Beyond Part C: Reducing Middle School Special Education for Early Intervention Children with Developmental Delays

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Beyond Part C: Reducing Middle School Special Education for Early Intervention Children with Developmental Delays

Mary Anne Ullery and Lynne Katz

University of Miami

ABSTRACT
This study examined the rates of special education placement during middle school grades (sixth through eighth) among children who participated in the Linda Ray Intervention Program (LRIP) center-based and home-based learning modalities. The study sample included 113 children in Miami Dade County Public Schools who had gestational cocaine exposure and received early intervention services due to developmental delays. This study found that children who participated in the center-based (25 hours per week) learning modality had a significantly lower rate of special education placement (14%) than the students in the home-based (three hours per week) learning modality (30%) in middle school. Also, results indicated that children who were socioeconomically disadvantaged (free/reduced lunch) and in the home-based learning modality were three to four times more likely to be in special education. This study provides evidence for the long-term impact of the LRIP center-based modality on special education outcomes.

Introduction
Research in the effectiveness of early intervention and the impact on young children has been plentiful and generally has noted positive effects on learning as well as behavior (Barnett, 1995, 1998; Campbell & Ramey, 1995; Condry, 1983; Conyers, Reynolds, & Ou, 2003; Schweinhart, Barnes, Weikart, Barnett, & Epstein, 1993). Most of these short- and long-term studies have examined the presence of intervention against a control group that lacked intervention. The following study adds to the literature in a unique way in that (a) it examines the impact of an early intervention program for children who were developmentally delayed, served by Part C of the Individuals with Disabilities Education Act (IDEA) and were prenatally exposed to cocaine; (b) it tracks children who participated in the intervention into middle school in a large urban school district; (c) it examines the long term impact of two types of intervention, a 25 hour per week center-based modality versus a 3 hour per week home-based modality; (d) it measures the prevalence of special education placement in middle school for both groups. This study supports the premise that center-based early intervention is vitally important and potentially more effective in reducing later special education placement, especially for young children who have been identified as developmentally delayed and are from high-risk environments.

Children who were prenatally exposed to cocaine represent an early identifiable population who greatly benefit from quality special education at the earliest possible time (Claussen, Scott, Mundy, & Katz, 2004). Risk factors for this group involve not only prenatal factors of the drug exposure but also environmental factors. Studies have found that these children suffer from prenatal factors such as poor health and nutrition, multiple drug use by parents, and maternal smoking (Chan, Wingert, Wachsman, Schuetz, & Rogers, 1986; Hulse, English, Milne, Holman, & Bower, 1997) as well as environmental factors.
like poverty and low maternal education (Hawley, Halle, Drasin, & Thomas, 1995; Lester, Colella, Swenson, Broadfield, & Daft, 2000; Mayes & Bomstein, 1996). Providing services for this high-risk population from birth to age three has been shown to change their developmental trajectories, especially with high-dose interventions such as a center-based modality (Bono et al., 2005; Claussen et al., 2004). Outcomes for children in early intervention programs, specifically those whose populations are high-risk, support the need for continued funding and open access to families whose children are developmentally delayed as a component of their educational continuum. Also, studying the long-term impact of early intervention can give communities the information they need to determine how best to create interagency partnerships (health, education, human services) so as to build a comprehensive support network for high-risk families whose children are developmentally delayed. This study seeks to determine the impact of a differentiated dosage, early intervention program for children who were prenatally exposed to cocaine with documented developmental delays on their later special education placement in middle school.

The link between early intervention and subsequent special education services

Since the mid-1980s research has shown positive effects of early intervention programs on long-term effects of reducing special education placement (Barnett, 1995, 1998; Campbell & Ramey, 1995; Condry, 1983; Conyers et al., 2003; Schweinhart et al., 1993). Four studies that have had great success in following early childhood education participants into elementary, middle, high school, and post-high school are the HighScope Perry Preschool Program (Schweinhart et al., 1993, 2005), the Carolina Abecedarian Project, the Chicago Child-Parent Centers (Reynolds, 2000; Reynolds et al., 2007) and the Infant Health and Development Program (IHDP; Brooks-Gunn et al., 1994; Hollomon & Scott, 1998; McCarton et al., 1997). Across all of these programs, however, the long-term outcomes differed in the domains that were studied and the degrees to which they were impacted, but they did highlight many benefits of early childhood intervention especially for high-risk young children. Findings from these four studies revealed positive long-term outcomes for the young children who participated in the intervention programs in comparison to the control group. The HighScope Perry Preschool Program provided three- and four-year-old African-American children with quality preschool from 1962 to 1967. Based on the natural development of young children, the curriculum for this program recognized children as active learners and encouraged them to plan and carry out their own activities. Adults (teachers) joined in, but allowed the children to plan and think through their own ideas (Promising Practices Network, http://www.promisingpractices.net/program.asp?programid=136#programinfo). Key study findings for this study indicated that the Perry Preschool group had lower percentages of placement in special education (16% vs. 28% for control group) even through high school years (Berrueta-Clement, Schweinhart, Barnett, Epstein, & Weikart, 1984).

Findings from the Carolina Abecedarian Project, operating between 1972 and 1985 indicated significant differences between children who had preschool treatment (12%) and the children who had no preschool (47%) in their special education placement by age 15 (Campbell & Ramey, 1995). This program was a year-round, full day intervention in a child care setting for the first five years of a child’s life (Ramey et al., 1984) targeting children at risk for developmental delays and school failure. The project was a two-part program: a preschool intervention and a primary school intervention. Participants either completed eight years of intervention, five years of intervention, three years of primary school, or no intervention at all.

