079)**
General health at entry in EI poor or fair	0.301 (0.049)***
General health at entry in EI is missing	-0.026 (0.179)
Race is African American	-0.072 (0.066)
Race is Hispanic/Latino, Native American or Asian	0.030 (0.098)
Race is mixed	-0.015 (0.168)
Race is missing	-0.050 (0.164)
Gender (1 = female)	0.122 (0.077)
Mother's education high school/GED	-0.057 (0.113)
Mother's education college w/no degree	0.041 (0.090)
Mother's education BA/BS or higher	-0.042 (0.147)
Mother's education missing	0.180 (0.386)
Observations	2195
R-squared	0.3897

Robust standard errors using balanced repeated replication weights in parentheses. Dependent variable is logarithm of total expenditures on EI. Reference individual is a male that enters EI in excellent health, is characterized as at-risk, whose mother has less than a high school diploma, living in a California household with income less than $15,000, and has only one parent in his household.

Imputed missing values of general health, race and maternal education have been set to "excellent", "white" and "high school/GED", respectively. Imputed missing values of BVI set to sample mean (0.566785).

* significant at 10%; ** significant at 5%; *** significant at 1%.

	Coefficients
Percent of county population uninsured	-0.005
	(0.022)
County per capita income	-0.001
	(0.009)
Percent of county population above 18 with high school education	-0.027
	(0.014)*
Percent of county population below poverty line	-0.002
	(0.011)
County infant deaths per 1,000 births	-0.000
	(0.028)
County census data missing	-0.235
	(0.312)
Household income $15,001 to $25,000	0.209
	(0.106)*
Household income $25,001 to $50,000	0.178
	(0.101)*
Household income $50,001 to $75,000	0.098
	(0.150)
Household income over $75,000	0.193
	(0.151)
Household income is missing	-0.097
	(0.145)
Two biological/adoptive parents in child household	-0.206
	(0.102)*
Respondent and partner in child household	-0.369
	(0.181)*
Respondent and other adult(s) in child household, no partner	-0.171
	(0.112)
Parental composition of child household is missing	0.080
	(0.292)
Observations	2195
R-squared	0.3897

Robust standard errors using balanced repeated replication weights in parentheses. Dependent variable is logarithm of total expenditures on EI. Reference individual is a male that enters EI in excellent health, is characterized as at-risk, whose mother has less than a high school diploma, living in a California household with income less than $15,000, and has only one parent in his household. Imputed missing values of household income and parental composition of household set to "$15,001 to $25,000" and "Two biological/adoptive parents in child household", respectively.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix F-12.a – Tests of equality and joint significance of disability related characteristic effects on total EI expenditures

	Speech	Developmental delay	Diagnosed condition	Undetermined
Speech				
Developmental delay	F-stat=0.68 $F_{df(1,15)}$=4.54 F-prob=0.4234			
Diagnosed condition	F-stat=3.65 $F_{df(1,15)}$=4.54 F-prob=0.0755	F-stat=6.59 $F_{df(1,15)}$=4.54 F-prob=0.0214		
Undetermined	F-stat=0.34 $F_{df(1,15)}$=4.54 F-prob=0.5691	F-stat=0.80 $F_{df(1,15)}$=4.54 F-prob=0.3845	F-stat=1.82 $F_{df(1,15)}$=4.54 F-prob=0.197	
All DRC effects	F-stat=8.12 $F_{df(4,12)}$=3.26 F-prob=0.0021			

Appendix F-12.b – Tests of equality and joint significance of general health at entry of EI effects on total EI expenditures

	Very good	Good	Fair or poor
Very good			
Good	F-stat=3.20 $F_{df(1,15)}$=4.54 F-prob=0.0939		
Fair or poor	F-stat=41.96 $F_{df(1,15)}$=4.54 F-prob=0.0000	F-stat=1.74 $F_{df(1,15)}$=4.54 F-prob=0.2069	
All health effects	F-stat=19.50 $F_{df(3,13)}$=3.41 F-prob=0.0000		

Appendix F-12.c – Tests of equality and joint significance of household income effects on total EI expenditures

	$15,001 to $25,000	$25,001 to $50,000	$50,001 to $75,000	Greater than $75,000
$15,001 to $25,000				
$25,001 to $50,000	F-stat=0.10 $F_{df(1,15)}$=4.54 F-prob=0.7538			
$50,001 to $75,000	F-stat=0.87 $F_{df(1,15)}$=4.54 F-prob=0.3661	F-stat=0.61 $F_{df(1,15)}$=4.54 F-prob=0.4480		
Greater than $75,000	F-stat=0.02 $F_{df(1,15)}$=4.54 F-prob=0.8872	F-stat=0.03 $F_{df(1,15)}$=4.54 F-prob=0.8685	F-stat=0.40 $F_{df(1,15)}$=4.54 F-prob=0.5362	
All household income effects	F-stat=2.14 $F_{df(4,12)}$=3.26 F-prob=0.1376			

Appendix F-12.d – Tests of equality and joint significance of parental composition of household effects on total EI expenditures

	Two biological/adoptive parents in child household	Respondent and partner in child household	Respondent and other adult(s) in child household, no partner
Two biological/adoptive parents in child household			
Respondent and partner in child household	F-stat=1.42 $F_{df(1,15)}$=4.54 F-prob=0.2525		
Respondent and other adult(s) in child household, no partner	F-stat=0.22 $F_{df(1,15)}$=4.54 F-prob=0.6436	F-stat=2.73 $F_{df(1,15)}$=4.54 F-prob=0.1193	
All adult composition of household effects	F-stat=1.54 $F_{df(3,13)}$=3.41 F-prob=0.2505		

Appendix F-13 – Main Effects of Individual Characteristics and Duration on Monthly Early Intervention (EI) Expenditures

Category	Variable	Coefficients	Percent effect on monthly EI expenditures
Disability-related characteristic (DRC)	At-risk (reference group)	N/A	N/A
	Speech	0.584 (0.143)***	79.3%***
	Developmental delay	0.561 (0.141)***	75.3%***
	Diagnosed condition	0.710 (0.125)***	103.3%***
	Undetermined	0.362 (0.323)	43.6%
General health at entry in EI	Excellent (reference group)	N/A	N/A
	Very good	0.042 (0.058)	4.3%
	Good	0.189 (0.075)**	20.8%**
	Fair or poor	0.348 (0.053)***	41.6%***
	Missing	-0.109 (0.160)	-10.4%
Birth vulnerability index (BVI)	BVI (0=no difficulties, 3=most difficulties)	-0.070 (0.027)**	-6.8%**
	Missing	-0.129 (0.146)	-12.1%
Duration in EI participation	Months	-0.229 (0.053)***	-20.4%***
	Months squared	0.013 (0.003)***	1.3%***
	Months cubed	-0.000 (0.000)***	-0.0%***
Observations		2,195	
R-squared		0.2388	

Robust standard errors using balanced repeated replication weights in parentheses. Dependent variable is logarithm of monthly expenditures on EI. Reference individual is a male that enters EI in excellent health, is characterized as at-risk, whose mother has less than a high school diploma, living in a California household with income less than $15,000, and has only one parent in his household.

Imputed missing values of DRC and general health set to at-risk and excellent, respectively. Imputed missing values of BVI set to sample mean (0.566785).

* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix F-13 (Continued) – Main Effects of Individual Characteristics and Duration on Monthly Early Intervention (EI) Expenditures

Category	Variable	Coefficients	Percent effect on monthly EI expenditures
Race	White (reference group)	N/A	N/A
	African American	0.017 (0.069)	1.7%
	Hispanic/Latino, Native American or Asian	0.041 (0.125)	4.1%
	Mixed	0.028 (0.161)	2.9%
	Missing	-0.006 (0.222)	-0.6%
Maternal education	Less than high school/GED (reference group)	N/A	N/A
	High school/GED	-0.106 (0.093)	-10.0%
	College w/no degree	0.009 (0.090)	0.9%
	BA/BS or higher	-0.065 (0.129)	-6.3%
	Missing	0.300 (0.409)	35.0%
Household income	Less than or equal to $15,000 (reference group)	N/A	N/A
	$15,001 to $25,000	0.225 (0.139)	25.2%
	$25,001 to $50,000	0.212 (0.096)**	23.7%**
	$50,001 to $75,000	0.111 (0.146)	11.7%
	Over $75,000	0.196 (0.153)	21.6%
	Missing	-0.022 (0.152)	-2.2%
Parental composition of household	Only one adult in child's household (reference group)	N/A	N/A
	Two biological/adoptive parents in child household	-0.164 (0.069)**	-15.1%**
	Respondent and partner in child Household	-0.294 (0.153)*	-25.5%*
	Respondent and other adult(s) in child household, no partner	-0.195 (0.083)**	-17.7%**
	Parental composition of child household is missing	-0.074 (0.302)	-7.1%
Gender	Male (reference group)	N/A	N/A
	Female	0.097 (0.072)	10.2%
Observations		2,195	
R-squared		0.2388	

Robust standard errors using balanced repeated replication weights in parentheses. Dependent variable is logarithm of total expenditures on EI. Reference individual is a male that enters EI in excellent health, is characterized as at-risk, whose mother has less than a high school diploma, living in a California household with income less than $15,000, and has only one parent in his household.

Imputed missing values of race, maternal education, household income and parental composition of household set to white, high school/GED, less than $15,000, and two biological/adoptive parents in child household, respectively.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix F-13 (Continued) – Main Effects of Individual Characteristics and Duration on Monthly Early Intervention (EI) Expenditures

Category	Variable	Coefficients	Percent effect on monthly EI expenditures
County level demographics	Percent of county population Uninsured	0.000 (0.016)	0.0%
	County per capita income (in thousands of dollars)	-0.001 (0.008)	-0.1%
	Percent of county population above 18 with high school education	-0.032 (0.012)***	-3.2%**
	Percent of county population below poverty line	-0.005 (0.010)	-0.5%
	County infant deaths per 1,000 births	-0.008 (0.027)	-0.8%
	County census data missing	-0.262 (0.397)	-23.0%
Observations		2,195	
R-squared		0.2388	

Robust standard errors using balanced repeated replication weights in parentheses. Dependent variable is logarithm of total expenditures on EI. Reference individual is a male that enters EI in excellent health, is characterized as at-risk, whose mother has less than a high school diploma, living in a California household with income less than $15,000, and has only one parent in his household.
Imputed missing values of census variables set to sample means.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix F-14.a – Tests of equality and joint significance of disability related characteristic effects on monthly EI expenditures

	Speech	Developmental delay	Diagnosed condition	Undetermined
Speech				
Developmental delay	F-stat=0.04 $F_{df}(1,15)=4.54$ F-prob=0.8371			
Diagnosed condition	F-stat=1.07 $F_{df}(1,15)=4.54$ F-prob=0.3171	F-stat=11.27 $F_{df}(1,15)=4.54$ F-prob=0.0043		
Undetermined	F-stat=0.39 $F_{df}(1,15)=4.54$ F-prob=0.5413	F-stat=0.37 $F_{df}(1,15)=4.54$ F-prob=0.5519	F-stat=1.16 $F_{df}(1,15)=4.54$ F-prob=0.2983	
All DRC effects	F-stat=14.74 $F_{df}(4,12)=3.26$ F-prob=0.0001			

