Family Influences on Adaptive Development in Young Children with Down Syndrome

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In this study we investigated the extent to which the family environment predicted differences in trajectories of adaptive development in young children with Down syndrome. The sample was comprised of 54 children with Down syndrome and their families who were studied from infancy through the age of 5 years as part of a longitudinal study of children with disabilities. Hierarchical linear modeling (HLM) was used to estimate the parameters of hierarchical growth models in domains of adaptive development. Results indicated that growth in communication, daily living skills, and socialization domains were predicted by measures of the family environment (i.e., family cohesion and mother-child interaction) above and beyond that predicted by maternal education. Further, Bayley MDI measures during infancy did not predict changes in adaptive development in any of the domains. The results are discussed in terms of implications for service provision and for expanding theoretical frameworks to include the development of children with disabilities.

INTRODUCTION

The study of the development of children with disabilities has been based largely on either medical models focused on clinical findings or on mechanistic models of learning. Studies on the emerging competencies of children with biologically based impairment have only rarely and inconsistently been informed by theoretical advances in the field of child development. Yet, by applying these evolving conceptual frameworks to children with atypical developmental patterns, our understanding of the full range of human adaptation will be broadened.

Children with Down syndrome are the most extensively studied subgroup of those with cognitive disabilities. Several longitudinal investigations have been conducted to document their development. These studies, which have focused most often on describing the emergence of cognitive skills, have yielded consistent patterns of findings. In an extensive longitudinal study, Carr (1995) investigated 44 English children with Down syndrome from 6 months of age to adulthood. She documented a general decline in standard cognitive scores, followed by a slight increase during the late adolescent period. In a study of children with Down syndrome in the United States, Reed, Pueschel, Schnell, and Cronk (1984) reported a lag in cognitive development over the first 3 years of life. Other researchers have noted a similar pattern (Connolly, Morgan, Russell, & Richardson, 1980; Gibson, 1978; Morgan, 1979; Nadel, 1988; Sharav, Collins, & Shlomo, 1985), which indicates that by early childhood most children with Down syndrome have standard cognitive performance scores at least two standard deviations below the normative mean. These findings do not imply a plateau in the development of cognitive skills, but rather that cognitive skills increase at a slower rate of acceleration than found in typically developing children.

Investigations of the emergence of other skills in specific domains of development also have yielded some consistent patterns. For example, children with Down syndrome appear to demonstrate particular weaknesses in communication, especially with respect to expressive (i.e., spoken) language (Chapman, Schwart, & Bird, 1991; Dykens, Hodapp, & Evans, 1994; Smith & von Tetzchner, 1986; Stoel-Gammon, 1990). In contrast, impairments are relatively less pronounced in social development and in the mastery of adaptive skills associated with the tasks of daily living (Cornwell & Birch, 1969; Tingey, Mortensen, Matheson, & Doret, 1991); but growth in these domains still progresses at a slower rate in comparison to that of typically developing children.

Most longitudinal studies of the development of children with Down syndrome have been primarily descriptive in nature and have served an important function, mainly to document children’s development. The work of Cicchetti and his colleagues (e.g., Cicchetti & Beeghly, 1990; Cicchetti & Ganiban, 1990; Cicchetti & Pogge-Hesse, 1982) builds on these descriptive studies but provides a theoretically based investigation of principles of development. Working within a developmental-organismic framework, they investigated the extent to which the development of
children with Down syndrome is similar structurally to that of other children. They found that development progresses through an orderly hierarchy of stages, with predictable points of stage consolidation and transition. For example, using a range of indicators, including children’s affective development and growth in symbolic play skills, Cicchetti and Beeghly (1990) describe the way in which the behavior of young children with Down syndrome is organized and integrated hierarchically. These findings support the hypothesis that organismic principles of development apply to children with Down syndrome as they do to all children. This proposition has implications for parents and practitioners who seek to influence the emerging capabilities of children with special needs as well as for scholars concerned with furthering developmental theory.

Beyond the intrachild focus of most organismic models, contemporary frameworks for studying child development increasingly emphasize the importance of transacting biological, social, and psychological factors (Sameroff & Fiese, 1990), the various systems in which children develop, including the family, school, and community (Bronfenbrenner, 1986), and bidirectional transactions within and across contexts over time (Lerner, 1991, 1998). Central to all of these current perspectives is the recognition of the family as the critical context of development for the young child.