The Chicago Child-Parent Centers (Conyers et al., 2003) examined the effects of an early intervention program in Chicago on special education placement with a large sample of 1377 (n = 895 in the preschool program and n = 482 who did not receive preschool intervention) of low-income primarily African American children. They found that children who participated in the Child-Parent Center preschool (12%) had lower rates of special education placement between grades one and eight than a comparison group who participated in an alternative full-day kindergarten (18%) at age five. The IDHP began in infancy and ended after the child turned three years and combined both home visiting and center-based care (Promising Practices Network,
This intervention was operated in medical institutions in various cities across the country, including the University of Miami School of Medicine. Although long-term five-year outcomes for the IHDP were positive in vocabulary (Brooks-Gunn et al., 1994) and eight-year IQ, verbal IQ, performance IQ, math achievement, and picture vocabulary (McCarton et al., 1997), site-specific findings were nonsignificant. For example, school performance at age nine at the Miami site of IHDP did not find differences between child attendance rates, rates of special education placement, and tests of reading, math computation, and math application (Hollomon & Scott, 1998).

**LRIP—early intervention**

The Linda Ray Intervention Program (LRIP) was initially designed in 1993 to examine three levels of early intervention on the developmental outcome of children who had gestational cocaine exposure. The purpose of the program was to prevent subsequent developmental problems for this population (Claussen et al., 2004). The LRIP program focused efforts on the child, since at the time, residential drug treatment programs for mothers were available in the community, but there were no services or attention paid to their children during their treatment and recovery stages. Many children whose parents had substance abuse issues were placed with a relative caregiver or foster care family (Hawley et al., 1995; Kelley, 1992). Focusing on the child as the intervention client was a new concept for that era and it allowed the LRIP to provide the intervention services continuum even if the child changed caregivers (Claussen et al., 2004; Scott, Urbano, & Boussy, 1991). Families of the children characteristically presented with a variety of co-occurring risk factors such as poverty, insecure attachment to caregivers, parenting stress, and psychological symptomatology (Claussen, Mundy, Malik, & Willoughby, 2002).

The LRIP was funded primarily through a three-party agreement between Miami-Dade County Public Schools (MDCPS) Pre-k Program for Children with Disabilities, The Early Steps System (Children’s Medical Services) and the University of Miami, as a Part C early intervention program for children identified with developmental delays. Progress monitoring of the child included working with the families and documented child progress monthly, quarterly, semi-annually, and annually. Teachers, social workers, caseworkers, guardians of the child, and the MDCPS staffing specialist worked jointly with the child and family. An Individualized Family Support Plan (IFSP) was developed at the onset, updated and monitored as an agreed on contract for the child’s educational path. The *Outcome* curriculum (Scott & Scott, 1992; http://www.socio.com/eipardd06.php), used at the LRIP was organized in the domains of social/emotional, language, cognitive, fine motor, gross motor, and self-help development (Scott, Hollomon, Claussen, & Katz, 1998). The *Outcome* curriculum was developed by program developers and staff and has since been published with Sociometrics Corporation as an effective early intervention program curriculum, along with *The Abecedarian Approach* curriculum and *The Infant Health and Development Program* (Sociometrics, http://www.socio.com/eipardd.php). All research on the *Outcome* curriculum was conducted at the LRIP with evaluations indicating significant effects in cognition, receptive and expressive language, and gross motor development compared to a control condition at 36 months of age (Sociometrics, http://www.socio.com/eipardd.php). The curriculum is specifically targeted for risk factors during pregnancy, premature infants or low birth weight, and low socioeconomic status. Delivery for the curriculum may be conducted in center-based, home-based, school-based, or medical settings (Sociometrics, http://www.socio.com/eipardd.php). Recommended staffing for use of the curriculum is classroom teachers with a minimum of a BA/BS in Education, Early Childhood, Child Development, or Psychology with two to three years of experience working with children three years or younger. The curriculum training utilized a train-the-trainer model for LRIP. The curriculum developers who worked at the center trained the early childhood teachers using hands-on strategies for each lesson. Often the children of the staff were engaged in curriculum activities to demonstrate implementation. The classroom teachers trained the paraprofessionals assigned to them in the curriculum, with oversight from the curriculum developer who continued to work at the LRIP for a number of
years. Teacher feedback meetings annually allowed for refining of activities within developmental levels. The curriculum was used in its entirety by both the center and home-based teachers. More detailed descriptions of the center-based and home-based modalities at the LRIP are described in the methods section of the study.

Short-term effects of the LRIP indicated that LRIP home and center groups demonstrated (a) improved developmental outcomes (cognitive, language, and behavior) over a 36-month period (Bono et al., 2005; Claussen et al., 2004) and (b) higher cognition and language scores at the end of LRIP center-based care than a non-intervention control group (Bono et al., 2005). Additional studies were completed within the overall LRIP project over time. One study examined three levels of intervention (center, home, and primary care) on 130 children, where at 36 months, cognition, receptive and expressive language, and gross motor development saw significant, moderate to large effects and behavior problems saw small significant effects (Claussen et al., 2004). This study also noted that children in the center-based modality had better language outcomes (Claussen et al., 2004). Another study on a smaller sample (n = 56) of the same population examined proximal variables and found that families of children enrolled in the center-based modality had more predictable daily routines than those in the home-based modality. Also, home caregiver education impacted the ability to establish or maintain daily routines where caregivers with lower education had less established routines than those with higher education levels (Bolzani Dinehart, Dice, Dobbins, Claussen, & Bono, 2006). Finally, another study on the same gestational cocaine exposure sample (n = 293) examined the moderating effect of low birth weight on the effectiveness of early intervention and found that children born with gestational cocaine exposure and who had low birth weight may benefit more from early intervention than children who are born with normal weight (Bono & Sheinberg, 2009). Only one study focused on a follow-up sample (n = 92), examining the continuity of social competence from 36 months of age to first grade, but this study did not examine intervention outcomes themselves. Each of these studies within LRIP examined (a) the impact of different types of early intervention where findings indicated the center-based modality had more positive results; (b) significant cognitive and language changes for children in the center-based modality who were gestational cocaine exposure and developmentally delayed; (c) proximal variables that impact the effects of the center-based modality. All of these studies were conducted on the participant sample between 0 and 36 months of age.