Appendix F-14.b – Tests of equality and joint significance of general health at entry of EI effects on monthly EI expenditures

	Very good	Good	Fair or poor
Very good			
Good	F-stat=3.24 $F_{df(1,15)}$=4.54 F-prob=0.0921		
Fair or poor	F-stat=47.87 $F_{df(1,15)=}$4.54 F-prob=0.0000	F-stat=6.61 $F_{df(1,15)=}$4.54 F-prob=0.0213	
All effects	F-stat=22.2 $F_{df(3,13)=}$3.41 F-prob=0.0000		

Appendix F-14.c – Tests of equality and joint significance of household income effects on monthly EI expenditures

	$15,001 to $25,000	$25,001 to $50,000	$50,001 to $75,000	Greater than $75,000
$15,001 to $25,000				
$25,001 to $50,000	F-stat=0.02 $F_{df(1,15)}$=4.54 F-prob=0.9034			
$50,001 to $75,000	F-stat=0.97 $F_{df(1,15)}$=4.54 F-prob=0.3393	F-stat=1.45 $F_{df(1,15)}$=4.54 F-prob=0.2478		
Greater than $75,000	F-stat=0.04 $F_{df(1,15)}$=4.54 F-prob=0.8449	F-stat=0.03 $F_{df(1,15)}$=4.54 F-prob=0.8739	F-stat=0.27 $F_{df(1,15)}$=4.54 F-prob=0.6117	
All effects	F-stat=3.24 $F_{df(4,12)}$=3.26 F-prob=0.0507			

Appendix F-14.d – Tests of equality and joint significance of parental composition of household effects on monthly EI expenditures

	Two biological/adoptive parents in child household	Respondent and partner in child household	Respondent and other adult(s) in child household, no partner
Two biological/adoptive parents in child household			
Respondent and partner in child household	F-stat=1.21 $F_{df(1,15)}$=4.54 F-prob=0.2893		
Respondent and other adult(s) in child household, no partner	F-stat=0.17 $F_{df(1,15)}$=4.54 F-prob=0.6881	F-stat=0.70 $F_{df(1,15)}$=4.54 F-prob=0.4153	
All effects	F-stat=2.14 $F_{df(3,13)}$=3.41 F-prob=0.1440		

Appendix F-15 – Effects of Individual Characteristics, Duration, Gender and Race on Total Early Intervention (EI) Expenditures by Disability-Related Characteristic

Category	Variable	At-risk	Speech-Only	Developmental Delay	Diagnosed Condition
General health at entry in EI	Excellent (reference group)	N/A	N/A	N/A	N/A
	Very good	-0.214 (0.304)	-0.043 (0.147)	0.094 (0.103)	0.095 (0.172)
	Good	-0.080 (0.233)	0.112 (0.213)	0.344 (0.201)	0.129 (0.172)
	Fair or poor	0.263 (0.317)	-0.074 (0.308)	0.111 (0.202)	0.365 (0.166)**
	Missing	-0.900 (0.865)	-0.073 (0.321)	-0.021 (0.295)	0.134 (0.155)
Birth vulnerability index (BVI)	BVI (0=no difficulties, 3=most difficulties)	-0.002 (0.126)	-0.045 (0.319)	-0.033 (0.032)	-0.062 (0.052)
	Missing	-0.235 (0.480)	0.277 (0.349)	-0.377 (0.335)	0.044 (0.270)
Duration in EI participation	Months	0.090 (0.016)***	0.122 (0.019)***	-0.221 (0.086)**	0.083 (0.006)***
	Months squared	N/A	N/A	0.020 (0.006)***	N/A
	Months cubed	N/A	N/A	-0.000 (0.000)***	N/A
Gender	Male (reference group)	N/A	N/A	N/A	N/A
	Female	0.320 (0.265)	0.012 (0.167)	0.102 (0.156)	0.121 (0.091)
Race	White (reference group)	N/A	N/A	N/A	N/A
	African American	0.004 (0.254)	-0.086 (0.252)	-0.021 (0.148)	-0.425 (0.135)***
	Hispanic/Latino, Native American or Asian	-0.306 (0.675)	-0.106 (0.242)	-0.011 (0.303)	-0.169 (0.206)
	Mixed	-0.362 (0.283)	-0.253 (0.163)	0.043 (0.312)	0.090 (0.183)
	Missing	0.567 (0.560)	0.012 (0.367)	-0.804 (0.636)	-0.050 (0.205)
Observations		241	377	660	879
R-squared		0.3488	0.3271	0.2936	0.3276

Effects based on results from regression of logarithm of total EI expenditures on controls related to child characteristics, social background, demography of county of residence.

Imputed missing values of general health and race set to excellent and white, respectively. Imputed missing values of BVI set to sample mean (0.566785).

* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix F-15 (continued) – Effects of Maternal Education and Household Characteristics on Total Early Intervention (EI) Expenditures by Disability-Related Characteristic

Category	Variable	At-risk	Speech-Only	Developmental Delay	Diagnosed Condition
Maternal education	Less than high school/GED (reference group)	N/A	N/A	N/A	N/A
	High school/GED	-0.191 (0.317)	-0.198 (0.140)	-0.016 (0.164)	0.198 (0.175)
	College w/no degree	-0.261 (0.349)	-0.037 (0.290)	0.068 (0.151)	0.268 (0.212)
	BA/BS or higher	-0.014 (0.317)	-0.085 (0.240)	0.103 (0.252)	0.147 (0.222)
	Missing	2.336 (1.698)	0.654 (0.990)	0.159 (0.383)	-0.496 (0.967)
Household income	Less than or equal to $15,000 (reference group)	N/A	N/A	N/A	N/A
	$15,001 to $25,000	0.756 (0.440)	-0.359 (0.226)	0.264 (0.210)	0.074 (0.219)
	$25,001 to $50,000	0.246 (0.381)	-0.533 (0.279)*	0.157 (0.117)	0.137 (0.181)
	$50,001 to $75,000	-0.004 (0.408)	-0.512 (0.303)	0.015 (0.232)	0.144 (0.246)
	Over $75,000	0.470 (0.391)	-0.572 (0.232)**	0.195 (0.290)	0.021 (0.259)
	Missing	0.001 (0.427)	-0.361 (0.392)	-0.049 (0.226)	0.007 (0.149)
Parental composition of household	Only one adult in child's household (reference group)	N/A	N/A	N/A	N/A
	Two biological/adoptive parents in child household	-0.063 (0.440)	-0.062 (0.291)	-0.185 (0.229)	-0.210 (0.230)
	Respondent and partner in child household	0.195 (0.916)	-0.511 (0.475)	-0.008 (0.264)	-0.680 (0.398)
	Respondent and other adult(s) in child household, no partner	-0.137 (0.650)	-0.038 (0.262)	0.007 (0.182)	-0.082 (0.161)
	Parental composition of child household is missing	-0.897 (0.755)	-0.992 (0.896)	-0.081 (0.573)	0.793 (0.786)
Observations		241	377	660	879
R-squared		0.3488	0.3271	0.2936	0.3276

Effects based on results from regression of logarithm of total EI expenditures on controls related to child characteristics, social background and demography of county of residence.

Imputed missing values of maternal education, household income and parental composition of household set to high school/GED, less than $15,000, and two biological/adoptive parents in child household, respectively.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix F-15 (continued) – Effects of Individual Characteristics and Duration on Total Early Intervention (EI) Expenditures by Disability-Related Characteristic

Category	Variable	At-risk	Speech-Only	Developmental Delay	Diagnosed Condition
County level demographics	Percent of county population uninsured	-0.003 (0.046)	0.025 (0.027)	0.011 (0.027)	0.021 (0.017)
	County per capita income (in thousands of dollars)	0.007 (0.037)	0.021 (0.029)	0.011 (0.015)	0.018 (0.016)
	Percent of county population above 18 with high school education	-0.015 (0.037)	0.010 (0.019)	-0.002 (0.022)	-0.005 (0.021)
	Percent of county population below poverty line	-0.004 (0.022)	0.002 (0.009)	0.010 (0.013)	0.000 (0.018)
	County infant deaths per 1,000 births	-0.040 (0.042)	0.008 (0.060)	0.009 (0.054)	0.030 (0.033)
	County census data missing	1.086 (0.813)	0.130 (0.151)	0.563 (0.343)	0.211 (0.234)
Constant		8.203 (3.752)**	5.254 (2.159)**	7.659 (2.859)**	6.367 (2.242)**
Observations		241	377	660	879
R-squared		0.3488	0.3271	0.2936	0.3276

Effects based on results from regression of logarithm of total EI expenditures on controls related to child characteristics, social background and demography of county of residence.
Imputed missing values of census variables set to sample means.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix F-16 – Percent Effect of Duration on Predicted Total Average Expenditure of Developmentally Delayed

Duration in Months	Duration Effect Index	Duration in Months	Duration Effect Index	Duration in Months	Duration Effect Index
1	N/A	13	156	25	320
2	N/A	14	170	26	327
3	N/A	15	185	27	332
4	105	16	200	28	334
5	101	17	215	29	334
6	100	18	231	30	331
7	102	19	246	31	325
8	106	20	261	32	316
9	113	21	275	33	N/A
10	121	22	288	34	N/A
11	131	23	300	35	N/A
12	143	24	311	36	N/A
Duration effect index calculated using estimated duration coefficients from the developmental delay regression results in Exhibit 3.17 and setting 6 months of duration equal to the index base of 100.					