Recently, in reviewing investigations of interventions for young children at risk for developmental problems, Guralnick (1998) proposed a model that identifies key predictors of children’s cognitive development based primarily on family factors. Specifically, he delineates two separate dimensions of families that have effects on children’s developmental trajectories: (1) family characteristics, including sociodemographic features; and (2) patterns of interactions within families. Whereas he posits an array of family patterns that are associated with children’s development, he stresses the important predictive power of the relational aspects of the family environment. Relationships within families include both connectedness of family members to each other and dyadic interactional systems (Krauss & Jacobs, 1990).

Many studies of typically developing children focus on the importance of relational aspects of families in promoting children’s functioning (Minuchin, 1988), but comparable investigations of children with disabilities have been more limited. In the bulk of published studies, researchers have concentrated largely on the relation between children’s development and family demographic characteristics, such as socioeconomic status (SES), parent education levels, or measures of parent intelligence. The findings from these studies have revealed a mixed pattern. Some report a significant positive relation between family demographic factors and the intelligence of their offspring with Down syndrome (Fraser & Sadovnik, 1976; Golden & Pashayan, 1976; Sharav et al., 1985; Turner, Sloper, Knussen, & Cunningham, 1991), whereas others fail to find evidence of such a relation (Bennett, Sells, & Brand, 1979; Carr, 1995; Irwin, 1989).

A growing base of studies of children with disabilities is emerging that extends developmental findings beyond their association with sociodemographic features of families to relational features of the family system. Although few in number, investigations of the relation between family cohesiveness, or connectedness, and the development of children with disabilities suggest that this aspect of family functioning has important predictive value. In a study of 115 families of children with mental retardation during middle childhood, Mink, Nihira, and Meyers (1983) found that cohesive, harmonious families had children with more positive socioemotional functioning. Mink and Nihira (1986) further found that family cohesion influenced the psychological adjustment of slow-learning adolescents. Warfield (1995) investigated a subsample of 85 children with developmental disabilities participating in the Early Intervention Collaborative Study (EICS; Shonkoff, Hauser-Cram, Krauss, & Upshur, 1992) and reported that greater family cohesiveness measured at the age of 3 years predicted fewer children’s behavior problems at the age of 5 years. In other investigations of the children with Down syndrome within the EICS sample, higher levels of family cohesiveness predicted greater motivation on mastery tasks during the preschool years (Hauser-Cram, 1993) and more positive peer interactions in the preschool classroom (Hauser-Cram, Warfield, Bronson, Krauss, Shonkoff, & Upshur, 1997).

Dyadic relationships within families, especially mother-child interactive behaviors, have been more extensively studied than other aspects of the family environment. The link between contingent and responsive mother-child interaction and strong performance on child skills is well documented for young children with and without disabilities (Barnard & Kelly, 1990). Research on mother-child dyads in samples of children with Down syndrome indicates that such children may be less responsive social partners for their parents, especially in early infancy, as they tend to initiate less interaction and produce fewer discernable social cues (Spiker & Hopmann, 1997). Nevertheless, positive interactions between mothers and infants (both typically developing and those with disabilities) are associated with better subsequent cognitive and communicative skills (Barnard, 1997).
Thus, although family environments can be conceptualized in many ways, the pattern of results from prior investigations suggests that the relational aspects of such microsystems—especially family cohesion and dyadic interaction—may be particularly potent in predicting the development of children with disabilities. Although these predictions have emerged from more than a single study or an isolated sample, they have been limited to the prediction of status (i.e., development at one point in time) rather than of growth (i.e., development across multiple points in time). Furthermore, most prior investigations have considered one, but not both, aspects of the family relational environment. Therefore, this investigation is unique in its focus on the extent to which the family environment, which incorporates measures of both maternal dyadic interaction and family cohesion, predicts growth over the early childhood period in children with Down syndrome.