Purpose of study

This study examines the impact of early intervention on eventual special education placement in middle school. Although the studies previously cited have examined early intervention in comparison with a control group, this study seeks to examine the impact of a higher intensity (25 hours per week) center-based modality versus a lower intensity (3 hours per week) home-based modality. Trends from Miami-Dade County from 2009–2010 indicate a steady growth in special education enrollment (Figure 1) through elementary school and slowing growth or plateau during the middle school years (MDCPS, 2010: http://oada.dadeschools.net/StudentMembership/FTEMembership/0210eselist.pdf). Thus, this study examined special education prevalence by middle school age (grades six through eighth) of children in center-based and home-based learning modalities, with the expectation that the children would have been identified as needing services during the elementary years.

The current study sought to determine the long-term effects of a center-based early intervention program on children who were developmentally delayed prior to age three and identified as having gestational cocaine exposure. It was hypothesized that children in the center-based modality would have lower rates of special education placement at middle school than a comparison group of children who received the home-based modality. It is expected that children who are high-risk would benefit more from a more intense early intervention model than a lower intensity home-based learning modality due to the following reasons: (1) many of the children had multiple delays and more time spent in intervention would be of benefit; (2) the disorganized nature of the home environment (high change in caregiver, domestic violence, neighborhood violence, etc.) for many of
the families in the program made for a challenging learning environment for the child-teacher-
caregiver to build an educational alliance. The research questions were (1) Does participation in the
center-based modality reduce the likelihood of receiving special education services for children in
middle school (grades six through eighth)? (2) What other demographic variables impact the
likelihood of children being placed in special education?

**Method**

**Participants**

LRIP researchers identified 134 middle school age children who attended the LRIP from 2000–2004.
Since the LRIP is part of the MDCPS system, we were granted access to middle school data and an
Institutional Review Board protocol was developed and approved through the University of Miami
Human Subjects Research Office. A total of 113 (84% of the expected total) middle school children
were matched by student ID number. The remaining unidentified children from LRIP may have
either left the county or may have been enrolled in private schools.

Of the 113 total students found, 63 (56%) children had been enrolled previously in the LRIP center
based learning modality; 50 (44%) were in the home-based modality. Inclusion criteria for the LRIP
program included (a) gestational cocaine exposure detected by self-report or by meconium testing at
birth; (b) residence in the catchment area; (c) a 25% developmental delay in at least one area of
development as verified on the Developmental Programming for Infants and Young Children
(DPIYC) Early Intervention Developmental Profile (Schafer & Moersch, 1981) for meeting Part C
eligibility of services. The catchment area for the center-based program was also limited by special
education transportation regulations for time on the van from each child’s home to the center.
Catchment for the home-based program was county-wide. Random assignment for these groups was
not feasible, as all children who were referred were at risk for developmental delays. Full-time equiv-
alanlcy state reimbursement calculations for the program necessitated maintaining enrollment of 60
center-based children to support the program costs. Both center- and home-based modalities were filled
concurrently, depending on where the child lived (for transportation feasibility) and for the feasibility of
home-based participation in the intervention. For example, if a child was unable to participate in the
home intervention due to the caregiver’s work schedule, yet lived within the center-based catchment, the
child was enrolled in the center-based modality and vice versa. Detailed descriptions of these modalities
and research findings can be found in previous published studies (Claussen et al., 2004; Bono et al., 2005;
Katz, Ceballos, Scott, & Wurm, 2007). In sum, children in the center-based modality had more advanced
language abilities than the home-based children at 36 months (Bono et al., 2005). Although mean
differences in cognition were noted in previous studies (Bono et al., 2005; Claussen et al., 2004)
significant differences were not.

A review of the middle school data for the children in this sample were nearly split on gender
(49% male and 51% female) and the majority of students were identified as African American (83%),

![ESE Population in MDCPS](image)

**Figure 1.** Trends in special education placement in Miami-Dade County.
with 11% Hispanic and 6% white non-Hispanic. According to the MDCPS records, most of the children were receiving free or reduced lunch (84%), only one child in the group had a truancy flag by middle school, and only two children were in juvenile justice. As per Florida Department of Education standards, middle schools are assigned a grade based on student achievement data on the Florida Comprehensive Assessment Test and end-of-course assessments. These school performance grades enable the public to determine how well any individual school is performing relative to the state performance [State of Florida Department of Education,](https://app2.fldoe.org/Ranking/documents/Guidesheet2011SchoolGrades.pdf) In middle school, children in this sample were primarily located in lower-performing schools, with 64% rated as a C, D, or F. Based on the LRIP center data, which was collected at enrollment into the LRIP, 13% were premature at birth, and 70% of the children had more than one caregiver change during their enrollment with the LRIP. Table 1 illustrates these demographic group differences.

Table 1. Group comparisons: demographics, ESE placement and school type.