Appendix F-17 – Effects of Individual Characteristics, Duration, Gender and Race on Monthly Early Intervention (EI) Expenditures by Disability-Related Characteristic

Category	Variable	At-risk Coefficients	At-risk Percent effect on monthly EI expenditures	Speech-Only Coefficients	Speech-Only Percent effect on monthly EI expenditures	Developmental Delay Coefficients	Developmental Delay Percent effect on monthly EI expenditures	Diagnosed Condition Coefficients	Diagnosed Condition Percent effect on monthly EI expenditures
General health at entry in EI	Excellent (reference group)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Very good	-0.121 -0.304	-11.4%	-0.044 -0.146	-4.3%	0.017 -0.071	1.7%	0.101 -0.151	10.6%
	Good	-0.052 -0.212	-5.1%	0.185 -0.214	20.3%	0.182 -0.185	20.0%	0.18 -0.152	19.7%
	Fair or poor	0.287 -0.323	33.2%	-0.021 -0.279	-2.1%	0.006 -0.271	0.6%	0.464 (0.140)***	59.0%
	Missing	-0.907 -0.844	-59.6%	-0.135 -0.362	-12.6%	-0.023 -0.259	-2.3%	0.13 -0.138	13.9%
Birth Vulnerability Index (BVI)	BVI (0=no difficulties, 3=most difficulties)	0.002 -0.127	0.2%	-0.207 -0.388	-18.7%	-0.011 -0.062	-1.1%	-0.096 (0.041)**	-9.2%
	Missing	-0.225 -0.484	-20.1%	0.266 -0.363	30.5%	-0.356 -0.293	-30.0%	-0.053 -0.29	-5.2%
Duration in EI participation	Months	0.044 (0.016)**	4.5%	0.031 (0.016)*	3.1%	-0.495 (0.090)***	-39.0%	-0.206 (0.065)***	-18.6%
	Months squared	N/A	N/A	N/A	N/A	0.031 (0.006)***	3.1%	0.011 (0.003)***	1.1%
	Months cubed	N/A	N/A	N/A	N/A	-0.001 (0.000)***	-0.1%	0 (0.000)**	0.0%
Gender	Male (reference group)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Female	0.283 -0.26	32.7%	0.069 -0.19	7.1%	0.062 -0.156	6.4%	0.116 -0.077	12.3%
Race	White (reference group)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	African American	-0.062 -0.309	-6.0%	0.035 -0.222	3.6%	-0.019 -0.144	-1.9%	-0.27 (0.143)*	-23.7%
	Hispanic/Latino, Native American or Asian	-0.378 -0.668	-31.5%	-0.117 -0.229	-11.0%	-0.045 -0.33	-4.4%	-0.258 -0.252	-22.7%
	Mixed	-0.236 -0.272	-21.0%	-0.279 (0.156)*	-24.3%	0.098 -0.277	10.3%	0.027 -0.2	2.7%
	Missing	0.455 -0.517	57.6%	-0.133 -0.378	-12.5%	-0.762 -0.575	-53.3%	-0.002 -0.23	-0.2%
Observations		241		377		660		879	
R-squared		0.2067		0.1736		0.1531		0.1257	

Effects based on results from regression of logarithm of monthly EI expenditures on controls related to child characteristics, social background, demography of county of residence.
Imputed missing values of general health and race set to excellent and white, respectively. Imputed missing values of BVI set to sample mean (0.566785).
* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix F-17 (continued) – Effects of Maternal Education and Household Characteristics on Monthly Early Intervention (EI) Expenditures by Disability-Related Characteristic

Category	Variable	At-risk		Speech-Only		Developmental Delay		Diagnosed Condition	
		Coefficients	Percent effect on monthly EI expenditures	Coefficients	Percent effect on monthly EI expenditures	Coefficients	Percent effect on monthly EI expenditures	Coefficients	Percent effect on monthly EI expenditures
Maternal education	Less than high school/GED (reference group)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	High school/GED	-0.22 -0.312	-19.7%	-0.188 -0.165	-17.1%	-0.061 -0.158	-5.9%	0.077 -0.104	8.0%
	College w/no degree	-0.269 -0.348	-23.6%	-0.051 -0.277	-5.0%	0.087 -0.126	9.1%	0.12 -0.129	12.7%
	BA/BS or higher	0.074 -0.334	7.7%	-0.069 -0.261	-6.7%	0.064 -0.27	6.6%	0.047 -0.141	4.8%
	Missing	2.239 -1.628	838.4%	0.176 -0.999	19.2%	-0.003 -0.489	-0.3%	-0.23 -0.878	-20.5%
Household Income	Less than or equal to $15,000 (reference group)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$15,001 to $25,000	0.719 -0.412	105.2%	-0.212 -0.192	-19.1%	0.27 -0.217	31.0%	0.037 -0.182	3.8%
	$25,001 to $50,000	0.283 -0.379	32.7%	-0.361 -0.289	-30.3%	0.16 -0.151	17.4%	0.105 -0.15	11.1%
	$50,001 to $75,000	0.057 -0.403	5.9%	-0.356 -0.242	-30.0%	0.044 -0.206	4.5%	0.1 -0.22	10.5%
	Over $75,000	0.406 -0.388	50.1%	-0.431 (0.159)**	-35.0%	0.165 -0.315	17.9%	-0.022 -0.244	-2.2%
	Missing	0.000 -0.399	0.0%	-0.418 -0.412	-34.2%	0.088 -0.247	9.2%	0.021 -0.129	2.1%
Parental composition of household	Only one adult in child's household (reference group)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Two biological/adoptive parents in child household	-0.082 -0.435	-7.9%	-0.152 -0.318	-14.1%	-0.181 -0.196	-16.6%	-0.075 -0.201	-7.2%
	Respondent and partner in child household	0.064 -0.879	6.6%	-0.404 -0.632	-33.2%	0.141 -0.274	15.1%	-0.467 -0.293	-37.3%
	Respondent and other adult(s) in child household, no partner	-0.149 -0.668	-13.8%	-0.151 -0.328	-14.0%	0.065 -0.234	6.7%	-0.004 -0.155	-0.4%
	Parental composition of child household is missing	-0.91 -0.725	-59.7%	-0.496 -0.682	-39.1%	0.115 -0.58	12.2%	0.488 -0.683	62.9%
Observations		241		377		660		879	
R-squared		0.2067		0.1736		0.1531		0.1257	

Effects based on results from regression of logarithm of monthly EI expenditures on controls related to child characteristics, social background, demography of county of residence.
Imputed missing values of general health and race set to excellent and white, respectively. Imputed missing values of BVI set to sample mean (0.566785).
* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix F-17 (continued) – Effects of Individual Characteristics and Duration on Monthly Early Intervention (EI) Expenditures by Disability-Related Characteristic

Category	Variable	At-risk Coefficients	Percent effect on monthly EI expenditures	Speech-Only Coefficients	Percent effect on monthly EI expenditures	Developmental Delay Coefficients	Percent effect on monthly EI expenditures	Diagnosed Condition Coefficients	Percent effect on monthly EI expenditures
County level demographics	Percent of county population uninsured	0 -0.044	0.0%	0.03 -0.022	3.0%	0.01 -0.025	1.0%	0.025 -0.017	2.5%
	County per capita income (in thousands of dollars)	0.007 -0.039	0.7%	0.022 -0.029	2.2%	0.011 -0.018	1.1%	0.017 -0.017	1.7%
	Percent of county population above 18 with high school education	-0.018 -0.04	-1.8%	0.006 -0.016	0.6%	-0.012 -0.021	-1.2%	-0.005 -0.021	-0.5%
	Percent of county population below poverty line	-0.005 -0.023	-0.5%	0.001 -0.007	0.1%	0.01 -0.014	1.0%	-0.001 -0.018	-0.1%
	County infant deaths per 1,000 births	-0.039 -0.04	-3.8%	0.007 -0.057	0.7%	-0.001 -0.054	-0.1%	0.031 -0.027	3.1%
	County census data missing	0.967 -0.775	163.0%	0.127 -0.135	13.5%	0.546 (0.304)*	72.6%	0.254 -0.256	28.9%
Constant		6.353 -3.933		4.001 (1.884)*		8.234 (2.960)**		6.003 (2.137)**	
Observations		241		377		660		879	
R-squared		0.2067		0.1736		0.1531		0.1257	

Effects based on results from regression of logarithm of monthly EI expenditures on controls related to child characteristics, social background, demography of county of residence.

Imputed missing values of general health and race set to excellent and white, respectively. Imputed missing values of BVI set to sample mean (0.566785).

* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix F-18a - Average Monthly Expenditure on Services in the Family Home by Disability Related Characteristic and Duration

Disability-Related Characteristic	Duration of stay	Average Monthly Expenditure	Std. Err.	Unweighted N	Weighted N
At-risk	Less than 6 Months in EI	$0	*	2	990
	Between 6 and 12 Months in EI	$266	$57	13	14,979
	Between 13 and 18 Months in EI	$151	$45	33	40,804
	Between 19 and 24 Months in EI	$279	$60	78	157,993
	Between 25 and 30 Months in EI	$361	$85	69	173,251
	More than 30 Months in EI	$392	$111	46	124,363
Speech	Less than 6 Months in EI	$312	$54	65	25,840
	Between 6 and 12 Months in EI	$244	$72	196	126,764
	Between 12 and 18 Months in EI	$313	$117	105	96,482
	Between 18 and 24 Months in EI	$229	$69	11	14,188
Developmental Delay	Less than 6 Months in EI	$385	$124	67	33,737
	Between 6 and 12 Months in EI	$296	$108	187	137,525
	Between 12 and 18 Months in EI	$372	$90	194	186,320
	Between 18 and 24 Months in EI	$439	$118	137	195,118
	Between 24 and 30 Months in EI	$867	$175	65	149,591
	More than 30 Months in EI	$150	$64	10	34,881
Diagnosed Condition	Less than 6 Months in EI	$421	$136	36	16,478
	Between 6 and 12 Months in EI	$623	$291	125	91,513
	Between 12 and 18 Months in EI	$466	$53	168	157,518
	Between 18 and 24 Months in EI	$541	$128	167	264,456
	Between 24 and 30 Months in EI	$637	$125	248	502,317
	More than 30 Months in EI	$707	$130	135	295,820
Undetermined	Less than 6 Months in EI	$157	$100	7	2,575
	Between 6 and 12 Months in EI	$187	$112	9	7,193
	Between 12 and 18 Months in EI	$86	$56	8	10,450
	Between 18 and 24 Months in EI	$489	*	7	12,049
	Between 24 and 30 Months in EI	$441	*	3	6,558
	More than 30 Months in EI	$200	*	4	11,569

* Indicates insufficient observations for balanced repeated replication estimation procedure.

Appendix F-18b - Average Monthly Expenditure on Services in Day Care or Preschool by Disability Related Characteristic and Duration

Disability-Related Characteristic	Duration of stay	Average Monthly Expenditure	Std. Err.	Unweighted N	Weighted N
At-risk	Less than 6 Months in EI	$113	*	2	990
	Between 6 and 12 Months in EI	$2	$2	13	14,979
	Between 13 and 18 Months in EI	$5	$6	33	40,804
	Between 19 and 24 Months in EI	$53	$31	78	157,993
	Between 25 and 30 Months in EI	$35	$13	69	173,251
	More than 30 Months in EI	$53	$20	46	124,363
Speech	Less than 6 Months in EI	$75	$50	65	25,840
	Between 6 and 12 Months in EI	$48	$21	196	126,764
	Between 12 and 18 Months in EI	$32	$21	105	96,482
	Between 18 and 24 Months in EI	$102	$138	11	14,188
Developmental Delay	Less than 6 Months in EI	$133	$36	67	33,737
	Between 6 and 12 Months in EI	$79	$20	187	137,525
	Between 12 and 18 Months in EI	$35	$14	194	186,320
	Between 18 and 24 Months in EI	$34	$14	137	195,118
	Between 24 and 30 Months in EI	$37	$9	65	149,591
	More than 30 Months in EI	$29	$29	10	34,881
Diagnosed Condition	Less than 6 Months in EI	$22	$13	36	16,478
	Between 6 and 12 Months in EI	$26	$15	125	91,513
	Between 12 and 18 Months in EI	$29	$6	168	157,518
	Between 18 and 24 Months in EI	$23	$13	167	264,456
	Between 24 and 30 Months in EI	$50	$15	248	502,317
	More than 30 Months in EI	$60	$11	135	295,820
Undetermined	Less than 6 Months in EI	$434	$351	7	2,575
	Between 6 and 12 Months in EI	$124	$112	9	7,193
	Between 12 and 18 Months in EI	$116	$119	8	10,450
	Between 18 and 24 Months in EI	$108	*	7	12,049
	Between 24 and 30 Months in EI	$395	*	3	6,558
	More than 30 Months in EI	$20	*	4	11,569

* Indicates insufficient observations for balanced repeated replication estimation procedure.

