

REVIEW**Early Intervention for Children with Intellectual Disabilities: An Update**

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This article provides an update on advances in both developmental and intervention science that have occurred in the field of early intervention for children with developmental delays in the past decade. From the perspective of developmental science, findings related to multiple and reciprocal pathways of influence on the development of children with delays that can inform early intervention practice are discussed. This is followed by a review of two prominent lines of early intervention research: promoting children's development by enhancing parent-sensitive responsiveness and

improving children's cognitive and social outcomes in inclusive preschool settings. Merging policy initiatives with our knowledge of developmental processes is discussed as the key to accelerating progress in the development of comprehensive early intervention systems.

Keywords: children with delays, developmental framework, early intervention, policy initiatives

Introduction

The provision of comprehensive early intervention services and supports for children with established developmental delays continues to be a high priority in the United States and in virtually all other high resource countries throughout the world. Moreover, despite the unique challenges posed by lower- and middle-resource countries, the potential contributions of early intervention to children's development and to family well-being for vulnerable children in general are well-recognized by the international community (World Health Organization & UNICEF, 2012). Surveys of parents have indicated that, in general, high levels of support exist in various countries for early intervention services (Lanners & Mombaerts 2000; Peterander 2000; Bailey *et al.* 2005). Despite variability related to ethnic minority and socio-economic status, parental income, duration of involvement in early intervention, specific child disabilities and other factors (Raspa *et al.* 2010), perceived parental benefits of participation in early intervention are considerable including assisting in

their child's development, working with professionals and advocating for their child. This latter study also noted that there appears to be greater optimism about the future as well as increased parental confidence in their ability to carry out their roles and responsibilities with respect to their child with a developmental delay.

These encouraging reports by parents are consistent with the long-established intervention science indicating that comprehensive early intervention programmes can, at minimum, help prevent the substantial decline in intellectual development that generally occurs across the early childhood period for children with developmental delays (Guralnick 2005). Moreover, both developmental and intervention science have suggested that benefits to children's social and cognitive competence are the direct result of enhancing developmental influences on children's outcomes related to various components associated with parent-child transactions (e.g. socioemotional connectedness), family-orchestrated child experiences (e.g. community participation; inclusive preschool) and children's health and safety (e.g.

preventive health) (Guralnick 2011). Collectively referred to as family patterns of interaction, these three major areas of influence on child competencies are also influenced by a family's resources including the personal characteristics of the parents (e.g. coping style, mental and physical health) and material resources (e.g. financial resources, social support). Consequently within this framework, comprehensive early intervention requires attention to all components at the level of family patterns of interaction as well as influences on these family patterns from the level of family resources. These components at both levels constitute well-established developmental pathways directly and indirectly affecting children's development. As will be described, the developmental science of normative development, our knowledge of the developmental patterns and processes associated with children with established delays, intervention science and early intervention practice continues to converge with the potential to ultimately coalesce into a system capable of maximizing children's development.

The purpose of this article is to update my prior review in this journal (Guralnick 2005) and discuss advances and future directions in the field of early intervention for children with developmental delays. More specifically, this article focuses on young children with identified delays in the cognitive domain, the vast majority of whom, including children with mild delays, will receive a classification of intellectual disability by school age (Vig *et al.* 1987; Bernheimer & Keogh 1988; Keogh *et al.* 1997). Not considered in this review are preventive interventions for children at environmental or biological risk or children with a primary autism diagnosis.

Emphasized in this update are conceptual and empirical efforts conducted within a developmental framework to refine and enhance our existing knowledge base for children with identified delays. An examination of children's behaviour problems is beyond the scope of this review although recent research in this area is consistent with the developmental framework presented here (Ciciolla *et al.* 2014; Pedersen *et al.* 2015). Discussion of the major themes that have emerged in the past decade is divided into three major sections. In the first section, advances in developmental science related to children with delays are discussed, including aetiology-specific information and research addressing developmental pathways that influence family patterns of interaction. In the second section, recent intervention approaches, mainly superimposed on existing early intervention services, and their conceptual underpinnings

are considered in a developmental context. Emphasis will be given to work promoting relationships, generally indexed by sensitive-responsive interactions between parents and children with delays. Additional research on inclusion will also be considered addressing both children's social and pre-academic skill development. In the final section, challenges facing the field of early intervention from a practice/systems perspective for children with delays will be discussed along with suggestions to address these challenges and move the field forward. In particular, it will be suggested that by merging policy initiatives with developmental and intervention science, including our knowledge of disability characteristics and patterns, it is possible to establish a framework for optimizing early intervention practices for children with delays and incorporate emerging findings.

Developmental Science

Understanding the patterns of cognitive abilities and adaptive skills of children with delays and influences on those skills and abilities has continued to be pursued within a developmental framework in numerous investigations. Broader assessments of children's problem-solving abilities including social components provide important perspectives with respect to children's goals and their involvement in daily activities. Information about the components that are the underpinnings of more general cognitive and social competencies including children's developmental resources (e.g. cognition, language) and organizational processes (e.g. executive function, social cognition, emotion regulation) has been of increasing interest in recent years. This assessment effort has been facilitated by the development and conceptual refinement of measures representing key aspects of cognition. As noted below, although only recently applied to children with delays, and recognizing that a full understanding of what constitutes intellectual development remains to be achieved, the National Institutes of Health Toolbox (Zelazo & Bauer 2013) provides an example of easily administered measures that include executive function and attention, episodic memory, language, working memory, and processing speed (Bauer & Zelazo 2014). By observing how these various aspects of children's cognition develop over time as a consequence of a diverse array of biological constraints in the context of environmental influences, we are obtaining a better understanding of how children adjust their developmental resources and organizational processes to

accommodate to these circumstances (Guralnick 2002; Karmiloff-Smith 2011; Elsabbagh & Karmiloff-Smith 2012). Evaluating these cognitive features, especially over time, provides insight into how constraints influence downstream developmental processes resulting in specific child competencies, including unusual and often more subtle styles of learning. It is this information that can be of considerable value when developing early intervention strategies to enhance the various components of a family's pattern of interaction with their child.