This study also differs from prior studies on the development of children with disabilities in another way. Other contemporaneous longitudinal studies of children with special needs have provided valuable information on stability and change in children’s cognitive skills (e.g., Dunst & Trivette, 1994; Keogh, Bernheimer, & Guthrie, 1997). In contrast, we have chosen to investigate indicators of adaptive behavior because of their importance for everyday functioning in community settings and because of their value in predicting later functioning for individuals with disabilities (Harrison, 1987). In addition, mental retardation is not defined solely on the basis of cognitive performance, but includes an assessment of adaptive behavior (American Association on Mental Retardation, 1992). Although often correlated with cognitive performance, adaptive behavior focuses on typical functioning rather than on maximum performance, thereby making it a more practical and meaningful outcome to parents and service providers (Meyers, Nihira, & Zetlin, 1979). Furthermore, although definitions of adaptive behavior differ, they possess common elements, include skills that reflect age-appropriate expectations, are defined by the social context, focus on independent functioning, and involve social and communication domains (Witt & Martens, 1984). Finally, because adaptive behavior assumes modifiability rather than stability (Harrison, 1987), it is an area of development where contextual influences may be particularly important.

Research Hypothesis

This investigation was conducted to test the hypothesis that the family relational environment predicts the development of adaptive functioning over the first 5 years of life in children with Down syndrome. Specifically, we hypothesized that family relations, defined as cohesiveness of the family and mother-child interaction, predict positive growth in children’s adaptive functioning above and beyond infant psychomotor functioning and maternal education level. Understanding the predictive power of features of families during early infancy, when children with Down syndrome typically enter early intervention programs, is valuable to service providers and program planners who target services to those who most need them. Such understanding also can assist and empower parents as active agents in promoting their child’s optimal development.

METHOD

Sample

The sample analyzed for this study includes children with Down syndrome who participated in the Early Intervention Collaborative Study (EICS), a longitudinal investigation of the predictors of resilience and vulnerability in the emerging competencies of young children with disabilities and the adaptive capacities of their families (Shonkoff et al., 1992). The study sample was recruited from 29 community-based early intervention programs in Massachusetts and New Hampshire between 1985 and 1987.

A total of 54 children with Down syndrome entered the study at the time of their enrollment in early intervention. This sample represented 79.4% of eligible children (i.e., all infants with Down syndrome who entered the 29 state-supported early intervention programs during the time of sample enrollment); sample children and families did not differ statistically from nonparticipants on child gender, race, or age at study entry, maternal education, marital status, employment status, or family income. Project physicians conducted an independent review of medical records to confirm that each child had a diagnosis of Down syndrome.

Table 1 presents the sociodemographic characteristics of the sample. On average, the children were 3.4 months of age ($SD = 2.0$) when they entered the study. Their mean Mental Developmental Index (MDI; Bayley, 1969) at study entry was 70.7 ($SD = 14.3$), and their mental age was 2.0 months ($SD = 1.6$). The vast majority of the sample was White, and one half was female.

The mothers, on average, had 14.1 years of education. Most were married, two fifths worked outside the home, and slightly more than one half of the sam-
Measures

Adaptive functioning. Repeated assessments of adaptive functioning measured at four time points were the outcome of interest in this investigation. The interview form of the Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984) was used to assess child functioning in four domains: communication, daily living, motor, and social. The Vineland is a 577-item questionnaire measuring individual personal and social competence from birth through adulthood. Data on this questionnaire were gathered through a semistructured interview that was conducted with the mother during each of four home visits so that growth in the four domains could be charted over time.

The interviewer asked the mother to identify the skills her child demonstrated on a regular basis. For example, communication skills included smiling and use of 50 words or more; daily living skills included eating solid food and being toilet trained at night; social skills included showing interest in others and having a preferred friend; and motor skills included sitting supported for 1 minute and climbing on low play equipment.

Growth modeling requires that scores have three characteristics: (1) they are interval, (2) they show metric invariance over time, and (3) they are not standardized. To conform to these requirements and to maximize interpretability of the results, we used subscale scores that were converted to age equivalents. The Cronbach’s α reliability coefficients for each of the four data collection points in order were .74, .80, .89, and .94 for communication; .73, .72, .77, and .92 for daily living; .80, .79, .78, and .87 for motor; and .81, .74, .75, and .91 for social.

Independent variables were measured at study entry and included the following:

Psychomotor development. The Bayley Scales of Infant Development (Bayley, 1969) was used to assess psychomotor development. This well-known instrument has 163 items and assesses object relations, perceptual-motor skills, memory, learning, problem-solving, and early communication through a series of tasks presented to the child by an examiner. A raw score is calculated based on the number of items passed in the domains described above. The raw score can be converted to a standard score, the Mental Development Index (MDI). In this sample, the MDI during infancy and toddlerhood, the two time points in which this measure was used, was moderately stable, \( r(53) = .54, p < .001 \).