<table>
<thead>
<tr>
<th>Study Category</th>
<th>Center-based Learning n (%)</th>
<th>Home-based Learning n (%)</th>
<th>Total</th>
<th>χ²</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total sample</strong></td>
<td>N = 63 (56%)</td>
<td>N = 50 (44%)</td>
<td>N = 113</td>
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<td></td>
</tr>
<tr>
<td><strong>Categorical family characteristics</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>SES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free lunch</td>
<td>49 (78%)</td>
<td>43 (86%)</td>
<td>93 (80%)</td>
<td>3.15</td>
<td>0.37</td>
</tr>
<tr>
<td>Reduced lunch</td>
<td>1 (1%)</td>
<td>2 (4%)</td>
<td>3 (4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not apply</td>
<td>12 (20%)</td>
<td>5 (10%)</td>
<td>17 (15%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applied not eligible</td>
<td>1 (1%)</td>
<td>0 (0%)</td>
<td>1 (1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family stability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low caregiver change (0–1)</td>
<td>32 (51%)</td>
<td>27 (54%)</td>
<td>59 (52%)</td>
<td>1.42</td>
<td>0.22</td>
</tr>
<tr>
<td>High caregiver change (2–3)</td>
<td>24 (38%)</td>
<td>12 (24%)</td>
<td>36 (32%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>7 (11%)</td>
<td>11 (22%)</td>
<td>18 (16%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Categorical child characteristics</strong></td>
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<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>32 (51%)</td>
<td>24 (48%)</td>
<td>56 (49%)</td>
<td>0.09</td>
<td>0.76</td>
</tr>
<tr>
<td>Female</td>
<td>31 (49%)</td>
<td>26 (52%)</td>
<td>58 (51%)</td>
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<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>African American</td>
<td>53 (84%)</td>
<td>40 (80%)</td>
<td>94 (83%)</td>
<td>0.54</td>
<td>0.76</td>
</tr>
<tr>
<td>Hispanic</td>
<td>7 (11%)</td>
<td>6 (12%)</td>
<td>13 (11%)</td>
<td></td>
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<tr>
<td>White non-Hispanic</td>
<td>3 (5%)</td>
<td>4 (8%)</td>
<td>7 (6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premature</td>
<td>11 (17%)</td>
<td>4 (8%)</td>
<td>15 (13%)</td>
<td>1.87</td>
<td>0.17</td>
</tr>
<tr>
<td>Full term</td>
<td>44 (70%)</td>
<td>37 (74%)</td>
<td>82 (72%)</td>
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<tr>
<td>Unknown</td>
<td>8 (13%)</td>
<td>9 (18%)</td>
<td>17 (15%)</td>
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<td></td>
</tr>
<tr>
<td>ESE Code</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>9 (14%)</td>
<td>15 (30%)</td>
<td>24 (21%)</td>
<td>4.29*</td>
<td>0.04</td>
</tr>
<tr>
<td>No</td>
<td>55 (86%)</td>
<td>35 (70%)</td>
<td>90 (79%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESE type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotionally handicapped J</td>
<td>4 (45%)</td>
<td>4 (27%)</td>
<td>8 (33%)</td>
<td>0.11</td>
<td>0.73</td>
</tr>
<tr>
<td>Specific learning disabled K</td>
<td>5 (55%)</td>
<td>10 (67%)</td>
<td>15 (63%)</td>
<td>3.52</td>
<td>0.06</td>
</tr>
<tr>
<td>Developmentally delayed T</td>
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<td>1 (6%)</td>
<td>1 (2%)</td>
<td>1.27</td>
<td>0.26</td>
</tr>
<tr>
<td>Truancy flag</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0 (0%)</td>
<td>1 (2%)</td>
<td>1 (1%)</td>
<td>1.29</td>
<td>0.25</td>
</tr>
<tr>
<td>No</td>
<td>63 (100%)</td>
<td>49 (98%)</td>
<td>113 (99%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of school</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public school</td>
<td>62 (98%)</td>
<td>50 (100%)</td>
<td>113 (99%)</td>
<td>0.78</td>
<td>0.37</td>
</tr>
<tr>
<td>Juvenile justice or alternative</td>
<td>1 (2%)</td>
<td>0 (0%)</td>
<td>1 (1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dade school grades 2010 (total)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>10 (16%)</td>
<td>8 (16%)</td>
<td>18 (16%)</td>
<td>5.54</td>
<td>0.23</td>
</tr>
<tr>
<td>B</td>
<td>10 (16%)</td>
<td>6 (12%)</td>
<td>16 (14%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>10 (17%)</td>
<td>17 (34%)</td>
<td>28 (25%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>24 (38%)</td>
<td>16 (32%)</td>
<td>40 (35%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>4 (6%)</td>
<td>1 (2%)</td>
<td>5 (4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ungraded (due to school/program type)</td>
<td>5 (7%)</td>
<td>2 (4%)</td>
<td>7 (6%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Statistic computed using Pearson Chi-Square; significant variables in bold* *p < 0.05.*
Procedures

Center-based learning modality

Children were transported to and from the center on a LRIP transportation van. Meals and snacks were provided through the Department of Health’s (DOH) Free and Reduced Cost Childcare Meal Program (United Stated Department of Agriculture Food and Nutrition Service, http://www.fns.usda.gov/cnd/care/cacfp/aboutcacfp.htm). Not only did these children receive instruction in a structured environment, they also were provided balanced nutrition through this DOH program, which was often a missed opportunity within the home (Butz, Lears, O’Neil, & Lukk, 1998).

Children were placed in age appropriate classroom settings with trained early intervention teachers and paraprofessional support with activities such as small/large group activities (art, functional, and symbolic play) and developmentally appropriate, structured activities corresponding to the IFSP goals for the children. As stated previously, many parents who had substance abuse issues often lost custody and their children were placed with a relative caregiver or in foster care (Hawley et al., 1995; Kelley, 1992). In order to provide continuity of care that may not have been prevalent in their home environments, children were assigned to the same teacher and paraprofessional team throughout their enrollment at the LRIP, rather than moving them from infant to toddler classes, as in many non-intervention or childcare programs. This program design was in place to strengthen the child’s bond with a secondary attachment figure (Raikes, 1993).

Each of the five classrooms consisted of lead teachers (typically with a Bachelors or Masters degrees in Early Childhood/Special Education) and with two or three classrooms assistants in each room (either 1:3 or 1:4 ratio based on the Birth through Two Program Standards for Serving Children with Disabilities, 1999). All classroom assistants had a minimum of a high school diploma, annual Department of Children and Families required 10 training hours annually, CPR and First Aid. See Table 2 for the overview of the center-based modality.