Aetiologic Specificity

Recent developmental work along these lines involving children with delays has primarily focused on subgroups of children with specific genetic aetiologies, frequently occurring as part of a larger multilevel framework involving gene-brain-behaviour relationships and their interactions. It is beyond the scope of this article to discuss the many investigations carried out in this dynamic and creative field (see Burack *et al.* 2012a), but a few examples will highlight the value of this information when designing early intervention programmes to establish as optimal array of family patterns of interaction as possible. One example comes from work with children with Williams syndrome where unusual eye movement planning problems may, over time, adversely influence visual exploration, spatial cognitive abilities, visual attention and joint attention (Brown *et al.* 2003; Elsabbagh & Karmiloff-Smith 2012; Landau 2012). There are also strengths to be capitalized upon, such as short-term memory, but constraints and their developmental consequences are likely to affect a family's ability to adjust their family patterns of interaction effectively to support children's development. Similar recent work focusing on children with Down syndrome continues to reveal special concerns related to complex organizational processes of executive function, social-cognition, and task motivation (Gilmore *et al.* 2009; Cebula *et al.* 2010), child characteristics that operate in conjunction with well-established expressive language problems, especially morphosyntactic weakness (Abbeduto *et al.* 2007b; Chapman & Bird 2012). Even considering protective factors for these children, these and other influences can, in a cumulative fashion, pose special problems for parents and others involved in supporting the child's development. This is also the case for other aetiologic subgroups such as children with Fragile X syndrome. Indeed, an array of developmental patterns reflecting difficulties with

respect to emotion regulation, gaze aversion, early visual attention, working memory and social anxiety are among the issues that many families must contend with as they seek to establish optimal family patterns of interaction (Murphy & Abbeduto 2005; Skinner *et al.* 2005; Abbeduto *et al.* 2007a; Cornish *et al.* 2008; Hagerman 2011; Kover *et al.* 2015). Many of these difficulties are reflected in the developmental course of many aspects of children's adaptive behaviour (Klaiman *et al.* 2014; Hahn *et al.* 2015). Declines in adaptive behaviour over time are common.

Even with an awareness that aetiologic specificity only implies a higher probability that children will exhibit a particular pattern, this knowledge can contribute to our understanding as to why intervention strategies, often effective for other children, have only limited impact for children belonging to a particular aetiologic subgroup. This moderating effect by children with a specific aetiology with respect to developmental influences will hopefully prompt creative intervention strategies linked to hypotheses generated by aetiology-specific findings. As Karmiloff-Smith (2011) reminds us, some of these aetiology-specific patterns can be quite subtle in nature. Information about children's developmental strengths can be of special value in this context as well and has been utilized in intervention studies reviewed later. In addition, as more becomes known about the underlying neurobiology of specific disabilities and their mechanisms, it may stimulate new strategies or approaches at the behavioural level (Karmiloff-Smith *et al.* 2014).

As exciting and creative as this line of research is, it is important to recognize the limits of aetiology-specific information with respect to early intervention practice. Specifically, these patterns are only probabilistic, with wide within-subgroup variability. Moreover, the general population of children with developmental delays is highly heterogeneous with many different aetiologies (e.g. foetal and post-natal infections, peri- and post-natal neurotoxins and trauma, *in utero* exposure to alcohol, drugs or environmental chemicals) (see McDermott *et al.* 2007; Diav-Citrin 2011; Ergaz & Ornoy 2011; Sansavini *et al.* 2011), and corresponding developmental patterns take many forms. Despite the fact that more and more genetic causes of children's delays are being identified (Mefford *et al.* 2012), a precise cause for a substantial number of children cannot yet be established with a reasonable degree of certainty. Consequently, even with these advances in developmental science, early intervention practices will require a framework that is capable of identifying the risk and protective factors

associated with children's developmental resources and organizational processes on an individual basis and incorporating that information to enhance a family's patterns of interaction with their child.

Taken together, early intervention for all children remains a problem-solving process involving the family, the intervention team and other supports within the community. The information provided by aetiology-specific developmental studies is of considerable value as all involved can better anticipate issues and construct intervention strategies more likely to have a positive impact. Studies of children with specific aetiologies in particular demonstrate most clearly how gene-environment interplay yields transformations that result in cascades of developmental events over time that influence the way children perceive and organize their social and physical environment and set goals for themselves. As a consequence, making corresponding adjustments in supportive environments that take these factors into consideration is critical. Although plasticity is constrained to various degrees by biological factors in general, opportunities to influence child development in substantial ways nevertheless exist across all of early childhood. This suggests that continuity in the form of high-quality family patterns of interaction is also critical. To ensure that this occurs, developmental surveillance and the application of needed intervention strategies, including strategies considering aetiology-specific characteristics where it applies, must be essential features of early intervention programmes throughout the entire early childhood period.

Experiential Mechanisms of Influence: Associations with Proximal Factors

In the past decade, investigators involved in developmental science have continued to seek a better understanding of precisely those environmental or experiential factors that directly influence the development of a child with a developmental delay. Evidence continues to suggest that mechanisms of influence found for children developing typically apply equally well to children with delays, despite extensive heterogeneity. As suggested, how to optimize those influences in the form of family patterns of interaction in consideration of children's characteristics by making appropriate adjustments is central to any developmental approach to early intervention. This constitutes a strong developmental framework from which to examine pathways of influence for children with delays (Guralnick 1998, 2011).

Most of the current research in developmental science involving children with delays has focused on associations between various forms of parent-child interactions and child outcomes. Specifically, assessments of the sensitive responsiveness of parents to their children in a variety of settings using a range of coding schemes have consistently revealed strong associations between clusters of these measures (e.g. contingent responding, affective warmth, following the child's lead, maintaining a connection with a balanced set of exchanges) and child outcomes (Trivette 2007; Mahoney & Nam 2011). Of note, many of these measures of sensitive responsiveness correspond to establishing and maintaining a high level of discourse between parents and children (i.e. establishing a discourse framework including expanding and interpreting children's communicative attempts), with child outcome measures focusing on language. For a variety of child language outcomes, available evidence reveals strong associations exist between this form of parent-sensitive responsiveness for highly heterogeneous groups of children with delays (see reviews by Landry *et al.* 2008; Warren & Brady 2007) as well as for aetiologic subgroups such as children with Fragile X syndrome (Wheeler *et al.* 2007; Warren *et al.* 2010; Brady *et al.* 2014; Hahn *et al.* 2014). Similarly, for children with Down syndrome, the extent of supported joint engagement by parents (e.g. follow-in episodes) with their child that incorporates symbols is related to children's receptive and expressive language (Adamson *et al.* 2009) as are episodes of joint attention with respect to receptive vocabulary (Zampini *et al.* 2015). Evidence also exists indicating that decontextualized speech by parents (e.g. talk about past, future, pretend, explanations) is especially supportive of various aspects of language development for young children with brain injuries (Demir *et al.* 2015). When exchanges involving decontextualized speech are occurring they are likely to be in the context of a well developed discourse framework.