Appendix F-18c - Average Monthly Expenditure on Services in a Center-Based Environment by Disability Related Characteristic and Duration

Disability-Related Characteristic	Duration of stay	Average Monthly Expenditure	Std. Err.	Unweighted N	Weighted N
At-risk	Less than 6 Months in EI	$162	*	2	990
	Between 6 and 12 Months in EI	$50	$39	13	14,979
	Between 13 and 18 Months in EI	$77	$40	33	40,804
	Between 19 and 24 Months in EI	$105	$43	78	157,993
	Between 25 and 30 Months in EI	$66	$19	69	173,251
	More than 30 Months in EI	$108	$43	46	124,363
Speech	Less than 6 Months in EI	$106	$28	65	25,840
	Between 6 and 12 Months in EI	$162	$48	196	126,764
	Between 12 and 18 Months in EI	$288	$164	105	96,482
	Between 18 and 24 Months in EI	$600	$211	11	14,188
Developmental Delay	Less than 6 Months in EI	$697	$355	67	33,737
	Between 6 and 12 Months in EI	$265	$42	187	137,525
	Between 12 and 18 Months in EI	$373	$91	194	186,320
	Between 18 and 24 Months in EI	$317	$135	137	195,118
	Between 24 and 30 Months in EI	$389	$122	65	149,591
	More than 30 Months in EI	$158	$100	10	34,881
Diagnosed Condition	Less than 6 Months in EI	$314	$129	36	16,478
	Between 6 and 12 Months in EI	$532	$156	125	91,513
	Between 12 and 18 Months in EI	$387	$138	168	157,518
	Between 18 and 24 Months in EI	$297	$140	167	264,456
	Between 24 and 30 Months in EI	$247	$66	248	502,317
	More than 30 Months in EI	$361	$76	135	295,820
Undetermined	Less than 6 Months in EI	$109	$65	7	2,575
	Between 6 and 12 Months in EI	$107	$108	9	7,193
	Between 12 and 18 Months in EI	$304	$254	8	10,450
	Between 18 and 24 Months in EI	$29	*	7	12,049
	Between 24 and 30 Months in EI	$698	*	3	6,558
	More than 30 Months in EI	$86	*	4	11,569

* Indicates insufficient observations for balanced repeated replication estimation procedure.

Appendix F-18e - Average Monthly Expenditure on Services in Clinics and Offices by Disability Related Characteristic and Duration

Disability-Related Characteristic	Duration of stay	Average Monthly Expenditure	Std. Err.	Unweighted N	Weighted N
At-risk	Less than 6 Months in EI	$25	*	2	990
	Between 6 and 12 Months in EI	$3	$4	13	14,979
	Between 13 and 18 Months in EI	$30	$18	33	40,804
	Between 19 and 24 Months in EI	$56	$22	78	157,993
	Between 25 and 30 Months in EI	$157	$105	69	173,251
	More than 30 Months in EI	$69	$29	46	124,363
Speech	Less than 6 Months in EI	$82	$40	65	25,840
	Between 6 and 12 Months in EI	$110	$68	196	126,764
	Between 12 and 18 Months in EI	$62	$26	105	96,482
	Between 18 and 24 Months in EI	$36	$62	11	14,188
Developmental Delay	Less than 6 Months in EI	$52	$37	67	33,737
	Between 6 and 12 Months in EI	$87	$49	187	137,525
	Between 12 and 18 Months in EI	$81	$42	194	186,320
	Between 18 and 24 Months in EI	$60	$44	137	195,118
	Between 24 and 30 Months in EI	$97	$53	65	149,591
	More than 30 Months in EI	$52	$34	10	34,881
Diagnosed Condition	Less than 6 Months in EI	$124	$78	36	16,478
	Between 6 and 12 Months in EI	$139	$42	125	91,513
	Between 12 and 18 Months in EI	$107	$38	168	157,518
	Between 18 and 24 Months in EI	$86	$16	167	264,456
	Between 24 and 30 Months in EI	$119	$46	248	502,317
	More than 30 Months in EI	$138	$45	135	295,820
Undetermined	Less than 6 Months in EI	$157	$117	7	2,575
	Between 6 and 12 Months in EI	$27	$39	9	7,193
	Between 12 and 18 Months in EI	$32	$23	8	10,450
	Between 18 and 24 Months in EI	$19	*	7	12,049
	Between 24 and 30 Months in EI	$190	*	3	6,558
	More than 30 Months in EI	$12	*	4	11,569

* Indicates insufficient observations for balanced repeated replication estimation procedure.

Appendix F-18e - Average Monthly Expenditure on Services in Other Environments by Disability Related Characteristic and Duration

Disability-Related Characteristic	Duration of stay	Average Monthly Expenditure	Std. Err.	Unweighted N	Weighted N
At-risk	Less than 6 Months in EI	$0	*	2	990
	Between 6 and 12 Months in EI	$20	$26	13	14,979
	Between 13 and 18 Months in EI	$29	$8	33	40,804
	Between 19 and 24 Months in EI	$1	$1	78	157,993
	Between 25 and 30 Months in EI	$4	$2	69	173,251
	More than 30 Months in EI	$2	$2	46	124,363
Speech	Less than 6 Months in EI	$27	$10	65	25,840
	Between 6 and 12 Months in EI	$5	$4	196	126,764
	Between 12 and 18 Months in EI	$4	$1	105	96,482
	Between 18 and 24 Months in EI	$3	$4	11	14,188
Developmental Delay	Less than 6 Months in EI	$5	$4	67	33,737
	Between 6 and 12 Months in EI	$7	$3	187	137,525
	Between 12 and 18 Months in EI	$9	$9	194	186,320
	Between 18 and 24 Months in EI	$3	$2	137	195,118
	Between 24 and 30 Months in EI	$32	$35	65	149,591
	More than 30 Months in EI	$11	$5	10	34,881
Diagnosed Condition	Less than 6 Months in EI	$0	$0	36	16,478
	Between 6 and 12 Months in EI	$17	$10	125	91,513
	Between 12 and 18 Months in EI	$21	$11	168	157,518
	Between 18 and 24 Months in EI	$15	$7	167	264,456
	Between 24 and 30 Months in EI	$14	$5	248	502,317
	More than 30 Months in EI	$14	$6	135	295,820
Undetermined	Less than 6 Months in EI	$0	$0	7	2,575
	Between 6 and 12 Months in EI	$0	$0	9	7,193
	Between 12 and 18 Months in EI	$68	$49	8	10,450
	Between 18 and 24 Months in EI	$0	*	7	12,049
	Between 24 and 30 Months in EI	$0	*	3	6,558
	More than 30 Months in EI	$1	*	4	11,569

* Indicates insufficient observations for balanced repeated replication estimation procedure.

Appendix G - Expenditures on Early Intervention and Outcomes

Appendix G-1a - Average Monthly Expenditure by General Health at 36 Months (N=1,762)

General Health at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Excellent/Very Good	$823	$80	1,166
Good	$1,031	$127	381
Poor or Fair	$1,476	$283	215

Appendix G-1b - Average Monthly Expenditure by Status of Hearing at 36 Months (N=1,762)

Hearing at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Hears normally	$895	$118	1,478
Hearing problem	$1,297	$168	218

Appendix G-1c - Average Monthly Expenditure by Status of Vision at 36 Months (N=1,699)

Vision at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Sees normally	$880	$109	1,422
Sight problem	$1,309	$146	277

Appendix G-1d - Average Monthly Expenditure by Ability to Communicate at 36 Months (N=1,712)

Ability to Communicate at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Communicates needs well	$688	$82	681
Communicates needs with a little trouble	$995	$112	627
Communicates needs with a lot of trouble	$1,402	$246	404

Appendix G-1e - Average Monthly Expenditure by Ability to Understand of Child's Speech at 36 Months (N=1,284)

Understanding of Speech at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Understand speech very easily	$568	$68	290
Understand speech fairly easily	$722	$110	385
Understand speech somewhat easily	$946	$118	447
Understand speech very hard	$997	$130	162

Appendix G-1f - Average Monthly Expenditure by Use of Arms/Hands at 36 Months (N=1,710)

Use of Arms/Hands at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Uses both arms/hands normally	$789	$85	1,339
Use of arms/hands with a little trouble	$1,296	$178	271
Use of arms/hands with lots of trouble	$1,849	$335	100

Appendix G-1g - Average Monthly Expenditure by Use of Legs/Feet at 36 Months (N=1,707)

Use of Legs/Feet at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Uses both legs/feet normally	$747	$82	1,278
Use of legs/feet with a little trouble	$1,232	$159	283
Use of legs/feet with lots of trouble	$1,824	$394	146

Appendix G-1h - Average Monthly Expenditure by Index of Developmental Competency (IDC) of Motor Skills at 36 Months (N=1,759)

IDC for Motor Skills at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Near age appropriate	$747	$77	1,419
Below age appropriate	$1,137	$153	151
Far below age appropriate	$1,860	$331	189

Appendix G-1i - Average Monthly Expenditure by Index of Developmental Competency (IDC) of Independence at 36 Months (N=1,759)

IDC for Independence at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Near age appropriate	$611	$73	554
Below age appropriate	$717	$92	508
Far below age appropriate	$1,329	$194	697

Appendix G-1j - Average Monthly Expenditure by Index of Developmental Competency (IDC) of Communication Skills at 36 Months (N=1,757)

IDC for Communication at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Near age appropriate	$716	$98	1,098
Below age appropriate	$1,020	$83	359
Far below age appropriate	$1,640	$272	300

Appendix G-1k - Average Monthly Expenditure by Index of Developmental Competency (IDC) of Cognitive Ability at 36 Months (N=1,753)

IDC for Cognitive Ability at 36 Months	Average Monthly Expenditure	Standard Error	Unweighted N
Near age appropriate	$766	$75	1,367
Below age appropriate	$1,294	$230	159
Far below age appropriate	$1,714	$287	227

Appendix G-2 – Average Monthly Expenditure by Change in Health and Functioning Between Entry Into Early Intervention and 36 Months