Table 2. Center-based vs. home-based learning modalities.

<table>
<thead>
<tr>
<th></th>
<th>Center-based Modality</th>
<th>Home-based Modality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum</td>
<td>The Outcome</td>
<td>The Outcome</td>
</tr>
<tr>
<td>Dosage</td>
<td>25 hours/week</td>
<td>3 hours/week</td>
</tr>
<tr>
<td>Location</td>
<td>Center-based</td>
<td>Home-based</td>
</tr>
<tr>
<td>Teacher credentials</td>
<td>BA/BS in Education, Early Childhood. Typically Master’s degree in Early Intervention or Special Education</td>
<td>BA/BS in Education, Early Childhood. Typically Master’s degree in Early Intervention or Special Education</td>
</tr>
<tr>
<td>Enrollment</td>
<td>Typically enrolled between 3 and 11 months of age</td>
<td>Typically enrolled between 3 and 11 months of age</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Balanced nutrition provided by DOH Free and Reduced Cost Childcare Meal Program</td>
<td>No meal provided by the program</td>
</tr>
<tr>
<td>Continuity of Care</td>
<td>Child had some continuity of care of staff and class location despite home environment changes</td>
<td>Child had continuity of care of staff. May have had location change due to custody changes in the home</td>
</tr>
<tr>
<td>Family Involvement</td>
<td>Little to no family involvement</td>
<td>Family was in the home yet were inconsistently engaged</td>
</tr>
</tbody>
</table>
Home-based modality

Although many home-based learning programs had noted effects on parenting rather than on child outcomes (Black et al., 1994) the LRIP home-based model focused on a child-centered outcome approach (Claussen et al., 2004). Children in the home-based program received intervention twice a week for 1.5 hour per visit. The goal of the LRIP center and home visiting program was to improve developmental outcomes for the zero to three target child through the delivery of the Outcome curriculum. For home-based, teachers brought developmentally appropriate learning materials to the home and primary caregivers were invited to participate in the sessions. Books, music, physical play, and, if possible, outdoor play, were integrated into the Outcome curriculum session for the home visit. However well intended, the often disorganized nature of the home environments of many of the high-risk families visited made carrying out the curriculum activities a challenge. Frequently, other children in the home (including older truant siblings) were eager to get the attention of the home visiting teacher and could provide distractions during the session. Primary caregivers could change from visit to visit, with a mother-child dyad participating at the onset, followed by grand-mother-child at the next visit, and a nonrelative babysitter the following session. This resulted in less consistent progress being made with the same adult caregivers gaining the skills needed to help in guiding the children in the home. On some occasions, domestic violence escalating at the time of the home visit made it necessary for the teacher to end the session prematurely for her own safety. One teacher was asked by the family of a target child to “pose” as a relative of the child if anyone came to the house during a session to avoid any discussion about the child’s developmental delays or prenatal drug exposure. While the LRIP home visiting teachers became integrated into the family over time, they often found themselves having to be more socially responsive to the family dynamics and less focused on completing the developmental lesson with the child. For example, one teacher recalled having to start each visit sitting with the family to eat potaje, a Latin stew, with the family before starting to work with the child. Not dining with the family would have been an insult even though the dosage of intervention provided at the visit was subsequently reduced. See Table 2 for the overview of the home-based modality.

Program measures

Data were collected on each child on enrollment into the program and later, child development research assessments for the LRIP were conducted at 18, 24, and 36 months of age. As stated previously, at baseline enrollment, children were assessed on the DPIYC (Schafer & Moersch, 1981) to qualify for services. Also at enrollment, demographic data (gender, race, ethnicity, gestational age, and socioeconomic status) were collected in survey form, including family stability measured by changes in primary caregiver. Changes in primary caregiver were monitored on an ongoing basis, and any changes were communicated from the case worker to the research associates and then entered into the data base.

To measure cognition at 18, 24, and 36 months, the children were administered the Bayley Scales of Infant Development (Bayley, 1993). This common developmental assessment for children ages 1 to 42 months yielded a mental age score as well as a standardized score (MDI: $m = 100; SD = 15$). This scale was standardized on a nationally representative sample of 1700 children 1–42 months of age. For both programs this assessment was conducted by a trained research associate in a quiet room outside the regular classroom.

In order to gain access to the middle school data through MDCPS, the LRIP researchers wrote a prospectus in 2010, detailing the study plan and the variables requested. The LRIP researchers identified 134 middle school age children who attended the LRIP from 2000–2004. Since the LRIP is part of the MDCPS system, the LRIP researchers were granted access to school data and a total of 113 (84% of the expected total) middle school children were located. The data were then extracted from the MDCPS system by MDCPS staff and securely passed to research staff at LRIP.
**Analysis plan**

All analysis for the study was conducted in SPSS Statistics 19. First, descriptive analysis was conducted to examine the study sample and related variables. Chi-square analysis was used to determine whether the distribution of the categorical groups (center-based modality vs. home-based modality) was different. Next, the Bayley mental change scores (MDI), were tested to examine the changes in individual students over time. Since this analysis investigated the differences between a series of paired observations (18–36 months) a paired sample t-test was used to examine whether the mean difference between the paired observation was significantly different from zero at the \( p < 0.05 \) level. Finally, binary logistic regression was used to analyze the prevalence of Exceptional Student Education (ESE) enrollment for the children in either center- or home-based learning modalities. This method of analysis was used since ESE enrollment (Yes/No) was not continuous and was best examined using binary logistic regression (Tabachnick & Fidell, 2001).