Mother’s education. Mothers reported the number of years of education they had completed on a demographic information form.

The Nursing Child Assessment Teaching Scale (NCATS). This widely used measure is an observational tool designed to assess a teaching interaction between a mother and her child (Barnard, 1978). The mother is asked to teach her child a task, such as reaching for a ring or building a tower out of blocks, that is just beyond his/her ability level as determined by the child’s performance on the Bayley Scales. The scale consists of 73 binary items that produce two summary scores; one score for the mother’s interaction with her child and one score for the child’s interaction with his/her mother. Building on the results of prior studies that emphasize the importance of maternal contingent interaction (Barnard & Kelly, 1990), we selected the score for the mother’s interaction with her child for use in this analysis. This score is computed by summing the scores from the 50 items that comprise four subscales: sensitivity to cues, response to distress, social-emotional growth fostering, and cognitive growth fostering. The NCATS assessment conducted during the first home visit (i.e., Time 1, T1) was used in the analysis. At T1, the mean score was 37.3 (SD = 5.8) and the scores ranged from 23 to 48. Higher scores indicate better mother-child interaction. The Cronbach’s α reliability coefficient was .79.

| Table 1 Demographic and Socioeconomic Characteristics of the Samplea |
|----------------|---|---|---|---|
| Characteristics | n  | %  | M  | SD | Range |
| Child           |    |    |    |    |      |
| Age at T1 (months) | 3.4 | 2.0 | 1.3–10.8 |
| Mental age (months) | 2.0 | 1.6 | 1.0–7.0 |
| Bayley MDI score | 70.7 | 14.3 | 43.0–100.0 |
| Racial/ethnic origin |    |    |    |    |      |
| European American | 47  | 87.0 |
| African American  | 1   | 1.9 |
| Hispanic American | 3   | 5.6 |
| Other            | 3   | 5.6 |
| Mother           |    |    |    |    |      |
| Years of education | 14.1 | 2.4 | 8.0–21.0 |
| Married         | 48  | 88.9 |
| Employedb       | 21  | 39.6 |
| Family          |    |    |    |    |      |
| Income at study entryc |    |    |    |    |      |
| Less than $20K | 15  | 28.8 |
| $20K–$30K      | 14  | 26.9 |
| Greater than $30K | 23  | 44.2 |

a N = 54.
bThe percentage is based on a sample size of 53, due to missing data.
cThe percentage is based on a sample size of 52, due to missing data.

people had an annual family income of less than $30,000 at study entry.
The Family Adaptability and Cohesion Evaluation Scale (FACES II). This measure is a 30-item self-administered questionnaire that assesses two aspects of family functioning: emotional cohesion (16 items) and adaptability (14 items) within the family (Olson, Bell, & Portner, 1982). The measure of emotional cohesion was used in the present analysis. Each item describes how a family may function (e.g., family members are supportive of each other; the family does things together) and respondents rate how often this description applies to their family on a scale from 1 (never) to 5 (always). The cohesion score is calculated using the formula developed by Olson et al. (1982). Mothers completed the questionnaire following the T1 home visit. At T1, the mean score was 67.6 (SD = 7.8) and the scores ranged from 44 to 80. Higher scores indicate more family cohesion. The Cronbach’s α reliability coefficient for the cohesion subscale was .87.

Procedure

Data were gathered during home visits conducted at four points in time: Time 1 (T1), at entry into the study that occurred within 4 to 6 weeks of the child’s enrollment in an early intervention program (M = 3.4 months, SD = 2.0); Time 2 (T2), after 1 year in the early intervention program (M = 15.5 months, SD = 2.0); Time 3 (T3), within 4 weeks of the child’s third birthday (M = 36.6 months, SD = 1.0); and Time 4 (T4), within 4 weeks of the child’s fifth birthday (M = 60.7 months, SD = 1.5). Each home visit was conducted by two research field staff who were not familiar with the study’s hypotheses. Field staff were trained to the levels of reliability required by each measure, and were checked for reliability throughout the study.

One staff member interviewed the mother, while the other staff person conducted the child assessments followed by the interactional teaching measure. Finally, a packet of self-report questionnaires, which included the FACES II, was left for the mother to complete after the visit and mail back to the project office.