Associations between parent-sensitive responsiveness and child outcomes are also evident in instructional-type interactions, even those that arise in a play context. For example, associations with greater child persistence (Gilmore *et al.* 2009) and mastery motivation (Young & Hauser-Cram 2006) have been found. Important aspects of the play of children with Down syndrome are associated with higher quality sensitive responsiveness (supportive behaviour) involving both their mothers (Venuti *et al.* 2009) and their fathers (De Falco *et al.*

2008). Children's social skills and attachment security have also been found to be associated with parent-sensitive responsiveness (Baker *et al.* 2007; Feniger-Schaal *et al.* 2012).

In particular, parent supportive exchanges that are consistent with the child's goals during play are predictive of better social skills, whereas interfering behaviors that redirect the child from their goals are predictive of lower levels of social skills (HYPERLINK \l "_ENREF_57" \o "Green, 2014 #6131" Green, Caplan, & Baker, 2014). It appears that these follow-in exchanges provide important opportunities relevant to both a discourse framework (e.g., comments, questions) and an instructional partnership (e.g., scaffolding) during play interactions.

In addition to associations involving parent-sensitive responsiveness (and the relationships that follow from extended high-quality interactions) and child outcomes for children with delays, associations with other aspects of family patterns of interaction have been found. For example, the provision of stimulating materials by parents (a parent-orchestrated child experience) such as occurs within a home literacy activity is associated with better child language (Van Der Schuit *et al.* 2009). Similarly, the work of Dunst and his colleagues continues to demonstrate strong associations between parent-orchestrated learning experiences in the community for their child and a range of child outcomes (see Dunst & Trivette 2009). Properly organized, extensive opportunities for critical learning experiences for the child are found in these daily interactions in diverse settings and activities (Wilcox & Woods 2011). Parents' ability and active efforts to ensure their child's health and safety are also components of family patterns of interaction that likely influence numerous aspects of a child's development both directly and indirectly (Strickland *et al.* 2004; Cole & Winsler 2010).

Taken together, research in the last decade has continued to strengthen our confidence that well-established developmental pathways that influence child outcomes apply to children with delays. Consequently, adoption of a broad developmental framework, even in the context of a more fine-tuned understanding of developmental processes for these children (see Burack *et al.* 2012b), seems warranted when considering approaches to early intervention. As is the case with all association-type studies, however, causal relationships can only be suggested. More definitive conclusions must await findings from intervention studies evaluating the effectiveness of altering these pathways on child

outcomes (see later section on Intervention Science). Nevertheless, in view of the extensive heterogeneity of children with delays and the corresponding extensive range with respect to the quality of family patterns of interaction in these association studies, early intervention efforts directed to those exhibiting lower quality sensitive responsiveness may well improve child outcomes. Reliably identifying subgroups exhibiting lower quality family patterns of interaction may well constitute a key task for future work in early intervention.

Influence of Stressors on Family Patterns of Interaction

The specific difficulties displayed by children with delays correspond to constraints on the underlying mechanisms related to children's developmental resources and organizational processes and can result in highly complex and difficult to understand behavioural patterns. Beyond the association studies, one question of importance is whether the quality of family patterns of interaction is adversely affected due to these child-specific challenges. When this occurs, child characteristics are said to have generated stressors. Put another way, despite the variability in family patterns of interaction described above, especially sensitive responsiveness, is there also an overall reduction in the quality of these patterns for families of children with delays? Of course, in the most general sense, adjustments in numerous family routines to accommodate to children's characteristics are certainly warranted and have been well documented (see Bernheimer & Weisner 2007). Of importance, research probing details of these adjustments in the last decade have suggested high levels of resilience for families of children with delays in this connection. This is especially the case with respect to parent-child transactions as revealed by experiments involving comparisons to various groups of children developing typically. For example, parents of children with heterogeneous developmental delays are quite capable of appropriately adjusting their level of scaffolding and social communications to their child's characteristics, including directives and directive subtypes, in instructional settings as well as in social play contexts. Despite the usual variability, these overall developmentally appropriate patterns of interaction continue to occur over a 2-year period, suggesting ongoing adjustments by parents as children make developmental advances (Guralnick *et al.* 2008b).

Studies of aetiologic subgroups such as children with Down syndrome have demonstrated similar patterns of

resilience. During collaborative play, mothers of children with Down syndrome appear attuned to their child and display a synchronous pattern of interactions suggesting the existence of high-quality relationships, including a discourse framework (Venuti *et al.* 2009). These adjustments occurred in the absence of overly directive exchanges. Other studies involving children with Down syndrome have detected the use of more parent directives in comparison with appropriately matched groups of typically developing children but the nature and timing of the directives suggested a low level of intrusiveness (e.g. scaffolding behaviours through suggestions rather than imperatives). Accordingly, quality parent-child relationships as indexed by high levels of sensitive responsiveness and warmth found in more recent studies, and in previous work (Marfo 1990; Landry *et al.* 1998; Roach *et al.* 1998), indicate the meaningful adjustments parents make to accommodate to their child's characteristics. In these instances at least, child-specific behaviours do not create stressors that adversely affect important features of family patterns of interaction.