**Results**

Demographic group differences are illustrated in Table 1. Since these variables were categorical and were coded as such, Chi-Square analysis was used to determine if there was a relationship between the group memberships (center-based learning vs. home/primary learning) and other variables collected either at entrance to the LRIP (family stability, gender, race/ethnicity, gestational age) or from the MDCPS data (SES, ESE type, truancy, school type, and school performance grade). Significance at the \( p < 0.05 \) level was found on ESE code (yes, no) only. All other variables (SES, ESE type, family stability, gender, race/ethnicity, gestational age, truancy, school type, and school grade) were not significant, indicating there were no differences between the two groups other than their early intervention modality (center/home). Table 1 presents the categorical variables that were examined across the two groups.

Of the children who had complete Bayley MDI scores during their enrollment at the LRIP, descriptive statistics revealed that at 18 and 24 months there was a mean difference in cognition scores for this sample (\( n = 71 \)), with the home-based learning group scoring higher than the center-based learning group. However, at 36 months for this sample (\( n = 85 \)), the gap closed with the center-based group scoring slightly higher than the home base learning group (see Table 3). Although these data were not significant at any time point, they show the trend of the center-based group growing at a faster rate than that of the home-based group by 36 months. Figure 2 illustrates the trajectories of the two groups over time.

Next, a paired sample t-test was run to examine the MDI change scores of individual students from 24 to 36 months. Although there did not appear to be any direct mean difference in MDI scores at any time point, there clearly were trajectory differences in growth. By pairing 24 and 36 month MDI scores in a paired sample t-test we could examine individual increases. In this analysis, the center-based group showed significant change over time \( t (36) = 4.61, \ p < 0.001 \) indicating that the children in the center-based modality saw greater MDI increases from 24 to 36 months of age. Although there were mean increases for the home-based modality they were not significant \( t (25) = 1.78, \ p > 0.05, \ CI_{95} 4.05, 9.55 \). Further Cohen’s effect size value \( (d = 0.49) \) suggests a moderate effect (see Table 4). This analysis coincides with the NEILS 2009–2010 study showing that children who were in early intervention were acquiring skills at a faster rate when they left the program than when

### Table 3. Group differences on Bayley Mental Developmental Index (18 to 36 months).

<table>
<thead>
<tr>
<th>Bayley Mental Developmental Index</th>
<th>Center-based Learning M(SD)</th>
<th>Home-based Learning M(SD)</th>
<th>( \chi^2 )</th>
<th>( P )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 months (( n = 62 ))</td>
<td>81.22 (23.45)</td>
<td>84.76 (23.88)</td>
<td>23.12</td>
<td>0.45</td>
</tr>
<tr>
<td>24 months (( n = 71 ))</td>
<td>80.07 (11.56)</td>
<td>83.00 (14.91)</td>
<td>26.03</td>
<td>0.46</td>
</tr>
<tr>
<td>36 months (( n = 85 ))</td>
<td>87.70 (9.92)</td>
<td>87.06 (11.44)</td>
<td>38.14</td>
<td>0.24</td>
</tr>
</tbody>
</table>
they began (Hebbeler, 2009). For this LRIP sample of middle schoolers, the center-based children saw greater gains in cognition than children in the lower dosage home-based modality. Unfortunately there was some data loss in this analysis since some of the data points were not completed for some of the children due to illness, and so on, where rescheduling was not feasible.

ESE was coded for analysis as follows: ESE was coded either Yes (1) or No (0). The Yes category combined the following ESE codes: Emotionally Handicapped, Specific Learning Disabled, and Developmentally Delayed. There were no children in this sample who were speech or language impaired. The other exceptionalities that were prevalent were medical in nature, such as hospital/homebound (n = 2), other health impaired (n = 3), and deaf or hard of hearing (n = 2). This was similar to the analysis conducted in Conyers and colleagues (2003), in that this study also combines ESE codes as prevalence or absence of that code for analysis. Descriptive and binary logistic regression analyses were used to address the research questions. Descriptive analysis provided a pattern of group differences and to determine if there was a need to adjust groups due to demographic or school differences. The descriptive analysis indicated the two groups were statistically equivalent and there was no need to control for any of the demographic or school variables (see Table 1).

Binary logistic regression was used to analyze the prevalence of ESE enrollment for the children in either center-based learning or home-based learning. Binary logistic regression predicts the outcome of a categorical dependent variable. Since in this study ESE had two categories (ESE or no ESE) and were coded as such, binary logistic regression was used to measure the relationship between the predictor variables (Tabachnick & Fidell, 2001). ESE, coded as 1 (yes) and 0 (no) was entered as the dependent variable and center learning (1) versus home learning (0) (GRP) and free or reduced lunch code (1) (SES) were entered as a categorical covariates.

A binary logistic regression analysis was conducted to predict ESE placement between children who were in the center-based modality and the home-based modality using group membership and SES as predictors. Following, chi-square was used to detect model significance and the Wald criterion was examined to determine the independent variable’s contribution to the model. Next,
the EXP (B) indicated the odds ratio or measure of effect size, indicating the ratio of relative importance of the independent variable on the dependent variable’s odds. R-square is not reported for these binary logistic regressions, since the dependent variable is dichotomous (2 group) and can be misinterpreted (Tabachnick & Fidell, 2001). Three models were conducted: Model 1 tested the first research question: center versus home learning to predict ESE. Model 2 tested the second research question: SES to predict ESE. Model 3 also tested the second research question: both learning group and SES to predict ESE. Table 5 illustrates the three models examined.

**Model 1: Predicted logit (ESE = 1) = α + β₁ x GRP**

A test of this model against a constant only model was significant, indicating the group predictor distinguished between assignment to ESE ($x^2 = 4.10, p < .05$ with df = 1). The Wald criterion demonstrated that GRP made a significant contribution to the prediction (Wald criterion 3.96, $p = 0.04$). EXP(B) value or odds ratio indicated that when group alone is added to the model the home-based learning participants are more than twice as likely to be in SES than center-based participants.