		Average	Standard Error	Unweighted N
General Health (N=868)	Change for worse	$1,190	$225	277
	No change, normal	$794	$87	886
	No change, not normal	$1,154	$231	213
	Change for better	$1,020	$97	378
Understanding Speech (N=1018)	Change for worse	$1,104	$227	98
	No change, normal	$461	$115	20
	No change, not normal	$1,205	$225	300
	Change for better	$875	$136	620
Make Needs Known (N=861)	Change for worse	$947	$111	179
	No change, normal	$860	$244	210
	No change, not normal	$1,323	$192	358
	Change for better	$803	$158	324
Hearing (N=351)	Change for worse	$1,229	$224	88
	No change, normal	$899	$128	1,322
	No change, not normal	$1,370	$189	126
	Change for better	$875	$88	137
Vision (N=1,671)	Change for worse	$1,030	$153	138
	No change, normal	$874	$101	1,323
	No change, not normal	$1,597	$173	128
	Change for better	$809	$172	82
Arm/Hand (N=1,672)	Change for worse	$1,279	$256	152
	No change, normal	$742	$76	1,140
	No change, not normal	$1,679	$151	162
	Change for better	$1,055	$179	218
Leg/Feet (N=1,660)	Change for worse	$1,343	$254	215
	No change, normal	$718	$69	1,038
	No change, not normal	$1,585	$181	150
	Change for better	$1,002	$150	257
IDC Motor (N=1,765)	Change for worse	$999	$181	64
	No change, normal	$751	$102	889
	No change, not normal	$1,611	$381	125
	Change for better	$993	$98	687
IDC Independence (N=1,765)	Change for worse	$889	$140	378
	No change, normal	$601	$86	268
	No change, not normal	$1,597	$224	305
	Change for better	$918	$109	814
IDC Communication (N=1,765)	Change for worse	$941	$197	148
	No change, normal	$714	$123	466
	No change, not normal	$1,449	$244	277
	Change for better	$957	$92	874
IDC Cognitive Ability (N=1,765)	Change for worse	$1,190	$235	174
	No change, normal	$739	$89	935
	No change, not normal	$1,807	$361	148
	Change for better	$930	$108	508

APPENDIX H - A Multivariate Analysis of the Relationship between Expenditures and Child Functioning in Early Intervention

Unlike the analysis in the Chapter 3, where variations in continuous measures of expenditures were described, the outcomes data presented above are of a *qualitative* or *discrete* nature (i.e., categorized). Yet, similar to the continuous measures, there also exists an ordering among the outcomes from best to worst. Therefore, a slightly more complicated model must be used to capture the variation in the ordered outcomes. To this end, we used an ordered logistic regression, which is specifically designed to estimate relationships where the dependent variable is categorical and ordinal.[44] The technique estimates the independent variables' effects on the odds of being in an outcome category relative to a predetermined reference category. From these estimated odds ratios, it is possible to calculate changes in the likelihood of being in a given outcome category due to changes in the various individual, social, and regional characteristics.

Appendix H-1 shows the estimated effects on general health at 36 months, transformed into changes in the probability or *marginal* probabilities of being in the categories excellent/very good, good, or poor/fair.[45] The first five rows contain the effects due to initial general health at entry and suggest that being in the categories good or poor/fair, relative to excellent, was associated with marked increases (decreases) in the likelihood of being in poor or fair (excellent or very good) health at 36 months. For example, the model indicates that for an otherwise identical child in excellent health at entry into early intervention, being in poor/fair health instead of excellent health at entry resulted in an expected 55 percent drop in the probability of being in excellent or very good health at 36 months. Moreover, compared to children who entered early intervention in excellent health, otherwise identical children entering early intervention with poor or fair health were 39.8 percent more likely to be in the same category at 36 months.

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[44] For more on regressions using discrete dependent variables the reader is referred to Maddala (1986).
[45] Full output of all regressions, including estimated odds ratios and corresponding standard errors, can be found in Appendices H2.a through H2.c.

Appendix H-1a - Regression Effects of Expenditures, Individual Characteristics, Social Background, and Region on General Health Outcome Probabilities at 36 Months

	Sig. Level	Changes in Probability for the Status of General Health associated with a one unit change in each independent variable		
		Excellent/ Very Good	Good	Poor/Fair
Average Monthly Expenditure (in thousands)		-0.4%	0.3%	0.2%
Excellent health at entry (reference)	N/A	N/A	N/A	N/A
Very good health at entry		-10.0%	6.0%	3.9%
Good health at entry	***	-31.3%	16.6%	14.7%
Poor or fair health at entry	***	-55.0%	15.2%	39.8%
At-risk (reference)	N/A	N/A	N/A	N/A
Speech		8.9%	-5.8%	-3.0%
Developmental delay		-5.6%	3.5%	2.2%
Diagnosed condition		-6.7%	4.2%	2.5%
Birth vulnerability index (1 low, 3 high)		-0.9%	0.5%	0.3%
Duration in months		-0.3%	0.2%	0.1%
White (reference group)	N/A	N/A	N/A	N/A
African American		-2.8%	1.8%	1.1%
Native American, Asian, Pacific, Mixed		-11.1%	6.5%	4.7%
Hispanic/Latino	***	-13.6%	7.9%	5.7%
Male (reference group)	N/A	N/A	N/A	N/A
Female		-1.7%	1.1%	0.7%
Mother has less than high school/GED (reference)	N/A	N/A	N/A	N/A
Mother has high school/GED		0.1%	-0.1%	-0.0%
Mother has some college with no degree		4.0%	-2.5%	-1.5%
Mother has BA/BS or higher		6.4%	-4.1%	-2.3%
Household income less than or equal to $15,000 (reference)	N/A	N/A	N/A	N/A
Household income $15,001 to $25,000		4.0%	-2.6%	-1.5%
Household income $25,001 to $50,000		11.7%	-7.6%	-4.1%
Household income $50,001 to $75,000		11.1%	-7.3%	-3.8%
Household income over $75,000		9.0%	-5.9%	-3.1%
Only one adult in household (reference)	N/A	N/A	N/A	N/A
Two bio/adopt parents in household		0.1%	-0.0%	-0.0%
Respondent and partner in household		1.3%	-0.8%	-0.5%
Respondent and other adult(s) in household		-6.7%	4.0%	2.6%
Percent of county uninsured		0.2%	-0.1%	-0.1%
County per capita income in thousands		-0.2%	0.1%	0.1%
Percent of county with some high school		-0.1%	0.0%	0.0%
Percent of county below poverty line		-0.3%	0.2%	0.1%
County infant deaths per 1,000 people		1.8%	-1.1%	-0.7%
Observations	1,565			

An otherwise identical child entering early intervention in good, as opposed to excellent, health is 31.3 percent less likely to be in excellent or very good health at 36 months and has a 14.7 percent greater chance of being in poor or fair health at this time.
* significant at 10%; ** significant at 5%; *** significant at 1%. Significance levels pertain to estimated parameter (logarithm of odds ratio).

The top row shows the effect of expenditures on general health outcomes. The sign of the marginal probabilities illustrates the difficulty in disentangling the effect of condition severity from expenditure. Even after explicitly including controls for severity of condition at entry, the marginal probabilities still suggest a very slight negative (positive) relationship between level of expenditure and better (worse) outcomes. However, the parameter estimate used to calculate these marginal probabilities was insignificant. Moreover, even if the marginal probabilities were significant, in terms of magnitude the

estimates can hardly be considered substantial. For instance, calculations suggest that a child receiving an average of $1,000 worth of services per month would only be 2 percent more likely to be in poor or fair health at 36 months.

The regression results pertaining to communication, cognition and senses, and motor skills are shown in Appendices H-1c through H-1e, respectively. Appendix H-1b contains the key to the levels of initial functioning at entry into early intervention for each functional dimension. Functional levels range from 1 (reference category), denoting the best possible condition at entry, to high values of 2, 3 and 4 (depending on functional dimension) marking the worst possible conditions at entry. These functional levels will be necessary to interpret the first set of rows in each of the subsequent tables.

Appendix H-1b - Key to Condition Severity at Entry Into Early Intervention

Functional Dimension(s)	Condition Severity Level	Definition
Understanding of child's speech	1	Very easy to understand (reference category)
	2	Fairly easy to understand
	3	Somewhat hard to understand
	4	Very hard to understand
Making needs known	1	Communicates needs well (reference category)
	2	Communicates needs with a little trouble
	3	Communicates needs with a lot of trouble
	4	Doesn't communicate
Indices of Developmental Competency (IDC's)	1	Near age-appropriate (reference category)
for communication skills, cognition,	2	Below age-appropriate
independence, and motor	3	Far below age-appropriate
Hearing and sight	1	Hears/sees normally (reference category)
	2	Has hearing/vision problem(s)
Use of arms/hands and legs/feet	1	Uses both normally (reference category)
	2	Uses both with a little trouble
	3	Uses both with a lot of trouble/doesn't use one or both

Communication

Appendix H-1c contains the regression results pertaining to communication outcomes. The first four columns show the effects on the understanding of a child's speech at 36 months of age. Again, there seems to be no significant effect of average monthly expenditure on the outcome probabilities. Turning to level of functioning at entry, we find that relative to a child whose speech was very easy to understand at enrollment, an otherwise identical child that is very difficult to understand is 28.2 and 21.6 percent less likely to be very or fairly easy to understand at 36 months, respectively. Similarly, those who were very difficult to understand at entry were 27 and 22.8 percent more likely to be somewhat difficult or very hard to understand at 36 months. Interestingly enough, the only other significant finding related to race. Relative to white children, otherwise identical children of African American descent were expected to be more easily understood at 36 months. Note that this analysis was based on a relatively small sample (N=353) because only children who were using words at entry to early intervention could be included.

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Appendix H-1c - Regression Effects of Expenditures, Individual Characteristics, Social Background, and Region on Communication-Related Outcomes at 36 Months

