



Early intervention and mental health: evidence review from premature and disadvantaged infants

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Abstract: The purpose of this review is to examine the data on the potential effect of early childhood interventions on later child and adult mental health. Specifically, it examines the effect of early intervention strategies to prevent or ameliorate of early behavioral problems, potential antecedents of later mental health issues. To maximize the generalizability the review focuses on two general, ‘at-risk’ groups: disadvantaged children and those born prematurely. Only one study, the Infant Health and Development Study provided long term results to address this question. Like other early interventions in the form of educational centers, home visiting and primary care strategies, care-giver reported behavior problems are reduced in the intervention group by the end of the intervention period. However, none of these approaches appears to confer no long-term effect on behavior problems, and hence, are unlikely to influence any associated mental health diagnoses. Many support an important indirect effect of interventions in decreases in delinquency, incarceration, other high-risk behaviors and welfare dependency. The pathway by which this occurs appears to be greater school success. Thus, an indirect effect may be posited. In summary, despite its importance, little systematic intervention with longitudinal follow-up has addressed the prevention of mental health problems.

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Early intervention

Early intervention is not a defined set of activities, but rather a strategy to prevent or reduce the effect of factors that might alter the development of young children. As such, it involves a heterogeneous set of programs and therapies aimed at improving the health and functional outcomes of young children (generally in the 0–4 years range) who present an equally broad array of risks for poorer development. Such programs may vary from those which provide direct therapeutic services to children with established diagnoses to broad-based educational efforts based on identified curricula (1). The implementation of an early intervention program depends on an established understanding about the factors impeding development as

well as the availability of evidence-based interventions. For children with specific diagnoses, the intervention program would address what is known about the effects of these diagnoses and may involve direct therapeutic services such as physical or occupational therapy by specialized personnel. Examples would include programs designed to improve the functioning of infants with autism, cerebral palsy or sensory-neural defects in vision or hearing of varying degrees of severity. Other early intervention approaches address the needs of children “at risk” of developmental problems, as a function of environmental circumstances or problems at birth. In this case, not all the children in a specific category will experience developmental problems, but many will. Examples here are seen in the early educational

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programs for socially disadvantaged children for whom the program provides the kind of learning experience that more advantaged children enjoy or for children born prematurely or with negative prenatal exposures like drugs (2).

Not only are the targets of early intervention heterogeneous (and some quite rare), but the structure of the programs themselves vary widely. As noted, some are specifically geared to providing specific therapeutic services. Others, such as those for disadvantaged children involve more general developmental and educational approaches to provide the kind of preschool experiences more advantaged children have. The sites at which the services are provided also vary from in-hospital settings especially for premature infants, clinics, classroom-like settings or the home. Likewise, the staffing of the programs can be quite heterogeneous ranging from registered nurses and preschool teachers and specific therapists to trained community health workers. The underlying curricula and intensity of service varies, not only due to the intervention underlying the design of the intervention, but also due to variability in access to the services reflecting residential mobility, other competing needs and services and turnover of staff (1,2).

Mental health

The consideration of mental health problems in children too young otherwise to be able to articulate the types of emotions or other symptoms that result in specific psychiatric diagnoses has long relied on the observation of problematic behaviors. There are well established systems of behavioral observation with established age-specific norms (3). Moreover, some subscales of these instruments may map onto symptoms consistent with specific diagnoses. Longitudinal use of these instruments provides support that early behavioral difficulties may presage later psychiatric and other behavioral problems in adolescence and adulthood. Thus, the relevant measure of mental health for early intervention would be its effect on behavior problems.

While behavioral interventions are certainly part of the repertoire of services to be provided in most early intervention programs, there are some limitations in assessing the effect of such program in this arena. First, assessing the presence of behavior problems depends on proxy reporting, most often the care taker or early intervention staff. Without an external benchmark, it is difficult to know how expectations may influence reports. For example, early intervention workers may describe what

is normal preschool behavior, and parents may not report it as a problem because it is a desired response. Second, problematic behaviors tend to emerge in the third year of life when self-regulation may be inadequate. This timing is toward the end of the usual early intervention period. While behavioral management is part of the reparatory of early intervention programs, specific approaches may not have time to be effective. Finally, while some early behaviors do extend into adulthood, many of the major psychiatric diagnoses, namely depression and psychoses, emerge in adolescence. Thus, it is unlikely that early intervention would influence these conditions.