Data Analysis

The analytic strategy employed for this investigation used individual growth curve analysis to model intra-individual change over time in the four domains of adaptive functioning and to detect the predictors of interindividual variation in growth in adaptive functioning (Rogosa & Willett, 1985; Willett, 1988). We used the hierarchical linear modeling (HLM) program of Bryk, Raudenbush, and Congdon (1994) to estimate the parameters of the hierarchical growth model. The Level-1 model estimated a growth trajectory in each domain of adaptive behavior for each individual in the sample based on the repeated measurements. Thus, for each domain of adaptive behavior, each individual’s trajectory was summarized by a set of growth parameters. The values (e.g., an intercept and a slope that represents change over time) of these parameters vary across individuals and can be used as outcomes in Level-2 analyses (see Appendix). Variation in growth can be predicted from a prescribed set of specific person-level variables. To test our central hypothesis, the model included three person-level predictors: the Bayley MDI, mother’s education, and family environment. The family environment variable was a composite score created by standardizing the mother-child interaction and family cohesion measures using a z-score transformation. The composite measure was the sum of the two z-score variables. Preliminary models that included both mother-child interaction and family cohesion indicated that these variables were correlated, r(53) = .57, p < .001.

RESULTS

Table 2 presents the percent of variance explained by each model and the parameter estimates and associated p values for the three predictors. Four findings

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Rate of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Communication</td>
</tr>
<tr>
<td>Bayley MDI</td>
<td>.001 (.001)</td>
</tr>
<tr>
<td>Mother’s education (years)</td>
<td>.014 (.009)</td>
</tr>
<tr>
<td>Family environment composite</td>
<td>.032* (.013)</td>
</tr>
<tr>
<td>Percent explained</td>
<td>14.3</td>
</tr>
</tbody>
</table>

Note: Numbers are b coefficients. Standard errors are in parentheses. 
* p < .05.
are notable. First, none of the variables tested was a significant predictor of growth in motor skills. Second, the MDI measured during infancy was not a significant predictor of growth in any of the domains of adaptive functioning. Third, mother’s education was a significant predictor of growth in social skills only. On average, higher maternal education was associated with greater growth in this area. Finally, and most important, the family environment composite measure was a significant predictor of growth, over and above the Bayley MDI and mother’s education level, in three domains: communication, daily living, and social skills. The model explained the greatest percent of variation in the growth in social skills (23.3%), and a lower percent of variance in the growth in communication (14.3%) and daily living skills (6.8%).

In order to depict the influence of the family context on growth rates over time, the results are presented as a series of graphic displays that summarize the fitted relations between growth and the predictors of interest. Thus, Figure 1 presents the growth curves of “prototypical” children (i.e., children who have specific values for the predictor variables and are chosen to serve as exemplars of the range of effects). By using the estimates from the models presented in Table 2, predicted values at each time point can be calculated for an individual child with any combination of values on the Level-2 variables.

We present the growth curves of “prototypical” children who have the same Bayley MDI and whose mothers had the same level of education but whose families differed in their scores on the family environment composite. In Figure 1A, we present the communication trajectories of two prototypical children. The children each had a Bayley MDI score of 70.74 and the mothers of both children had 14.1 years of education. These values were chosen because they are the mean values for each variable. The family environment composite score for Child A was selected to be 1.774 (i.e., one standard deviation above the sample mean score), and the score for Child B was selected to be −1.774 (i.e., one standard deviation below the sample mean score). Therefore, the gap between the two trajectories in Figure 1A represents the effect size, or the magnitude of the effect of the family context composite variable on growth in communication skills. Note that there is no significant difference in where the trajectories begin, illustrating that the children do not differ in communication at entry into the study (at 3.4 months of age). There are, however, important differences in the rate at which the children progress. Child A (in a positive family context) progresses at a faster rate than Child B (in a less desirable family context) so that at the age of 5 they are separated by a gap of 6.2 points. Because the out-

![Figure 1](image-url)  
**Figure 1** Growth trajectories in communication, daily living, and social skills for two prototypical children, one with a high composite and the other with a low composite measure of family environment.
comes are age equivalence scores measured in months, this translates into a difference of 6.2 months. Similarly, the daily living score and the social skills score for Child A at age 5 are 4.8 and 5.5 months higher respectively than the scores for Child B (see Figures 1B and 1C).