	Changes in Probability for Understanding Speech					Changes in Probability for Making Needs Known				Changes in Probability for IDC Communication			
	Sig. Level	Very Easy	Fairly Easy	Somewhat Hard	Very Hard	Sig. Level	Communicates Well	With Little Trouble	With Lots of Trouble	Sig. Level	Near age	Below	Far below
Average Monthly Expenditure/100		-0.3%	-0.2%	0.4%	0.1%		-0.6%	0.2%	0.4%		-0.4%	0.2%	0.2%
Condition severity at entry = 1 (reference)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Condition severity at entry = 2		-5.4%	-3.2%	6.0%	2.5%	***	-27.9%	-0.8%	28.7%	***	-16.0%	7.4%	8.6%
Condition severity at entry = 3		-19.4%	-13.0%	21.0%	11.4%	***	-36.7%	-13.9%	50.6%	***	-42.5%	14.4%	28.1%
Condition severity at entry = 4	*	-28.2%	-21.6%	27.0%	22.8%	*	-14.1%	4.8%	9.3%	N/A	N/A	N/A	N/A
At-risk (reference)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Speech		-16.2%	-12.2%	18.1%	10.3%		-9.1%	1.9%	7.2%		-12.9%	5.8%	7.1%
Developmental delay		-17.0%	-10.0%	18.4%	8.7%	**	-14.9%	3.0%	11.9%	*	-18.7%	8.7%	10.0%
Diagnosed condition		-21.6%	-15.5%	23.1%	14.1%	***	-21.8%	6.6%	15.2%	***	-30.7%	13.6%	17.0%
Birth vulnerability index (1 low, 3 high)		2.8%	1.4%	-3.0%	-1.2%		-0.2%	0.1%	0.1%		5.0%	-2.5%	-2.5%
Duration in months		0.2%	0.1%	-0.2%	-0.1%	**	-1.0%	0.3%	0.7%	**	-1.3%	0.7%	0.6%
Excellent health (reference)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Very good health		-0.9%	-0.4%	0.9%	0.4%		-1.3%	0.4%	0.9%		0.6%	-0.3%	-0.3%
Good health		-6.7%	-4.2%	7.6%	3.3%	***	-11.8%	2.8%	8.9%	*	-7.5%	3.6%	3.9%
Poor or fair health		17.7%	1.9%	-15.2%	-4.4%	***	-16.9%	2.2%	14.6%	**	-17.2%	7.5%	9.7%
White (reference group)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
African American	***	24.0%	2.3%	-20.3%	-6.1%	***	12.1%	-4.7%	-7.3%		3.0%	-1.5%	-1.5%
Native American, Asian, Pacific, Mixed		9.8%	2.4%	-9.3%	-2.9%		5.2%	-1.9%	-3.3%	*	-19.3%	7.7%	11.7%
Hispanic/Latino		1.1%	0.5%	-1.1%	-0.4%		5.3%	-1.9%	-3.4%		-2.3%	1.1%	1.1%
Male (reference group)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Female		6.8%	3.0%	-7.2%	-2.7%		5.8%	-1.9%	-3.9%		4.5%	-2.3%	-2.2%
Mother has less than high school/GED (reference)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mother has high school/GED		-11.1%	-7.3%	12.5%	5.9%		10.0%	-3.6%	-6.4%		-0.7%	0.4%	0.4%
Mother has some college with no degree		-6.2%	-3.5%	6.8%	2.8%		3.7%	-1.3%	-2.5%		2.7%	-1.4%	-1.3%
Mother has BA/BS or higher		-4.1%	-2.3%	4.6%	1.9%		7.0%	-2.5%	-4.5%		6.6%	-3.5%	-3.2%
Household income less than or equal to $15,000 (reference)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Household income $15,001 to $25,000		6.9%	2.4%	-6.9%	-2.4%		-8.3%	2.0%	6.3%		-1.2%	0.6%	0.6%
Household income $25,001 to $50,000		13.1%	3.8%	-12.7%	-4.2%		-0.9%	0.3%	0.6%		7.2%	-3.7%	-3.5%
Household income $50,001 to $75,000		8.6%	2.8%	-8.5%	-2.9%		-3.5%	1.0%	2.5%		4.5%	-2.3%	-2.2%
Household income over $75,000		16.0%	2.6%	-14.3%	-4.3%		3.7%	-1.3%	-2.4%	*	13.4%	-7.4%	-6.0%
Only one adult in household (reference)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Two bio/adopt parents in household		-10.0%	-3.7%	10.1%	3.6%		-4.7%	1.6%	3.1%		3.8%	-1.9%	-1.9%
Respondent and partner in household		-1.4%	-0.7%	1.5%	0.6%		-11.0%	1.8%	9.2%		2.1%	-1.1%	-1.0%
Respondent and other adult(s) in household		-1.2%	-0.6%	1.3%	0.5%		-2.0%	0.6%	1.4%		5.4%	-2.9%	-2.6%
Percent of county uninsured		-0.3%	-0.1%	0.3%	0.1%		-0.1%	0.0%	0.1%		1.0%	-0.5%	-0.5%
County per capita income in thousands		-0.3%	-0.1%	0.3%	0.1%		0.0%	-0.0%	-0.0%		0.2%	-0.1%	-0.1%
Percent of county with some high school		-0.2%	-0.1%	0.2%	0.1%		0.0%	-0.0%	-0.0%		0.1%	-0.1%	-0.1%
Percent of county below poverty line		0.2%	0.1%	-0.2%	-0.1%		0.2%	-0.1%	-0.1%		-0.0%	0.0%	0.0%
County infant deaths per 1,000 people		-0.0%	-0.0%	0.1%	0.0%		0.7%	-0.2%	-0.5%		0.4%	-0.2%	-0.2%
Observations			353					1,491				1,239	

Note: for IDC measures "High", "Medium" and "Low" refer to near age-appropriate, below age-appropriate and far below age-appropriate, respectively. * significant at 10%; ** significant at 5%; *** significant at 1%

The next set of columns shows the estimates associated with a child's ability to make his/her needs known. The results for expenditures were similar to those for the general health and understanding of speech dimensions. Children in all initial functional levels below the reference category "communicates needs well" were less likely to communicate well at 36 months. However, the pattern is u-shaped across the initial ability groups. While those that communicated with a little or a lot of trouble at entry were 27.9 and 36.7 percent less likely to be communicating well at 36 months than their counterparts who entered the program with no communication trouble, those who couldn't communicate at all at the beginning of the program were only 14.1 percent less likely to communicate well at three years of age. Some of these children are perhaps "late talkers" who once they received help and got older, could communicate well.

The disability-related characteristics also show significant effects on a child's ability to make his/her needs known at 36 months. Although there was no significant difference between children who were at risk (the reference group) and those with only a speech problem, the results show that children with a developmental delay were 14.9 percent less likely to communicate one's needs well and 11.9 percent more likely of having lots of trouble communicating. In addition, relative to children at risk, those who began early intervention with a diagnosed condition were 21.8 percent less likely to communicate well at 36 months and 15.2 percent more likely to have lots of trouble communicating at this age.

Duration, health and race also were significantly related to being able to make one's needs known at 36 months. Each additional month a child received early intervention corresponds to a 0.7 percent increase in the probability of having a lot of trouble communicating needs, and is mirrored by a 1 percent decrease in being able to communicate well. This most likely means children with severe communication problems began services at an earlier age. Relative to children in excellent health, those entering early intervention in poor/fair or good health were less likely to have good communication skills at age three. Finally, African American children were more likely than otherwise similar white children to communicate well at 36 months.

The last measure presented is the IDC measure of communication skills. The estimated effect of expenditure is again minute and insignificant. Entering early intervention with a below or far below age appropriate communication competencies was associated with a smaller chance of having a near age appropriate skills at 36 months. Again, we find that children who were characterized as having a developmental delay were 18.7 percent less likely than those at risk to be near age-appropriate at 36 months and 10 percent more likely to be below age-appropriate. For those with diagnosed conditions, the numbers are even larger— they were 30 percent less likely than at risk children to be near age-appropriate and 17 percent more likely to be below age-appropriate.

While the effects of health on IDC for communication are quite similar to those found for the outcome "making needs known", those of race were not. Here it was found that children of Native American, Asian, Pacific, or mixed backgrounds were 19.3 percent less likely to have a near age-appropriate IDC communication score than white children. In addition, a significant effect of household income was found for children from the wealthiest households (i.e., over $75,000 per year) who, relative to children from

households with less than $15,000, were 13.4 percent more likely to be rated near age-appropriate at 36 months.[46]

Senses, Cognitive Ability and Independence

Appendix H-1d shows the expected changes in outcome probability for four areas: hearing, vision, cognition, and independence. There was no discernable expenditure effect on hearing status at 36 months. Children who entered with a hearing problem were 43.7 percent more likely to have one at three years of age.[47] Having a diagnosed condition relative to being at risk was associated with a 5.6 percent greater probability of having a hearing problem at 36 months and higher birth vulnerability also increased the likelihood of experiencing a hearing problem at this age. Hispanic children were 4.4 percent less likely than white children to have a hearing problem at the three-year mark. Similar to the IDC for communication, children from the wealthiest households had an 8.5 percent smaller chance of having a hearing problem at 36 months. Finally, infant mortality rate provides a significant yet counterintuitive result. For every infant death per 1,000 inhabitants, the probability of having a hearing problem at 36 months decreased by 0.9 percent.[48]

A positive relationship between expenditure and the probability of having a vision problem was found to be marginally significant but incredibly small in magnitude. This reiterates the difficulty in estimating the true impact of expenditures on outcomes. The effects of initial functioning level and disability-related characteristic on the probability of experiencing a vision problem at three years was qualitatively the same as for the hearing functional dimension. However, although birth vulnerability no longer plays a significant role, duration in early intervention significantly increased the probability of having a vision problem at 36 months. Contrary to hearing and the communication IDC, high household incomes (between $50,001 and $75,000) were expected to increase the probability of having a vision problem by 12.9 percent.

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[46] To the extent that private services were provided for these children that were not included in the individual family service plan, this can be interpreted as weak evidence that expenditures do have a positive impact on outcomes.

[47] Note that for hearing and vision the outcome is a dichotomous measure (i.e., only assumes two values) so that the change in probability of having a hearing/vision problem at 36 months necessarily exactly offsets the change in not having a hearing/vision problem.

[48] One macabre interpretation of this finding is that children with hearing problems at entry also have a higher mortality rate so that we are left with only those with no hearing problems in areas with high infant mortality.

The third and fourth set of columns contains the results pertaining to the IDC measures of cognition and independence. Expenditure significantly decreased (increased) the probability of having high (low) independence at 36 months, however the absolute effect size was only roughly 1 percent for every $100 in average monthly expenditure. Again, the biggest determinant of outcome level at three years for both functional dimensions was that IDC measure at entry into early intervention. Relative to children with near age appropriate cognition at entry, those with below and far below age appropriate cognitive levels were 42.5 and 25.2 percent less likely to be in the high category at 36 months. Individuals with diagnosed conditions were less likely to have high cognition or to be highly independent compared to those who were at risk.

Appendix H-1d – Regression Effects of Expenditures, Individual Characteristics, Social Background, and Region on Mental-Related Outcomes and Senses at 36 Months