For the purposes of a discussion of the effect of early intervention on mental health, the question can be framed as to whether early intervention interventions are associated with a reduction in problem behaviors in children at risk, rather than those with established diagnoses. Further, if so, what are the long-term effects of such changes. The focus of this summary is on the effects of general developmentally oriented early intervention services such as home visiting or class room-based approaches to prevent the emergence of behavioral problems among children not all of whom will experience them.

In view of the heterogeneity of programs and conditions to which early intervention might pertain, it is impossible to make global statements about “its” effect. Moreover, a review of all potential early intervention programs is beyond the scope of this chapter. To keep this effort to a manageable level involved two principles. The first is restriction of consideration to specific populations. The populations were selected to reflect children “at risk” of developmental difficulties, not those with defined syndromes. Second, where possible, reliance was placed on existing summaries of the literature of general developmental programs, and a detailed independent literature review was not conducted. Specifically, the literature sought was for programs for those 0–3 years of age.

Relevant populations

Two groups of children were considered especially relevant to this chapter, in part because of the substantial number of studies of both the prevalence of problems and intervention for early childhood development. In addition, both groups can be characterized as being “at risk” for developmental problems, but not all experience them. Thus, they provide evidence of the potential scope of the effect of interventions across levels of severity of risk. More specifically, both groups experience a higher risk of behavior problems, and

subsequent mental health issues in adulthood.

Children experiencing socio-economic disadvantage

An extensive literature documents the potential negative effects on child development due to being born poor. Multiple overlapping mechanisms have been described that indicate the pathways by which these negative influences occur, including maternal depression, low maternal educational attainment that limits mothers' ability to care for their child, inadequate diets with iron deficiency and exposure to environmental toxins such as lead (2). This strong evidentiary base has led to the development of interventions to counteract these mechanisms, and foster better development. The more successful of these interventions are based on a strong theory of development and a well-defined curriculum (2,4). These interventions are designed to address the acquisition of basic cognitive skills needed for school success but not necessarily in the child's environment, such as basic reading and numeracy exposures.

Low birth weight/premature children

Contrary to the impression that might be gleaned from the literature, low birth weight/prematurity (lbw/p) does not constitute a syndrome. Rather, the outcomes reflect the potential injuries to immature organs from having to function when they are not ready or from the sometimes significant interventions needed to save lives. Clearly, the greater the prematurity, the greater the risk of one or more adverse outcomes. While a great deal of attention has been paid to the cognitive and motoric outcomes of these children, these are not the only ones. Others include reactive airway disease, behavioral problems, growth and nutrition difficulties, among others (5,6). In addition, while premature infants tend to be disproportionately from disadvantaged backgrounds (poverty increases the risk of prematurity), not all are. Thus, this population of children, a little under 10% of all births, constitutes an important one for observing child development in the face of potential neurologic compromise, presence of a number of chronic illnesses, and heterogeneity of socio-economic background.

Evidence of the effect of early intervention on behavioral problems

Infant health and development program

One study that specifically addresses this issue is the Infant Health and Development Program (IHDP) (7,8). IHDP

was a multi-site randomized trial of the effects of early intervention on the outcomes of low birth weight premature infants, and one of the largest and most rigorous studies of its type. The following summarizes the methods.

Selection of sites

Criteria for site selection included an academic delivery service of sufficient size to enroll 135 infants under 37 weeks and 2,500 grams in a six-month window, a pediatric service to provide surveillance, and access to a facility for center-based education. The sites were heterogeneous for socio-demographic characteristics. Although most were urban, at least one site had rural areas. Access to the intervention facility in years 2 and 3 was assured by a specific bus service.

Sample

Eligible infants met the birth weight and gestational age criteria noted above, and an expected residence within a reasonable time from the development center. Infants excluded from the study were those with prolonged hospitalizations, specified illnesses and malformations, and or mothers not fluent in English (the intervention materials and assessments were in English). Among multiple births, one infant was selected at random to be the study subject. Infants were recruited into two strata: one-third with birth weights of 2,001–2,500 grams (heavier low birth weight infants or HLBWs) and two-thirds, 2000 or less (lighter low birth weight infants or LLBWs). Randomization was done using a mechanism that assured balance at each site by birth weight, sex, maternal educational level, maternal race, primary language, and participation in another study. Of the almost 1,000 eligible infants, one-third of the sample was randomized to the intervention group (INT) and two-thirds to the follow-up only (FUO) group. Because the sample was purposively recruited in two strata, the two groups could be analyzed separately.

Intervention

The intervention consisted of three components: a home-visiting program during the first year of life, a center-based development intervention until 3 years of age corrected for duration of gestation, and a parent group during the center-based phased. All components used a previously established curriculum modified for premature infants. Both groups received high-risk follow-up pediatric care with referral to any community services needed.