**Model 2: Predicted logit (ESE = 1) = α + β₁ x SES**

This model examines the predictive value of SES (free/reduced lunch) on ESE assignment. A test of the model against the constant was not significant ($x^2 = 1.95, p > 0.1$ with df = 1). The Wald criterion demonstrated that SES alone did not make a significant contribution to the prediction (Wald criterion = 2.12, $p = 0.145$). This indicated that SES alone is not predictive of special education placement for this population.

**Model 3: Predicted logit (ESE = 1) = α + β₁ x GRP + β₂ x SES**

A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between assignment to ESE ($x^2 = 9.38, p < 0.01$ with df = 2). The Wald criterion demonstrated that GRP made a significant contribution to prediction (Wald criterion = 5.41, $p < 0.03$) as did SES (Wald criterion 5.42, $p < 0.03$). EXP(B) value or odds ratio indicated that when group and SES are added to the model the home-based learning participants are between three and four times more likely to be receiving special education services.

In sum, children who were developmentally delayed and were assigned to the home-based modality had a significantly higher rate of ESE placement in middle school than children who were enrolled in the LRIP center-based modality. Also SES in combination with group had an impact on whether these children were placed in ESE. Although SES alone was not a predictor of ESE placement for this population, when SES was entered into the model with GRP, it was predictive of ESE placement. Of the three models run, Model 3 included the best predictors of ESE placement: group and socioeconomic status.

**Discussion**

The purpose of this study was to examine the effect of the LRIP on subsequent special education placement within a sample of children who were had gestational exposure to cocaine and developmental delays and graduated from the LRIP. Subsequently, they were followed up through the Miami
Dade Public Schools database at middle school. In response to the two research questions, this study makes several contributions to the literature on early childhood intervention impact especially with young children who are high-risk for academic failure. First, this study examined a subgroup of children who participated in either the center or home-based learning modalities of the LRIP. Exploratory analysis of this group found that the during their early intervention participation, the center-based children scored lower than the home-based children on the Bayley MDI at both 18 and 24 months of age, however by 36 months of age these children caught up and surpassed their peers on the home-based program. In examining the rates of middle school special education placement, children who were in the home-based modality were twice as likely to be enrolled in special education as children in the center-based modality (see Figure 3). One reason for these findings is that the high-dosage structure of the center-based modality had more impact on this population of children. Another reason is that although the initial design of the home-based modality allowed for the teacher to work with parent and child together in the home, the reality was that the caregiver change from visit to visit as well as the disorganized nature of the home environments in which they were working did not allow for consistent delivery of the curriculum. This, in turn, resulted in weaker long-term outcomes to be seen for this population. Second, this study examined other demographic variables to see what other predictors may have impacted rates of special education in middle school. This study found that children who resided in low income homes and enrolled in the home-based modality were three to four times more likely to be receiving special education services. Third, this study tracked children with gestational exposure to cocaine through the middle school years. Previous research (Bono, et al., 2005; Claussen et al., 2004) cited short-term outcomes for this population but long-term effects of any early intervention are few and none focus on this particular high-risk population. Results from this study indicate that early intervention for young children who were prenatally exposed to cocaine and had developmental delays can be successful in reducing later special education placement, which is particularly relevant considering the annually escalating cost of later special education services.

Importance of early intervention for young children at risk

Implementing an early intervention program for children younger than three years, when children are still receptive and forming their neural circuits, may positively impact their developmental trajectories and can potentially protect them from their environmental risk factors. It is during this time that the human brain has greater plasticity (Doyle, Harmon, Heckman, & Tremblay, 2009; Halfon, Shulman, &
Hochstein, 2001) and, more importantly, lack of proper stimulation during the zero to three age range can have long lasting negative effects on development (Kotulak, 1998). For this subsample of children, although there were no significant differences at any time-point, mean differences indicated a greater jump in cognition scores from 18 to 36 months for center-based children as illustrated in Figure 2. Also for this particular group, the center-based children were slightly more at-risk as revealed in poorer MDI scores upon enrollment than those in the home-based group and responded better to their full time center-based treatment. Lester and colleagues (2000) illustrated the importance of providing services as early as possible to prevent long-term negative outcomes for young children who are at-risk. The center-based group received 25 hours of intervention per week in a center setting while the home-based group received the same curriculum based intervention for three hours a week, one-on-one in the home (for more details see Claussen et al., 2004). These results indicate the importance of providing high-intensity early intervention versus a lower intensity program for children who are particularly at risk and may be one of the reasons for center-based children’s acceleration in developmental outcomes. The increases in mean cognition scores from 18 to 36 months indicate the upward trend for center-based children at the end of their early intervention program that may have reached well past their early intervention years. Later into middle school, children who were in the center-based learning program saw only 14% of their LRIP peers in special education, while home-based children saw 30% of their LRIP peers receiving services.

**Poverty and special education placement**

Several studies link the socioeconomic disadvantage to special education placement (Alvarez, 2011; Aragon, 2000; Brooks-Gunn, Berlin, & Fuligni, 2000; Conger et al., 1994; Hanson, McLanahan, & Thomson, 1997; Payne, 2005; Strand & Lindsay, 2009). Many of these studies describe the impact of poverty not only academically, but also physically, socially, and emotionally. In a dissertation by Alvarez (2011), special education placement was examined in Central Valley School District in California, finding that districts with high poverty rates often had high specific learning disability (SLD) placement rates. Interestingly, follow-up partial correlations found that SLD placement was complex and there were many variable that contribute to special education placement, not poverty alone (Alvarez, 2011). In contrast to this study of children with gestational cocaine exposure, although poverty alone did not predict special education placement, it did enhance the model with the group variable.