	Changes in Probability for Hearing			Changes in Probability for Sight			Changes in Probability for IDC Cognitive Ability				Changes in Probability for IDC Independence			
	Sig. Level	No Hearing Problem	Has Hearing Problem	Sig. Level	No Vision Problem	Has Vision Problem	Sig. Level	High	Medium	Low	Sig. Level	High	Medium	Low
Average monthly expenditure/100		-0.1%	0.1%	*	-0.1%	0.1%		-0.5%	0.2%	0.3%	***	-0.9%	-0.2%	1.1%
Condition severity at entry 1 (reference)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Condition severity at entry 2	***	-43.7%	43.7%	***	-41.1%	41.1%	***	-25.2%	9.9%	15.3%	***	-13.5%	-4.9%	18.5%
Condition severity at entry 3	N/A	N/A	N/A	N/A	N/A	N/A	***	-42.5%	14.3%	28.2%	***	-25.0%	-13.5%	38.5%
At-risk (reference)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Speech		5.3%	-5.3%		-1.0%	1.0%		-5.6%	2.5%	3.1%		1.0%	0.2%	-1.1%
Developmental delay		-4.1%	4.1%		-4.9%	4.9%	*	-9.9%	4.4%	5.5%		-7.0%	-1.8%	8.8%
Diagnosed condition	*	-5.6%	5.6%	**	-13.0%	13.0%	***	-19.2%	8.5%	10.7%	*	-13.0%	-4.0%	16.9%
Birth vulnerability index (1 low, 3 high)	*	-1.4%	1.4%		0.3%	-0.3%		8.9%	-4.1%	-4.8%		-1.7%	-0.4%	2.0%
Duration in months		-0.2%	0.2%	***	-1.0%	1.0%	**	-0.0%	0.0%	0.0%	**	-0.9%	-0.2%	1.1%
Excellent health (reference)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Very good health		1.4%	-1.4%		0.7%	-0.7%		-0.6%	0.3%	0.3%		-1.6%	-0.4%	2.0%
Good health		0.1%	-0.1%		-6.2%	6.2%	*	-10.8%	4.8%	6.0%		-4.6%	-1.3%	5.9%
Poor or fair health		-2.7%	2.7%		-5.7%	5.7%	**	-11.8%	5.1%	6.7%	**	-8.9%	-3.5%	12.4%
White (reference group)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
African American		-4.6%	4.6%		-5.8%	5.8%	*	10.2%	-4.9%	-5.3%	**	14.2%	0.3%	-14.5%
Native American, Asian, Pacific, Mixed		-2.0%	2.0%		-5.8%	5.8%		-8.1%	3.6%	4.6%		-6.4%	-2.4%	8.8%
Hispanic/Latino	**	4.4%	-4.4%		-3.4%	3.4%		4.1%	-1.9%	-2.2%		-0.3%	-0.1%	0.4%
Male (reference group)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Female		5.0%	-5.0%	**	-6.9%	6.9%		5.1%	-2.4%	-2.7%	***	18.4%	1.8%	-20.2%
Mother has less than high school/GED (reference)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mother has high school/GED		-0.5%	0.5%		3.0%	-3.0%		7.2%	-3.4%	-3.8%		-3.1%	-0.7%	3.8%
Mother has some college with no degree		-5.0%	5.0%		-0.9%	0.9%		8.5%	-4.1%	-4.5%		-2.5%	-0.6%	3.1%
Mother has BA/BS or higher		-2.8%	2.8%		3.1%	-3.1%		7.7%	-3.7%	-4.0%		0.3%	0.1%	-0.4%
Household income less than or equal to $15,000 (reference)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Household income $15,001 to $25,000		0.4%	-0.4%		-3.4%	3.4%		1.3%	-0.6%	-0.7%		-4.4%	-1.3%	5.7%
Household income $25,001 to $50,000		1.3%	-1.3%		-4.6%	4.6%		5.2%	-2.5%	-2.8%	**	-10.2%	-3.3%	13.6%
Household income $50,001 to $75,000		3.3%	-3.3%	*	-12.9%	12.9%		0.9%	-0.4%	-0.5%	*	-9.8%	-4.0%	13.8%
Household income over $75,000	**	8.5%	-8.5%		-6.3%	6.3%		4.3%	-2.0%	-2.2%		-11.1%	-5.2%	16.3%
Only one adult in child's household	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Two bio/adopt parents in household		-2.4%	2.4%		-2.1%	2.1%		1.0%	-0.5%	-0.5%		3.7%	0.9%	-4.6%
Respondent and partner in household		-0.9%	0.9%		-6.9%	6.9%		-15.3%	6.3%	9.0%		-6.7%	-2.6%	9.3%
Respondent and other adult(s) in household		1.9%	-1.9%		-0.4%	0.4%		-8.0%	3.6%	4.5%		8.1%	0.6%	-8.7%
Percent of county uninsured		0.4%	-0.4%		-0.4%	0.4%		0.3%	-0.1%	-0.2%		0.2%	0.0%	-0.3%
County per capita income in thousands		0.0%	-0.0%		0.4%	-0.4%		0.3%	-0.1%	-0.1%		-0.4%	-0.1%	0.5%
Percent of county with some high school		-0.2%	0.2%		0.2%	-0.2%		-0.4%	0.2%	0.2%		0.4%	0.1%	-0.4%
Percent of county below poverty line		-0.2%	0.2%		0.3%	-0.3%		0.1%	-0.0%	-0.0%		0.0%	0.0%	-0.0%
County infant deaths per 1,000 people	*	0.9%	-0.9%		-1.0%	1.0%		-0.9%	0.4%	0.5%		-0.1%	-0.0%	0.1%
Observations		1,491			1,492			1,422				1,005		
Note: for IDC measures "High", "Medium" and "Low" refer to near age-appropriate, below age-appropriate and far below age-appropriate, respectively. * significant at 10%; ** significant at 5%; *** significant at 1%														

Duration in early intervention is once again significantly negatively correlated with having a high IDC score for both functional dimensions. Entering early intervention in poor or fair health is also negatively related to better outcomes for both cognition and independence. African American children are 10.2 and 14.2 percent more likely than whites to have 36-month IDC scores that are high for cognitive ability and independence, respectively. Lastly, higher levels of household income (between $25,001 and $75,000) are correlated with a decrease in the likelihood of having a high level of independence at three years of age.

Motor

Results pertaining to the use of arms and hands, legs and feet, and the IDC measure of motor skills are contained in Appendix H-1e. A marginally significant negative effect of expenditure on the use of legs and feet is found. However, it is so small in magnitude that it can be safely ignored. The results pertaining to functional level are remarkably similar across all three motor-related dimensions. Entering early intervention at the lowest functional levels is associated with a 54.2 to 66 percent decline in the probability of being in the best outcome category at 36 months of age.

Eligibility for early intervention services due to a speech problem is positively related to using both arms and hands normally at 36 months, while having a diagnosed condition is negatively related to this outcome. Having a diagnosed condition is also negatively correlated with the probability of normal use of legs and feet at three years. Duration in early intervention is negatively associated with the probability of using all limbs normally (both arms/hands and legs/feet). Strangely enough, the results suggest that children born under more vulnerable circumstances are more likely to use both legs and feet normally. General health at entry into early intervention proves to be a significant determinant of the IDC measure of motor, where those in poor or fair health are 7.3 percent less likely than individuals in excellent health to have a high score at 36 months.

The last significant findings are found for the functional dimension concerning use of arms and hands. Children with mothers that have some (uncompleted) college are slightly more likely to use their arms and hands normally at 36 months. However, the effect only increases this likelihood by 1.2 percent. Two marginally significant findings suggest that household incomes over $75,000 and from $15,001 to $25,000 are associated with a lower probability of using both arms and hands normally.

Appendix H-1e - Regression Effects of Expenditures, Individual Characteristics, Social Background, and Region on Communication-Related Outcomes at 36 Months

	Changes in Probability for Use of Arms/Hands				Changes in Probability for Use of Legs/Feet				Changes in Probability for IDC Motor Skills			
	Sig. Level	Uses Both Normally	Has Little Trouble	Has Much Trouble	Sig. Level	Uses Both Normally	Has Little Trouble	Has Much Trouble	Sig. Level	High	Medium	Low
Average Monthly Expenditure/100		-0.7%	0.5%	0.2%	**	-0.1%	0.1%	0.0%		-0.4%	0.3%	0.1%
Condition severity at entry 1 (reference)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Condition severity at entry 2	***	-32.6%	20.6%	12.0%	***	-20.3%	11.5%	8.8%	**	-30.0%	21.6%	8.4%
Condition severity at entry 3	***	-54.2%	23.7%	30.5%	***	-59.6%	24.3%	35.3%	***	-66.0%	28.7%	37.3%
At-risk (reference)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Speech	**	13.0%	-9.7%	-3.3%		-2.2%	1.3%	0.8%		12.9%	-10.3%	-2.6%
Developmental delay		0.8%	-0.6%	-0.2%		-8.1%	5.0%	3.2%		-6.8%	5.2%	1.6%
Diagnosed condition	*	-14.8%	10.6%	4.2%	**	-17.8%	10.6%	7.2%		-12.4%	9.6%	2.8%
Birth vulnerability index (1 low, 3 high)		-5.2%	3.8%	1.5%	***	2.2%	-1.4%	-0.8%		-2.1%	1.6%	0.5%
Duration in months	**	-1.1%	0.8%	0.3%	***	-0.0%	0.0%	0.0%		-0.6%	0.5%	0.1%
Excellent health (reference)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Very good health		-0.1%	0.1%	0.0%		3.5%	-2.2%	-1.3%		1.2%	-1.0%	-0.3%
Good health		-4.0%	2.9%	1.1%		-2.8%	1.7%	1.1%		-6.3%	4.8%	1.4%
Poor or fair health		-5.3%	3.8%	1.5%		-9.9%	5.9%	4.0%	**	-7.3%	5.6%	1.7%
White (reference group)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
African American		4.6%	-3.4%	-1.3%		4.5%	-2.8%	-1.7%		2.8%	-2.2%	-0.6%
Native American, Asian, Pacific, Mixed		-10.2%	7.1%	3.1%		-2.5%	1.5%	0.9%		-5.9%	4.5%	1.4%
Hispanic/Latino		0.6%	-0.4%	-0.2%		1.6%	-1.0%	-0.6%		8.4%	-6.7%	-1.8%
Male (reference group)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Female		-1.0%	0.7%	0.3%		2.0%	-1.2%	-0.8%		3.2%	-2.5%	-0.7%
Mother has less than high school/GED (reference)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mother has high school/GED		3.3%	-2.4%	-0.9%		2.5%	-1.6%	-1.0%		10.8%	-8.5%	-2.3%
Mother has some college with no degree	**	1.2%	-0.9%	-0.3%		6.0%	-3.7%	-2.2%		12.7%	-10.0%	-2.7%
Mother has BA/BS or higher		-2.1%	1.5%	0.6%		3.3%	-2.1%	-1.2%		11.5%	-9.1%	-2.4%
Household income less than or equal to $15,000 (reference)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Household income $15,001 to $25,000	*	-0.6%	0.4%	0.2%		-2.6%	1.6%	1.0%		-12.8%	9.7%	3.1%
Household income $25,001 to $50,000		0.4%	-0.3%	-0.1%		-1.2%	0.7%	0.5%		-6.8%	5.3%	1.5%
Household income $50,001 to $75,000		0.8%	-0.6%	-0.2%		5.6%	-3.5%	-2.1%		-10.2%	7.7%	2.4%
Household income over $75,000	*	-5.2%	3.7%	1.5%		0.0%	-0.0%	-0.0%		-14.3%	10.8%	3.6%
Only one adult in child's household	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Two bio/adopt parents in household		8.6%	-6.1%	-2.5%		4.4%	-2.7%	-1.7%		-2.0%	1.6%	0.4%
Respondent and partner in household		8.3%	-6.1%	-2.1%		7.3%	-4.7%	-2.7%		4.4%	-3.5%	-0.9%
Respondent and other adult(s) in household		8.0%	-5.9%	-2.1%		0.6%	-0.4%	-0.2%		-1.6%	1.2%	0.4%
Percent of county uninsured		0.4%	-0.3%	-0.1%		0.4%	-0.2%	-0.1%		0.3%	-0.2%	-0.1%
County per capita income in thousands		0.4%	-0.3%	-0.1%		0.1%	-0.1%	-0.0%		0.3%	-0.2%	-0.1%
Percent of county with some high school		-0.0%	0.0%	0.0%		-0.1%	0.0%	0.0%		0.0%	-0.0%	-0.0%
Percent of county below poverty line		-0.2%	0.1%	0.0%		-0.2%	0.1%	0.1%		-0.0%	0.0%	0.0%
County infant deaths per 1,000 people		-0.6%	0.4%	0.2%		-0.9%	0.5%	0.3%		-0.9%	0.7%	0.2%
Observations		1,487				1,190				1,497		

Note: for IDC measures "High", "Medium" and "Low" refer to near age-appropriate, below age-appropriate and far below age-appropriate, respectively. * significant at 10%; ** significant at 5%; *** significant at 1%

Appendix H2.a – Ordinal Logit Regressions of Early Intervention Expenditures, Individual Characteristics and Social Background on Outcomes at 36 Months