Given the heterogeneity of the development of children with delays and their families, consistency of results across studies involving family adjustments is not a reasonable expectation. In addition to sampling issues and difficulty generalizing over the many studies that included aetiologic subgroups, comparison groups have varied widely in matching characteristics (e.g. chronological age, developmental level), and measures of presumably similar constructs have varied extensively as well. Indeed, an earlier large-scale longitudinal study involving a heterogeneous group of children with delays did in fact suggest lower quality of mother-child interaction skills. Problems were detected during the infant-toddler period and continued to be evident through age 10 (Hauser-Cram *et al.* 2001). More recent work suggests that increasing difficulties with respect to mother-child interaction can occur over time (less sensitive, more remote) (Slonims & McConachie 2006) as is the case for increases in more negative and intrusive parent behaviours (Blacher *et al.* 2013; Green *et al.*, 2014). Discourse problems, particularly with respect to limiting the number of questions addressed to children, even those with Down syndrome, have been found (De Falco *et al.* 2011). Moreover, coordinated rather than supported joint engagement poses more of a challenge for parent-child dyads (Adamson *et al.* 2009) as does verbal turn-taking (Thiemann-Bourque *et al.* 2014). These findings also suggest the potential for relationship problems with respect to socioemotional connectedness, but it is difficult

to apply conventional classification schemes to determine attachment security (Feniger-Schaal *et al.* 2012). Moreover, direct assessments of socioemotional connectedness involving children with delays have not been the subject of systematic investigation. The existence of higher levels of behaviour problems for this group of children do, however, suggest that socioemotional connectedness can be adversely affected (Baker *et al.* 2003). These difficulties may also manifest themselves in various measures of parental stress.

Recent evidence, then, continues to suggest various levels of vulnerability due to children's characteristics with respect to family patterns of interaction along with considerable parental adjustments, but only for as yet to be defined subgroups of children and families. Direct assessments of the individual components of family patterns of interaction (their risk or protective status) are therefore most critical, especially as related to areas of concern noted above. The risk and protective status of various children's characteristics (i.e. their developmental resources and organizational processes) from specific subgroups can also alert us to potential areas likely to be of concern now or in the future.

Similarly, as discussed next, a family's resources, including risk and protective factors associated with the personal characteristics of the parents (e.g. their mental and physical health, coping style), and material resources (e.g. financial resources, social support) can also be of value in helping to identify subgroups of families most likely to experience stressors that will adversely affect one or more family patterns of interaction. Association studies for a variety of groups not involving children with delays have suggested that limited family resources, especially in the form of high stress levels or restricted social support, can adversely affect many components of a family's pattern of interactions (e.g. Cicchetti *et al.* 2006; Thompson *et al.* 2006; Davies & Woitach 2008).

Stressors to Family Resources: Distal Factors

For families with a child with a developmental delay challenges to these resources are considerable. Such challenges tend to be persistent and can alter the risk status of all components of the personal characteristics of the family and their material resources. Indeed, the process of family adaptation to these challenges begins during the diagnostic phase, a highly emotional period that requires at least some initial form of resolution to avoid longer-term adverse effects on parent-child transactions (Barnett *et al.* 2006). The level of risk and

protective factors associated with each of the components of a family's resources contribute substantially to a family's initial response when their child's delay is confirmed but, of course, will also vary with the nature and severity of the child's characteristics (Poehlmann *et al.* 2005). Fortunately, most families engage in a problem-solving process that enables them to adjust to the challenges and avoid stressors from emerging at the level of a family's resources (Bailey *et al.* 2008; Watson *et al.* 2011). Coping strategies are especially valuable (Minnes *et al.* 2015). Should stressors emerge however, beyond implications for a family's overall well-being, these adverse influences can affect children's development by adding risk to one or more of the components of family patterns of interaction.

Researchers have typically evaluated the success of this problem-solving process at the level of family resources in the context of different types of perceived family stress. Standardized measures such as the Parenting Stress Index (Abidin 1995) are often used. Findings in this important area have revealed the complexity of these patterns of adjustment and their various influences. Most notably, parents perceive stress most acutely as a result of specific child challenges, such as the demandingness or perceived acceptability of the child's behaviour. Generally, this type of child-related stress on parents increases over time with scores often reaching clinical cut-off points (Most *et al.* 2006; Crnic *et al.* 2009; Gerstein *et al.* 2009). As expected, the degree to which children exhibit behaviour problems is a major factor in elevating child-related stress, much more so than children's cognitive level (Neece *et al.* 2012; Azad *et al.* 2013). Also as expected, due to the particular patterns associated with aetiology-specific subgroups (e.g. timing of the diagnosis, child temperament, communication skills, and behavioural patterns), corresponding variations in child-related stress on parents follow (Eisenhower *et al.* 2005; Poehlmann *et al.* 2005; Lanfranchi & Vianello 2012).

Despite difficulties with respect to child-specific challenges, current work indicates that many of the protective factors associated with each of the components of family resources are sufficient to enable most families to minimize what is generally referred to as 'parent-related stress'. This construct of parent-related stress encompasses measures of social isolation, perceived social impact, constraints on daily activities and parents' sense of their ability to carry out their parenting role. Clinical stress levels for these measures are infrequently reached and achieve a level of stability, but do vary widely across families (Bailey *et al.* 2007a). This variability is due in part to the mutual and

reciprocal interactions occurring among components of a family's resources (Meppelder *et al.* 2015), operating in a manner similar to that of typically developing children (Olsson & Hwang 2008). Perhaps the best example of these interrelationships among family resource components involving children with delays that follow a general developmental framework are studies suggesting the influence of social support on virtually every component of a family's resources, including parent mental health and positive coping strategies (Hassall *et al.* 2005; Kersh *et al.* 2006; Bailey *et al.* 2007b; Plant & Sanders 2007; Guralnick *et al.* 2008a; Raspa *et al.* 2014). Support directly related to assistance with respect to parenting tasks (i.e. child care, advice) seems especially useful (Guralnick *et al.* 2008a).