DISCUSSION

The analyses in this study were based on ecological and contextual theories of development which highlight the importance of the family environment in supporting the emergence of children’s skills. More specifically, the analyses were driven by a conceptual framework that positions the relational aspects of the family environment as central to children’s developmental trajectories. Three key findings from this investigation have important implications for both practice and theory. First, the lack of predictive power of the Bayley MDI indicates that such assessments of infant psychomotor skills are poor prognosticators of development in adaptive domains, at least for children with Down syndrome. The modest correlation of infant psychomotor assessments with later cognitive performance has been demonstrated frequently (Cicchetti & Wagner, 1990; McCall, 1979). Our results suggest that although data from other studies indicate that cognitive and adaptive behavior appear to be correlated during later phases of the life cycle (Carr, 1988), they may have different trajectories and predictors of growth during the early childhood period.

Second, although motor skills were similar to other domains of adaptive behavior in their lack of relation to infants’ MDI scores, they differed significantly in their lack of relation to other measures of the family environment. Of the four areas of adaptive behavior investigated, motor development was the only domain that was found to be impervious to measured environmental effects. This lack of sensitivity to contextual differences indicates that the motor domain, more than other dimensions of adaptive behavior, appears to be less influenced by variations in the psychosocial aspects of family experiences.

Third, the results of this investigation highlight the power of family factors in predicting growth in communication, social, and daily living skills for children with Down syndrome. The general relation between sociodemographic factors, such as maternal education, and children’s development has been well documented (Duncan, Brooks-Gunn, & Klebanov, 1994). This study builds on the results cited by prior researchers who reported a relation between maternal education and cognitive performance in children with Down syndrome (e.g., Golden & Pashayan, 1976), by extending that relation to growth in domains of adaptive behavior as well. Specifically, our findings demonstrate a significant correlation between mother’s education and growth in social skills.

More important, our data indicate that measures of family processes appear to have important predictive power for the development of children with Down syndrome above and beyond that of maternal education. Specifically, early relational aspects of the family environment appear to be important predictors of children’s growth in communication, social skills, and skills of daily living. Families in which members feel more connected to each other, and in which mothers engage in emotionally supportive, contingently responsive and cognitive growth-promoting interactions with their child with Down syndrome, have children who, over time, demonstrate significant benefits in communicating and socializing with others and in their ability to engage in independent self-care tasks. These findings clearly demonstrate the importance of the family context in promoting development for children with biologically-based disabilities.

We recognize the need for caution in evaluating these findings. First, the sample lacks representation of diverse groups. The families in the study were quite stable in terms of their configuration and economic well-being, and they varied little in ethnic background. In additional analyses, we found evidence of stability in measures of the family environment during early childhood (Warfield, Krauss, Hauser-Cram, Uphur, & Shonkoff, 1999). Therefore, the extent to which the findings of this investigation relate to families with more diverse characteristics or more fluctuating home environments requires further inquiry.

The lack of cultural diversity in this sample is an important limitation on the findings. Views of the meaning of disability to a family (Hanson, 1992; Weisner, Beizer, & Stolze, 1991) and of ways in which parents interact with their children vary for different cultural groups (Garcia Coll, 1990; Laosa, 1980). Thus, although the importance of family context in predicting development is a valuable principle to test, the specific relations found in this investigation may not be replicated in cultural groups where the meaning of disability, of family cohesion, and of traditions of maternal interaction differ from those in a European American sample.

Furthermore, not only do children affect their family, but their family also affects them. Thus, the transactional nature of those relations over time requires further elaboration. Hodapp (1997) postulates that, because children evoke different responses from their caregivers, the “evocative environment” may be important to understand in investigations of families of children with Down syndrome. In a study of children with a variety of developmental delays and disabili-
ties, Gallimore, Weisner, Bernheimer, Guthrie, and Nihira (1993) described how parents made accommodations to the daily routines of family life based on their children's needs. Thus, the web of relations among children's needs and the attention and accommodations they evoke from their caregivers is complex and warrants thoughtful investigation and measurement.

Additionally, we note that children and families in this study were enrolled in early intervention programs. Our data do not include measures of the quality of these programs, and it is possible that program quality affects both family functioning and child outcomes. We do know, however, that programs provided the range of services typical of early intervention programs throughout the country (Shonkoff et al., 1992).