	General Health	Understanding Speech	Making Known Needs	IDC Communication	IDC Cognitive Ability	IDC Independence	Hearing	Vision	Arms/ Hands	Legs/Feet	IDC Motor
Average monthly expenditure/100	0.019	0.021	0.024	0.015	0.031	0.047	0.013	0.010	0.024	0.038	0.011
	(0.011)	(0.036)	(0.020)	(0.017)	(0.016)*	(0.011)***	(0.009)	(0.005)*	(0.017)	(0.015)**	(0.023)
Speech	-0.405	1.169	0.410	0.532	0.326	-0.050	-0.992	0.078	-1.145	-0.841	0.192
	(0.364)	(0.993)	(0.433)	(0.385)	(0.799)	(0.346)	(0.601)	(10.464)	(0.417)**	(0.496)	(7.946)
Developmental delay	0.239	1.119	0.675	0.782	0.580	0.380	0.498	0.372	0.419	-0.044	0.689
	(0.248)	(1.246)	(0.310)**	(0.400)*	(0.794)	(0.354)	(0.470)	(0.617)	(0.599)	(0.284)	(0.986)
Diagnosed condition	0.292	1.562	0.950	1.305	1.164	0.727	0.753	1.028	0.814	0.795	1.424
	(0.274)	(1.178)	(0.288)***	(0.267)***	(0.867)	(0.356)*	(0.361)*	(0.380)**	(0.463)*	(0.291)**	(0.908)
Birth vulnerability index (1:low, 3:high)	0.038	-0.171	0.008	-0.210	-0.559	0.088	0.195	-0.026	0.138	0.281	-0.200
	(0.076)	(0.381)	(0.089)	(0.139)	(0.148)***	(0.088)	(0.094)*	(0.198)	(0.161)	(0.095)***	(0.242)
Duration in months	0.011	-0.011	0.043	0.055	0.000	0.047	0.030	0.084	0.039	0.058	0.004
	(0.014)	(0.052)	(0.017)**	(0.022)**	(0.018)	(0.022)**	(0.018)	(0.023)***	(0.016)**	(0.016)***	(0.057)
Very good health	0.422	0.054	0.056	-0.026	0.036	0.086	-0.204	-0.060	-0.082	0.008	-0.338
	(0.249)	(0.536)	(0.159)	(0.300)	(0.595)	(0.278)	(0.366)	(0.351)	(0.287)	(0.228)	(0.491)
Good health	1.317	0.443	0.523	0.312	0.622	0.254	-0.008	0.463	0.390	0.210	0.247
	(0.240)***	(0.341)	(0.142)***	(0.153)*	(0.287)**	(0.195)	(0.363)	(0.375)	(0.291)	(0.178)	(0.496)
Poor or fair health	2.518	-0.891	0.792	0.705	0.659	0.521	0.336	0.416	0.442	0.272	0.754
	(0.250)***	(0.571)	(0.246)***	(0.248)**	(0.281)**	(0.217)**	(0.558)	(0.266)	(0.518)	(0.299)	(0.302)**
African American	0.122	-1.213	-0.502	-0.129	-0.727	-0.685	0.540	0.430	-0.190	-0.257	-0.460
	(0.317)	(0.407)***	(0.116)***	(0.307)	(0.402)*	(0.248)**	(0.446)	(0.489)	(0.367)	(0.281)	(0.475)
Native American, Asian, Pacific Islander, Mixed	0.462	-0.529	-0.219	0.787	0.456	0.373	0.244	0.411	0.354	0.498	0.210
	(0.513)	(1.406)	(0.496)	(0.408)*	(0.683)	(0.249)	(0.683)	(0.607)	(0.787)	(0.593)	(0.730)
Hispanic/Latino	0.567	-0.065	-0.223	0.095	-0.274	0.017	-0.734	0.255	-0.643	-0.031	-0.151
	(0.190)***	(0.596)	(0.258)	(0.242)	(0.360)	(0.366)	(0.307)**	(0.319)	(0.456)	(0.261)	(0.787)
Female	0.076	-0.407	-0.248	-0.192	-0.330	-0.930	-0.698	0.533	-0.216	0.053	-0.187
	(0.225)	(0.258)	(0.164)	(0.245)	(0.210)	(0.147)***	(0.172)***	(0.210)**	(0.258)	(0.214)	(0.329)
Mother has high school/GED	-0.004	0.749	-0.423	0.031	-0.476	0.165	0.061	-0.246	-0.777	-0.180	-0.243
	(0.164)	(0.603)	(0.327)	(0.391)	(0.444)	(0.346)	(0.606)	(0.555)	(0.768)	(0.508)	(0.269)
Mother has some college with no degree	-0.175	0.392	-0.158	-0.117	-0.578	0.134	0.608	0.073	-0.948	-0.066	-0.596
	(0.279)	(0.600)	(0.269)	(0.395)	(0.370)	(0.413)	(0.582)	(0.413)	(0.414)**	(0.537)	(0.602)
Mother has BA/BS or higher	-0.284	0.261	-0.293	-0.287	-0.528	-0.016	0.348	-0.262	-0.871	0.109	-0.324
	(0.271)	(0.632)	(0.363)	(0.218)	(0.567)	(0.402)	(0.554)	(0.586)	(0.634)	(0.739)	(0.600)
Observations	1,565	353	1,491	1,239	1,422	1,005	1,491	1,492	1,497	1,487	1,190
* significant at 10%; ** significant at 5%; *** significant at 1%											

Appendix H2.b – Ordinal Logit Regressions of Household and Regional Characteristics on Outcomes at 36 Months

	General Health	Understanding Speech	Making Known Needs	IDC Communication	IDC Cognitive Ability	IDC Independence	Hearing	Vision	Arms/ Hands	Legs/Feet	IDC Motor
Household income $15,001 to $25,000	-0.179 (0.393)	-0.391 (0.758)	0.369 (0.478)	0.049 (0.336)	-0.085 (0.338)	0.243 (0.314)	-0.060 (0.553)	0.256 (0.724)	0.730 (0.364)*	0.030 (0.347)	0.225 (0.405)
Household income $25,001 to $50,000	-0.527 (0.410)	-0.725 (0.750)	0.038 (0.355)	-0.311 (0.311)	-0.344 (0.384)	0.579 (0.218)**	-0.180 (0.451)	0.350 (0.389)	0.423 (0.328)	-0.022 (0.291)	0.109 (0.389)
Household income $50,001 to $75,000	-0.513 (0.331)	-0.481 (0.972)	0.150 (0.224)	-0.194 (0.337)	-0.058 (0.344)	0.578 (0.286)*	-0.520 (0.544)	0.856 (0.462)*	0.594 (0.437)	-0.043 (0.519)	-0.599 (0.511)
Household income over $75,000	-0.408 (0.285)	-0.829 (0.762)	-0.156 (0.311)	-0.614 (0.311)*	-0.288 (0.251)	0.677 (0.441)	-1.938 (0.719)**	0.451 (0.475)	0.797 (0.429)*	0.269 (0.378)	-0.000 (0.471)
Two bio/adopt parents in household	-0.003 (0.423)	0.575 (1.193)	0.200 (0.393)	-0.162 (0.508)	-0.062 (0.277)	-0.200 (0.317)	0.341 (0.549)	0.175 (0.478)	0.134 (0.564)	-0.442 (0.353)	-0.386 (0.595)
Respondent and partner in household	-0.058 (0.382)	0.085 (1.435)	0.507 (0.383)	-0.091 (0.885)	0.794 (0.546)	0.390 (0.711)	0.111 (0.815)	0.478 (0.658)	-0.317 (0.660)	-0.506 (0.857)	-0.920 (1.160)
Respondent and other adult(s) in household	0.282 (0.384)	0.076 (0.884)	0.088 (0.451)	-0.236 (0.564)	0.458 (0.578)	-0.401 (0.482)	-0.277 (0.549)	0.032 (0.467)	0.102 (0.489)	-0.473 (0.523)	-0.059 (0.624)
Percent of county uninsured	-0.007 (0.022)	0.016 (0.065)	0.005 (0.016)	-0.043 (0.037)	-0.020 (0.033)	-0.011 (0.015)	-0.054 (0.038)	0.035 (0.034)	-0.018 (0.029)	-0.020 (0.028)	-0.036 (0.047)
County per capita income in thousands	0.010 (0.028)	0.019 (0.020)	-0.002 (0.022)	-0.007 (0.021)	-0.017 (0.017)	0.022 (0.020)	-0.003 (0.033)	-0.034 (0.032)	-0.020 (0.025)	-0.022 (0.027)	-0.009 (0.036)
Percent of county with some high school	0.003 (0.025)	0.009 (0.039)	-0.002 (0.026)	-0.006 (0.030)	0.025 (0.025)	-0.020 (0.033)	0.024 (0.030)	-0.013 (0.038)	-0.003 (0.031)	0.002 (0.018)	0.007 (0.050)
Percent of county below poverty line	0.012 (0.011)	-0.013 (0.028)	-0.008 (0.010)	0.000 (0.016)	-0.004 (0.014)	-0.002 (0.015)	0.029 (0.024)	-0.025 (0.024)	0.001 (0.015)	0.009 (0.015)	0.014 (0.018)
County infant deaths per 1,000 people	-0.079 (0.053)	0.003 (0.076)	-0.030 (0.034)	-0.016 (0.046)	0.059 (0.080)	0.005 (0.038)	-0.125 (0.071)*	0.084 (0.080)	0.059 (0.052)	0.030 (0.072)	0.080 (0.086)
Observations	1,565	353	1,491	1,239	1,422	1,005	1,491	1,492	1,497	1,487	1,190

* significant at 10%; ** significant at 5%; *** significant at 1%

	General Health	Understanding Speech	Making Known Needs	IDC Communication	IDC Cognitive Ability	IDC Independence	Hearing	Vision	Arms/ Hands	Legs/Feet	IDC Motor
Fairly easy to understand		0.347 (0.872)									
Somewhat hard to understand		1.347 (0.814)									
Very hard to understand		2.193 (1.121)*									
Communicates needs with a little trouble			1.437 (0.243)***								
Communicates needs with a lot of trouble			2.348 (0.462)***								
Doesn't communicate			0.600 (0.334)*								
IDC communication medium				0.666 (0.171)***							
IDC communication low				1.819 (0.192)***							
IDC cognitive ability medium					1.298 (0.312)***						
IDC cognitive ability low					2.151 (0.436)***						
IDC independence medium						0.784 (0.223)***					
IDC independence low						1.643 (0.324)***					
Has hearing problem							2.828 (0.366)***				
Has vision problem								2.211 (0.511)***			
Uses both arms/hands with a little trouble									1.581 (0.335)***		
Uses both arms/hands with a lot of trouble									3.186 (0.435)***		
Uses both legs/feet with a little trouble										1.502 (0.206)***	
Uses both legs/feet with a lot of trouble										2.435 (0.438)***	
IDC motor skills medium											1.333 (0.616)**
IDC motor skills low											3.489 (0.746)***
Observations	1,565	353	1,491	1,239	1,422	1,005	1,491	1,492	1,497	1,487	1,190

* significant at 10%; ** significant at 5%; *** significant at 1%