For most families, protective factors such as social support can help prevent parent-related stress from reaching the point where true stressors emerge, which would adversely affect one or more family patterns of interaction. Yet, we must be mindful of recent research demonstrating that, even for children with Down syndrome, an overall decrease in parent life satisfaction and an increase in parent stress during the first 3 years of the child's life are seen (Nes *et al.* 2014). These difficulties are further compounded by the fact that, in general, families of children with delays have a higher initial overall level of risks to many of the components of family resources, especially financial resources, prior to the birth of a child with a delay (see Emerson & Hatton 2009). Furthermore, over time related burdens such as out-of-pocket expenses associated with the need for unusual child care arrangements add additional risk factors at this level (see Emerson *et al.* 2006; Olsson & Hwang 2008). Accordingly, challenges from both the level of the child and the level of family resources can combine to place great pressure on the adaptive capacities of families.

Taken together, these findings are not only consistent with a developmental framework but continue to highlight the need to identify subgroups that currently benefit from early intervention to varying degrees. Should this occur, careful analyses will lead to the development of new intervention strategies. This will require a comprehensive approach, often large scale, involving the identification of risk and protective factors at the level of child development, the level of family patterns of interaction and the level of a family's resources. In the next section, recent research designed to enhance, clarify or refine the effectiveness of early intervention is examined in the context of our knowledge

of developmental pathways of influence. As will be seen, although adding considerably to our knowledge base, interventions have not been comprehensive. Rather, considerable effort has revolved around interventions designed to enhance parent-sensitive responsiveness and increase children's ability to benefit from opportunities found in inclusive environments. The potential does exist, however, to combine information gained from these and other studies to develop a more comprehensive approach to early intervention that can be applied to community practices utilizing a consistent framework.

Intervention Science

Indeed, the past decade of research addressing early intervention issues for children with delays has focused primarily on smaller-scale refinements and enhancements. This contrasts sharply with the many far more comprehensive randomized clinical trials (RCTs), some long term, that were carried out during this time period for children at risk due to biological factors, especially those born preterm (see Guralnick 2012), those at risk due to environmental factors (see Guralnick 2013), and for children with autism (see Vismara & Rogers 2010). It also contrasts with the rich and vibrant conceptual and empirical work focusing on various aspects of developmental science for children with delays described earlier. To some extent, the absence of comprehensive larger scale and longer-term intervention studies reflects an acceptance of the fact that children with delays and their families do benefit from current early intervention programmes. Comprehensive studies of early intervention are difficult and expensive to carry out and, in the absence of well-specified newly developed or competing models, little incentive exists to pursue this line of research. Studies that span both the infant/toddler and preschool periods are especially rare, despite the importance of service continuity across the early childhood period.

However, some recent efforts directed at providing more structured curricula that are comprehensive in nature have been carried out. This includes a behaviourally based intervention approach mainly borrowed from the extensive research in this area for children with autism (Eldevik *et al.* 2010) and international work involving a skills-based approach (Shin *et al.* 2009). Collectively, although small in scale, this work suggested that children with delays can benefit from careful sequencing of learning activities and environmental structure, supporting a very early review

of intervention effectiveness indicating that a well defined structure is a critical element in successful programmes (Shonkoff & Hauser-Cram 1987). How needed structure can be blended with natural routines and other developmental principles associated with family-centred practices, relationship formation, inclusion and many others remains a critical issue in our field as will be evident in many of the refinement and enhancement studies noted below. Such future efforts must consider the fact that extensive diversity of intervention practices is common in the service system today for children with delays, many failing to utilize evidence-based practices (see Bruder 2010). This is a broader policy and systems issue, and is discussed in a later section.

Sensitive Responsiveness and Relationships

Pathways influencing child outcomes have been discussed earlier, with sensitive responsiveness along with affective warmth and engagement serving as building blocks for critical relationships that emerge over time (Aksan *et al.* 2006; Feldman 2007; Tomasello & Carpenter 2007). Relationships can take many forms: three types identified in the form of a discourse framework, an instructional partnership and socioemotional connectedness appear to be particularly valuable influences on children's development and have been noted briefly earlier. Additional details of the definitions and characteristics of these relationships in the context of early intervention programmes can be found elsewhere (Guralnick 2011).

The role of the parent-sensitive responsiveness component in relation to child outcomes has not only been an important part of advances in developmental science but intervention science as well. The particular characteristics and form of interventions in the past decade that have focused on the sensitive responsiveness component of relationships have varied with the age, aetiology and severity of a child's delay. In general, sensitive responsiveness interventions have tended to be shorter term (generally a few months), although longer-term follow-up was common.

A series of RCTs by Mahoney and his colleagues (Kim & Mahoney 2005; Mahoney *et al.* 2006; Karaaslan *et al.* 2013) provide an excellent example of this approach. Interventions to enhance the sensitive responsiveness of mothers of a heterogeneous group of children with delays were typically carried out in various settings, including the home, for a period of 3–4 months. The importance of incorporating sensitive responsiveness strategies (e.g.

those related to appropriate levels of reciprocity, contingency, shared control, affect and matching interactions to child behaviour and characteristics) into family routines and social interactions was stressed. A non-structured, non-didactic approach was emphasized in this intervention. On the whole, despite the small scale of many of the studies, it was evident that mothers' sensitive responsiveness could be increased relative to comparison groups, although effects were primarily short term with corresponding changes in child outcomes less apparent in some instances.

Another series of refinement and enhancement type studies addressed general concerns exhibited by many children with developmental delays, that is a lack of initiative in engaging the physical and social environment. It is through these proactive efforts that children gain and organize information related to their developmental resources and organizational processes that can then be applied to accomplish their goals. Problems with respect to intentional communication efforts by children with limited expressive language represent one important aspect of this general concern and have been a major theme in recent years.

Specifically, to promote intentional communication, studies have utilized various comparison groups and included parents of preschool age children with delays, often in combination with a trained therapist working directly with their child (see Roberts & Kaiser 2011). For example, an intervention to promote a discourse framework involving both parents and therapists was able to enhance utterances that were targeted more so than intervention only involving therapists (Kaiser & Roberts 2013). Yet, differences using broader standardized language measures were not found and even the effects for targeted utterances began to diminish after intervention was completed. This was the case even though parents tended to display greater sensitive responsiveness as indicated by more frequent use of certain discourse strategies. Consistency and continuity of high-quality sensitive-responsive parental support seemed critical, but this is not an easily accomplished mix especially for those children with limited expressive language. Indeed, even when combining responsivity education for parents with staff-implemented intervention, consistent and sustained effects are difficult to achieve (Fey *et al.* 2006, 2013; Warren *et al.* 2008; Yoder *et al.* 2014). Refinements that consider intervention intensity, degree of structure needed, as well as unique effects on specific subgroups such as children with Down syndrome can be of value (Yoder *et al.* 2014, 2015; Bauer & Jones 2015).