Finally, the measures used in this investigation were not all based on independent reports. Although the measures of mother-child interaction and child psychomotor performance were collected by trained observers or examiners, the measures of adaptive functioning and family cohesion were based on maternal report. The measures utilizing maternal report were collected in different ways (i.e., by interview and by questionnaire), but as both are based on maternal perception, they have shared variance.

Despite these caveats regarding overgeneralization of our findings, our analyses point to the value of considering the family context in attempting to understand variability in the development of children with disabilities. Although the characteristic features of Down syndrome are biologically based, the data from this investigation demonstrate the importance of the family environment, especially relational processes, in explaining individual differences in crucial areas of adaptive development. The findings from this study have direct implications for policymaking and individual service delivery in a wide range of early intervention and other early childhood programs. Of greatest importance, these data underscore the limitations of focusing solely on the child's needs, and highlight the importance of enhancing dyadic interaction patterns and family cohesiveness as a potent mechanism to promote children's development. Families who enter early intervention programs with low levels of internal cohesion and mothers who exhibit less responsive and less contingent interactive relationships with their infants may have greater and/or different service needs than other families. Perhaps more important, basing decisions about service delivery primarily on children's medical diagnosis, levels of cognitive impairment, or demographic variables, like mother's education level, may result in the provision of inadequate or even misplaced support, and thereby fail to promote the full range of competencies of children with special needs.

The findings presented here also have implications for child development theory, as they suggest that children with Down syndrome, like other children, are affected by family relationships. Thus, contextually based ecological models, although constructed primarily with a view toward typical development, have considerable untapped salience for understanding and predicting the functioning of children with biologically based impairments. Studies of children with disabilities can add much to our understanding of the extent of variability in individual adaptation, the range of families in which child development unfolds, and the relations between the two. To this end, the construction of more sophisticated models of human development will be advanced considerably by the inclusion of what we are able to learn about the emerging abilities of children with developmental disabilities.

ACKNOWLEDGMENTS

The Early Intervention Collaborative Study has been supported by grants MCJ-250533 and MCJ-250583 from the Maternal and Child Health Bureau (Title V Social Security Act), Health Resources and Services Administration, U.S. Department of Health and Human Services, and by grants from the Jessie B. Cox Charitable Trust, the Foundation for Child Development, the John D. and Catherine T. MacArthur Foundation, and from the Massachusetts Department of Education, Bureau of Early Childhood Programs.

We are most grateful to the children and families who have participated in this project for many years. We also thank those who participated in data collection, especially Ann Steele, the project manager, for her dedication to the project and thoughtful comments on this manuscript. We appreciate the careful assistance in the preparation of this manuscript provided by Jean McCoy. Finally, we acknowledge the contributions of Richard M. Lerner and Larry H. Ludlow to the concepts and analyses presented here.

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APPENDIX

Hierarchical Linear Model (HLM) used to Identify Predictors of Adaptive Functioning in Children with Down Syndrome

After examining plots of repeated adaptive functioning scores in each of the four domains versus time for each sample member, a linear growth model was developed and used at Level 1:

$$\text{ADAPT}_{pt} = \Pi_{0p} + \Pi_{1p}(\text{AGE}_{pt} - 3.4) + \Sigma_{pt}$$

where $p = 1, \ldots, 54$ subjects and $t = \text{age at each measurement}$. In this model, age has been rescaled by subtracting the mean age at which children in the sample entered this study from each child's actual chronological age of entry. The choice of centering facilitates interpretation of the model intercept ($\Pi_{0p}$), which represents the value of adaptive functioning at the sample mean age of entry into the study for child $p$. The model slope ($\Pi_{1p}$) describes the monthly growth rate in adaptive functioning or the constant rate of change in adaptive functioning per month for child $p$.

The Level-2 model can be represented as:

$$\Pi_{0p} = \gamma_{00} + \gamma_{01}X_{p} + \ldots + \gamma_{0k}X_{k}$$

$$\Pi_{1p} = \gamma_{10} + \gamma_{11}X_{p} + \ldots + \gamma_{1k}X_{k} + u_{1p}$$

where $k = \text{the number of predictors in the model.}$ The Level-2 variance of the model intercept term was constrained to zero because children in the sample did not vary significantly in adaptive functioning skills upon entry into the study.

REFERENCES