The Abecedarian Project, discussed previously, served children from low-income families and offered them full-time high-quality intervention in a childcare center and noted many positive long-term effects of the intervention compared to a control group (www.promisingpractices.net) including lower placement in special education. A follow-up study 30 years later (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2012) found that individuals who were in the treatment group had more years of education, although there were mixed effects for economic benefits (Campbell et al., 2012).

Research has revealed that indeed poverty matters; and in some of these studies the most significant predictor of special education placement is poverty (Goldberg, McLaughlin, Grossi, Tytun, & Blum, 1992; Hebbeler et al., 2007). An examination from the National Early Intervention Longitudinal Study (NEILS) indicated that children who have low SES are more likely to make slower developmental progress (Hebbeler et al., 2007). Also, according to NEILS 2007, children in poverty were less likely to receive early intervention ESE services for speech or language delays, were more often premature at birth, and were more likely to be in poor health. The NEILS study also questioned the impact of a low dosage home visitation model specifically for low-income families, in that the design of the model (typically one hour per week in the home) may not be an effective model given the high needs of the population. Ultimately, the NEILS 2007 study found that considering the combination of disability and poverty, odds for positive later outcomes were low for these high-risk children.
Many early intervention programs targeting low SES families and families at-risk are designed to reduce the impact of poverty on child development, thus reducing the number of at-risk children in special education (Campbell et al., 2002; Hebbeler, Spiker, Bailey, & Scarborough, et al., 2007). In these studies, the outcomes for children in low SES families who received more intensive early intervention starting as infants have been shown to have higher scores on mental, reading, and math tests than children who do not receive intervention (Campbell et al., 2002). Even more striking, many of these effects persist at least until age 21 (Campbell et al., 2002).

**Tracking children with gestational cocaine exposure through the middle school years**

Previous literature describing the long-term benefits of early childhood programs on children’s school success have shown reductions of special education placement (Barnett, 1995, 1998; Campbell & Ramey, 1995; Condry, 1983; Schweinhart et al., 1993); however in some of these cases the differences were not statistically significant. This smaller scale LRIP study did find statistically significant difference in ESE prevalence in middle school for this specific population of children who received center-based instruction. Also, the data loss for the children examined in this study was only 16%. Tracking this high-risk population long term can be exceptionally challenging due to their home instability and the transient nature of their home environments.

**Implications for policy and practice**

This study is particularly important in that it gives policymakers a glimpse into a subset of young children who are at high-risk for poor academic outcomes. Considering the rising cost of special education services, combined with the growth in special education enrollment, it is worthwhile to examine further early intervention models that have an impact on reducing special education placement in middle school. According to the National Center for Education Statistics (2011), special education spending has increased at a faster rate than general education spending, and rising enrollment, rather than rising per pupil cost, has driven special education spending upward. Quite often, early interventions that are geared to prevent disadvantaged children from entering special education have been proven to be more cost effective than remediation later down the road (Carneiro & Heckman, 2003).

In an era of cost-cutting, sequesters, and deficits, determining the long-term benefit of any program is crucial in determining its future viability. Early education programs, now more than ever, are expected to be cost-effective as well as outcome driven. Determining cost-effectiveness, however, is not easy, especially when the effectiveness may not be seen for years to come. Researchers are now examining early intervention as a public investment or even an economic development strategy (Clothier & Poppe, 2013). A paper published by the Minneapolis Federal Reserve Bank (Rolnick & Grunewald, 2003) examined early education investment and any other state investment and found specifically, that model programs could yield more than $8.00 for every $1.00 that is invested (Rolnick & Grunewald, 2003).

A recently released Society for Research in Child Development (SRCD) research policy brief titled *Investing in Our Future: The Evidence Base on Preschool Education* (Yoshikawa et al., 2013) summarizes recent research on preschool education and emphasizes that the benefit of quality preschool programs outweigh any cost. The brief indicated that a benefit may be both cost savings in the form of reduced needs for special education and grade retention or cost savings in the form of lower instances of later welfare and criminal activity (Yoshikawa et al., 2013). These benefits are accrued, not only for the individual but for society at large. Overall this brief found that the benefits of quality early learning programs are both educationally cost effective but also a positive investment for society overall.
Limitations

There are several limitations for this study. First, the sample is relatively small and examines a very homogenous group: babies and toddlers who are developmentally delayed and were prenatally exposed to cocaine. Generalizations of early intervention can only be made for this at-risk population; however, considering ongoing community efforts to provide early intervention services for at-risk families, this data builds an even stronger argument for providing these services earlier rather than waiting to provide ESE services later. Second, we lacked home data (caregiver changes, current caregiver demographics) on the children once they entered middle school. It would be interesting to examine the impact of home/caregiver stability on ESE placement, especially considering the population of these children. It is expected that this group of children had experienced varying levels of home instability that may mediate or moderate their school outcomes; however, this current study did not have any mechanism for measuring home stability over time for this group. Tracking children who are at-risk for poor academic outcomes in order to measure impacts of early intervention is crucial in determining how best to allocate funds appropriately. However, the resources to conduct this type of research and analysis are often not available. Manpower is needed in order to conduct proper follow-up, by maintaining a relationship with the families and keeping records of phone and address changes. This study was relatively successful in locating all but 16% of the children being tracked, although there are gaps in the data, which could not be connected. Third, this study did not have individual academic grades for the children. A clearer picture of the child outcomes, their academic grades, including their conduct grades, would be useful in understanding the full academic record. Fourth, this study did not have access to the date of their enrollment in ESE post LRIP completion. This information would be useful in calculating a cost-benefit analysis for the early intervention program, and enable an analysis of the number of years receiving ESE services.

Suggestions for further research

Further study with this population should first seek to follow this sample of students through high school. Second, it would be worthwhile to examine individual class grades for these children. Finally, obtaining a matched control group of children enrolled in their current school would be optimal in examining the long-term effects of the program, as this study only looks at the effects of the center-based modality versus the home-based modality.

References