In order to address the intensity issue as well to implement more naturalistic interventions, recent work has placed greater emphasis on parent-implemented language interventions. Although only in the pilot stages, this work has employed distance-learning technologies to coach parents to improve sensitive-responsive strategies (i.e. follow child's lead, appropriate use of prompts, focus on child's object of interest, and linguistically map accordingly). Initial results for children with Fragile X syndrome suggest the feasibility and potential effectiveness of this approach (McDuffie *et al.* 2015). As this strategy develops and is further refined, greater opportunities for establishing a true discourse framework will exist, allowing continuity of this and related relationship processes to emerge over time. Further advances in coaching technologies that support embedding parent-child interactions in natural family routines will promote the formation of relationships and strengthen family-centred practice (Wilcox & Woods 2011; Friedman *et al.* 2012).

In related work, assisting parents to support pre-linguistic toddlers to enhance joint attention and symbolic play using strategies that include alternative and augmentative communication techniques such as manual sign and speech-generating devices indicated that children's communication abilities can be improved (Wright *et al.* 2013). Importantly, parents can also incorporate these techniques successfully into daily routines (Romski *et al.* 2010, 2011). These studies involving highly technical strategies generate small but potentially important developmental effects in a specific area of concern. As children's communicative needs continue to change over time, additional efforts to promote a broader discourse framework would likely be necessary.

These very promising studies must be viewed in the light of the fact that, as noted earlier, many families are quite capable of making needed adjustments to maintain sensitive-responsive interactions with their child. Moreover, even for those subgroups of families having difficulty adjusting, these highly focused interventions must add considerable value for significant effects to be detected in view of the wide range of early intervention resources available in their community to many families who participate in these studies. Nevertheless, this work demonstrated the potential value of combining naturalistic intervention strategies with more behavioural or structured intervention strategies (McWilliam 2010). Even some forms of behavioural-structured strategies can be effective in promoting the exploratory behaviour of infants with Down syndrome (Bauer & Jones 2014). Yet,

there remains a degree of tension between more structured, didactic-oriented approaches and those that seek to promote interaction patterns that build relationships commonly found in high-quality parent-child transactions. The ultimate goal is to encourage children's self-generated active knowledge acquisition and problem-solving abilities, which relationship formation approaches promote. Some reconciliation of this matter can be achieved if families and interventionists agree that it is essential to determine the minimum level of structure needed to encourage more naturalistic exchanges and relationship building. Indeed, developmental science suggests that long-term benefits of early intervention depend upon the quality of these relationships.

Preschool Inclusion

One setting in particular in which a certain level of structure is valuable and necessary is in preschool. It is the case that teacher-child relationships similar to those described for parent-child transactions create the type of environment conducive to promoting all aspects of a child's development, including specific pre-academic skills related to language and mathematics (e.g. Burchinal *et al.* 2008; Howes *et al.* 2013). In this context, information is periodically transmitted in a highly structured, didactic manner and organized by specific curricula.

A major question is whether children with delays not only benefit from preschool settings that are a unique combination of free flowing social interactions and structured formats but also can do so when participating with a large proportion of children who do not exhibit delays. Indeed, including children with delays in typical educational settings is part of a larger effort to support practices that maximize children's full participation in all community activities – social, recreational and educational. Although often difficult to implement, this human rights principle is now well accepted on many grounds (Guralnick 2001; Brown & Guralnick 2012; Bruder & Guralnick in press).

Many countries have established universal preschool education and this movement is rapidly advancing in the United States. Universal preschool provides an opportunity for children with delays to take advantage of these inclusive settings but also raises the question as to whether high-quality inclusive preschool programmes can meet their special needs in that context. Recent work has directly addressed this question focusing on the development of pre-academic skills of children with mild or moderate developmental delays enrolled in Tulsa,

Oklahoma's high-quality universal preschool programme. Initial results using a quasi-experimental design indicate that children with and without special needs make significant advances and at a similar pace with respect to early literacy (Phillips & Meloy 2012). Although additional efforts are needed to realize similar benefits in the domains of math readiness and problem-solving skills, these results suggest that access to universal preschool programmes means that *all* children can benefit. Accordingly, parents of children with delays should pursue this family-orchestrated child experience. Early intervention systems capable of coordinating other services and supports in conjunction with inclusive preschool programmes that centre on families and promote other aspects of family patterns of interaction will provide the type of comprehensive system essential to maximizing children's cognitive as well as their social competence.

Indeed, the need for efforts to promote the social competence of children with delays becomes even more evident in inclusive settings. Specifically, it has been well established that children with delays exhibit unusual difficulties in relating with peers and establishing friendships (Guralnick 1999, 2010). Despite the significance of this problem and its broad implications for children's quality of life now and in the future, only limited research has been conducted in recent years. The most comprehensive RCT to address the peer competence of children with delays focused on the organizational processes of social cognition and emotion regulation using play scripts as a critical intervention strategy. Over a 2-year period, interventions were carried out at home working with parents and in inclusive preschools working with teachers. All aspects of the intervention were guided by a developmental framework. Results were promising in that, especially for children with IQs below 70, compared to the control group, intervention children displayed more positive responses to social bids by peers and the intervention prevented increases in a range of negative social interactions. Yet, other measures tapping core features of peer-related social competence did not differentiate the groups (Guralnick *et al.* 2006). As indicated in my previous review (Guralnick 2005), this important area has not received sufficient attention from researchers, a concern still evident today. Peer relationship issues are certain to become more apparent as preschool children with delays begin to participate even more frequently in inclusive settings as universal preschool programmes as well as involvement in other community activities become more common.

Summary

Numerous advances related to early intervention for children with developmental delays have occurred in the last decade as researchers have addressed important issues in both developmental and intervention science. Considerable progress has been achieved with respect to understanding the complex and multifaceted experiential influences on the development of children with delays. Of importance, consistency with the developmental pathways and reciprocal influences common to developmental models established for typically developing children have been found. These consistent findings increase our confidence that the pathways identified through association studies are indeed causal pathways. Moreover, extensive conceptual and empirical work has focused on subgroups of children with specific aetiologies. Remaining within a broad developmental framework, this line of research has generated new ways of thinking about how biological constraints influence children's development and suggested innovative intervention possibilities. Admittedly, the promise of translating advances in aetiology-specific knowledge to early intervention practice is far from being fulfilled. However, model programmes attempting to incorporate this knowledge for some subgroups at the level of child development are emerging (Iarocci *et al.* 2006) as are intervention studies taking aetiology-specific information into account (Wright *et al.* 2013). Moreover, aetiology-specific information can be of value when considering risks at the level of family resources, especially with respect to parental mental health or related problems connected with heritable disorders. For example, mothers of children with Fragile X syndrome who are pre-mutation carriers or have the full mutation provide one example of potential elevated risk and can thereby help guide a sophisticated assessment and intervention process (Head & Abbeduto 2007). Further work in developmental science, particularly longitudinal studies for aetiology-specific subgroups, is likely to suggest important intervention targets.

Intervention science during the past decade has been carried out primarily to enhance parent-sensitive responsiveness as a means of promoting children's development; continuing to find support for the influence of this developmental pathway for children with delays. Much of this effort, however, has been focused on smaller-scale studies designed to enhance language and communication. In so doing, as often occurs in the context of systematic efforts to alter

developmental trajectories, it became apparent that we have not yet successfully reconciled the role of intervention structure, didactic approaches to intervention and more naturalistic intervention strategies. Moreover, further work with respect to the conceptualization and proper assessment of relationships that emerge in contexts that include varying levels of sensitive responsiveness are needed.

Developmental science is making progress in this regard and will enhance our understanding of this relationship construct and its application in early intervention settings (Bornstein & Manian 2013). Research relevant to enhancing relationships in discourse, instructional and socioemotional contexts will be especially valuable. Developmental science suggests that these are the keys to promoting children's independent problem-solving abilities, that is initiating goals and building social and cognitive competencies by enhancing various aspects of developmental resources and organizational processes. Although relatively narrow in scope, the past decade of refinement and enhancement studies, even involving the most general aspects of sensitive responsiveness, have likely influenced various aspects of relationship processes. As a consequence, they have potentially important practical implications. That is, small benefits in specific developmental areas that are incorporated into a more comprehensive early intervention programme can yield a valuable cumulative effect. Other work during the past decade addressed important issues related to inclusion focusing on the domains of peer relationships and fostering pre-academic skills. Yet, these are complex areas and will require a long-term program of research to identify practices that are both feasible and effective.

Future Directions: Early Intervention Systems

How then might the field of early intervention for children with delays move forward? What needs to occur to accelerate progress not only in developmental and intervention science but in the general practice of early intervention as well? From a practice perspective, early intervention systems are in place in high resource countries and, as noted earlier, parent satisfaction is at a reasonable level and general outcomes suggest child progress is occurring. Agreement also exists with respect to what might best be referred to as structural features and values governing programmes that, together, generate important practice principles (Guralnick 2008). Among those principles is the

importance of ensuring high levels of coordination and accountability, individualizing interventions, focusing on families, using evidence-based strategies, establishing surveillance procedures, ensuring participation in inclusive settings, developing programmes and intervention strategies that are culturally appropriate, and ensuring that the professional workforce is well trained. Yet, we know that these structural/values principles have not been as effectively implemented in practice as needed even in high resource settings (Bruder 2010; Hebbeler *et al.* 2012). Of importance, these principles operate at a policy level and will therefore require policy level initiatives (Bruder 2010; Vargas-Barón 2013). Similarly, early intervention programmes based on diverse conceptual models of intervention and eclectic practices with uncertain foundations or evidence suggest that opportunities exist to further enhance the development of children with delays (Guralnick 2011).

Ideally, early intervention practices would benefit from merging policy initiatives with a developmental framework. Each could effectively inform the other with the interplay of policy and practice based on child development principles providing a unique opportunity to enhance the early intervention service system for children with developmental delays. As suggested in my earlier review, the Developmental Systems Approach (DSA) is one such framework that can be utilized to guide the interaction of policy and developmentally based early intervention services. In the past decade, the DSA has served as a guide to policy-relevant systems design and evaluation in numerous countries (see Bruder & Guralnick 2012) and the developmental framework has been refined in an effort to more directly guide early intervention practice at a community level (Guralnick 2011).

Figure 1 illustrates the three major levels of the DSA, the components constituting each level and the interactions that can occur within and between levels. Within this framework, the overarching goal of early intervention is to optimize the components of family patterns of interaction. The importance of relationships, comprehensiveness, continuity over time and family centredness is central to this approach. Indeed, adopting a capacity-building approach for families is central to this task (Dunst & Trivette 2009). It also reflects the fact that a substantial number of parents adjust well to the challenges posed by child-specific characteristics (see dashed line between the levels of child development and family patterns of interaction). However, if the demands posed by children's developmental patterns exceed a family's ability to adjust, stressors emerge adversely

affecting one or more components of family patterns of interaction. A family's resources can be initially at high risk or become depleted thereby creating stressors as well to many of its components. In this cycle of interconnected pathways, family resources can then exert a negative influence on family patterns of interaction, further increasing levels of risk. Due to unique child characteristics related to a combination of biological constraints and prior experience, children can also moderate influences designed to optimize family patterns of interaction (see dotted line between the levels of child development and family patterns of interaction). Indeed, children vary substantially in their response to developmental influences, and a primary task of early intervention is to find creative ways to maximize family patterns of interaction despite this variability. Aetiology-specific information can clearly contribute to this process.

Addressing both the unique developmental patterns and learning styles of children along with any stressors that emerge at other levels constitutes a demanding problem-solving task for families and early intervention practitioners. In so doing, problems are often encountered that are best addressed within the policy/values contexts. In this way, intervention efforts designed to maximize family patterns of interaction can highlight policy/values concerns. Addressing issues, such as access to inclusive programmes or health care settings, and improving professional training are among the many policy issues that will certainly constitute a long-term process to achieve resolution. However, by considering developmental and intervention science when communities frame policy initiatives, the ultimate outcome is more likely to yield a well-designed effective system for early intervention.

For communities seeking to adopt a developmental approach, screening and assessment tools are available for most of the components noted in Figure 1, as are compatible intervention strategies linked to many of those components (Dunst *et al.* 2000; Spiker *et al.* 2005; Guralnick *in press*). Such a screening and assessment process also lends itself nicely to identifying subgroups of families in which children will vary substantially with respect to their need for substantial early intervention resources. Establishing the level of risk and protective factors at all three levels can guide both intervention approaches and suggest the timing and levels of intensity of intervention that can often anticipate and avoid future problems. The design and implementation of evaluation systems are frequently seen as barriers, but can be accomplished more easily within a common framework. These more detailed

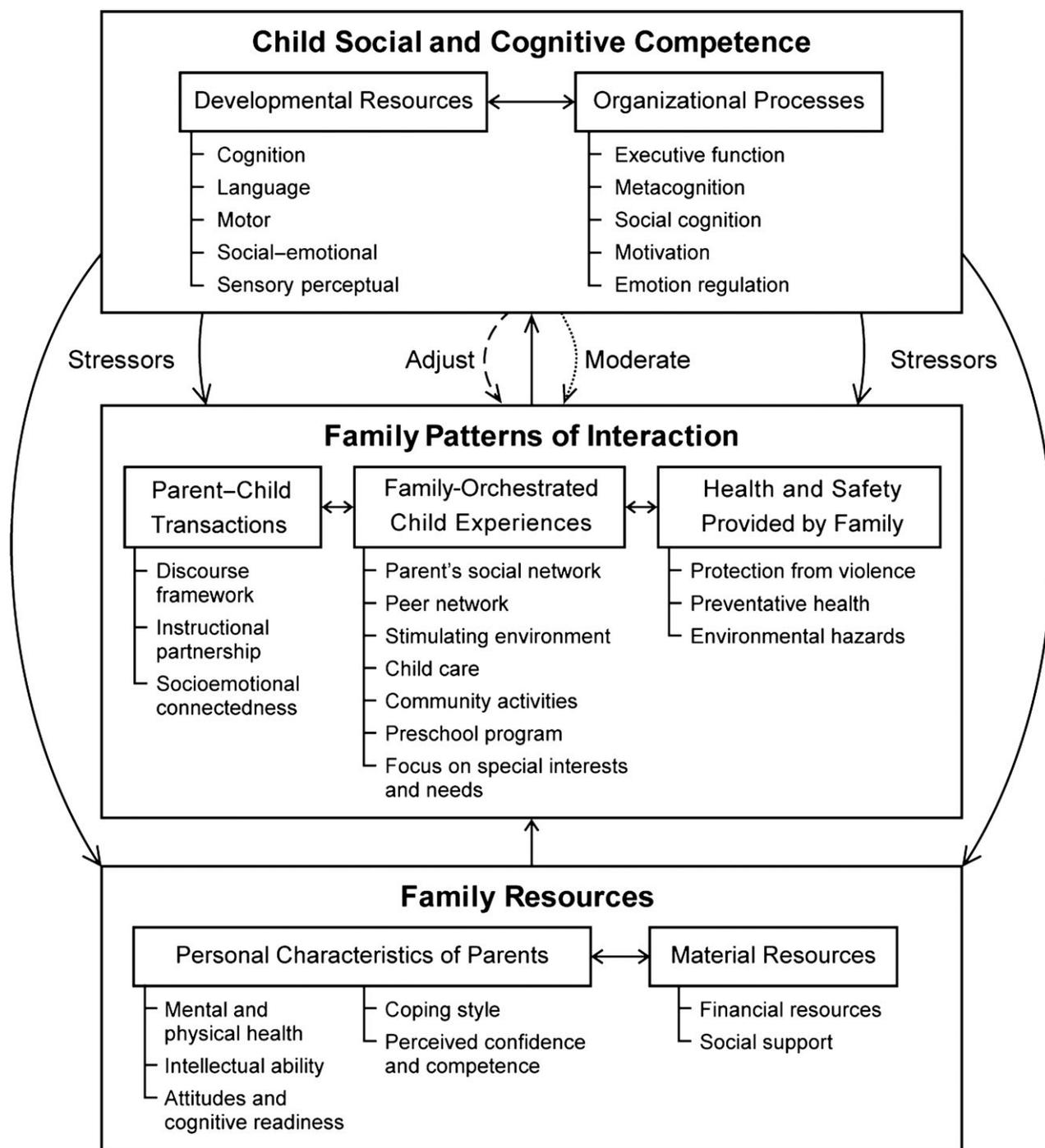


Figure 1 The Developmental Systems Approach illustrating levels, components, and relationships. Reprinted from M. J. Guralnick 2013, *Infants & Young Children*, 26, p. 277.

evaluation systems associated with the components in Figure 1 can complement broader based systems now available (e.g. The Early Childhood Outcomes Center, 2011). Of importance, this framework can incorporate

information from refinement and enhancement studies such as those discussed earlier that provide useful evidence of benefit. As such, this framework provides a way to both understand new findings in a

developmental context and appropriately incorporate them into daily practice.

By adopting a common framework, the coherence and consistency among programmes is increased and a useful organizational structure is established. This structure, especially for data collection and evaluation, can guide the ongoing problem-solving process that is required for effective early intervention practice. Of equal importance, this structure is designed to work with researchers to identify gaps in our knowledge, especially when consistent patterns making it difficult to establish high-quality family patterns of interaction become evident. Beyond fostering collaboration with researchers, this approach can promote effective communication among all involved. Taken together, common goals, agreed upon developmental and policy frameworks, and a common language for discussing next steps can bring a new level of coherence and effectiveness to an early intervention system. Although not underestimating the significant barriers that exist in carrying out such an enterprise, the direction provided by the interaction of policy initiatives, the developmental science of normative development, knowledge specific to risk and disability, intervention science and early intervention practices will ultimately enhance the value and benefits of early intervention for children with developmental delays.

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