Behavioral outcomes

Although cognitive, health and familial outcomes were

assessed, the focus of this report is on behavior problems. Major outcome assessments occurred at 3, 5, 8 and 18 years of age (the first corrected for duration of gestation). Behavior problems were assessed at each outcome point using the age-appropriate Achenbach measure for the first three assessments and a modified behavior problem battery at age 18 (3,9).

At the end of the intervention, at age 3, behavior problem scores in the INT group were significantly lower than in the FUIO group. Effect sizes were greater for mothers of low educational attainment, as ascertained by her report of her last completed grade in school. The positive effect of the INT was noted even among the smallest infants, <1,000 grams (10). However, this difference vanished by age 5, and was not seen at ages 8 or 18. This was true overall and within birth weight groups.

Other long-term outcomes

What did emerge at age 18 were persistent small, but significant, differences in cognitive and achievement outcomes favoring the INT group in the HLBW group. In addition, reported risky behaviors using the Youth Risk Behavior Surveillance System questionnaire were also lower in the INT group (9).

Relevance of IHDP to other early intervention studies

Although there have been a number of studies in lbw/pt infants, almost all have focused on cognitive outcomes. A recent Cochrane review concludes that, on average, these interventions do lead to improvements in cognitive functioning in early childhood (11). However, as noted above, two larger studies (one of which was IHDP) account for much of the average changes in developmental quotients. The review did not address behavior.

For disadvantaged children, there is a substantial body of information. The more successful of these interventions are based on a strong theory of development and a well-defined curriculum. These interventions may be delivered through home visitation or in child development centers, or in combination. Clearly, the former is more likely to involve the child's caretakers, while the latter focus more specifically on the child. Although most interventions have a strong theoretical perspective, the perspectives vary creating even more heterogeneity in the scope and content of the intervention (1).

Nonetheless, replicable findings have emerged. The center-based models followed from the experience of Head Start in the 1960s. Early differences between Head Start

participants and non-participants diminished or vanished early in the school years. Because these comparisons relied on observational data, several groups developed more rigorous designs, including randomized trials, to provide a better estimate of early childhood, largely educational intervention in classroom settings. In general, such approaches resulted in substantial gains on cognitive scores of disadvantaged children at the end of the program (ages 3–4). Less often reported were changes in behavior problem scores, although some studies reported improvements in social-behavioral development (12–14).

Few of these studies report long-term follow-up of behavior. As with IHDP, however, several of these study populations has also revealed better school performance, better work outcomes, less dependency on welfare and less risky behavior, including delinquency (15). In particular, the reduction in crime-related behavior, and especially reduction in jail time contributes substantially to arguments for large returns on investment in early intervention (16).

Home visiting models have recently been reviewed as part of the introduction of such services under the Affordable Care Act (17). Home visiting is a strategy for delivering services, and varies considerably from program to program. These variations include the types of services including child development guidance, assistance with obtaining needed community resources and parental support, as well as the personnel providing the services. The latter generally are trained community health workers, but one prominent approach relies on registered nurses. The variability also contributes to an assessment of adequacy of the delivery model. In the ACA review just over a third of the models met criteria for inclusion under the ACA.

As with the center-based interventions, much of the outcome data focuses on cognitive development. Of the 12 programs meeting criteria, only four provided specific information on behavior problems, and these effects were generally favorable. Another four reported on other measures of social development but not specifically problems. Generally, these were measures such as attachment seen in a single study (17). Few if these studies address long-term behavioral outcomes. In one study at age 18, no behavioral differences were found (18).

Most of these home visiting efforts aim at improving parenting skills in managing early childhood behavior. More recently, there have been efforts to embed these approaches in well child care. The approaches may involve referral for specific behavioral interventions, the inclusion of parenting advice in anticipatory guidance, or the availability

of developmental specialists in the pediatric practice. Individual trials have shown reduction in problematic behaviors (19). However, longer term studies are not available.

Discussion

The first point to note is that behavior, specifically problematic behavior, is not an outcome routinely assessed in the evaluation of early intervention programs. In contrast to cognitive developmental scores, routine assessment of behavior, including measures of positive social-emotional behavior is relatively rare. Moreover, much of the research reviewed in a recent National Academies (19) report deals with school-based interventions and others directed at older children and adolescents. In the early intervention literature, there is not a strong conceptual framework to guide the behaviors to be observed and the appropriate interventions. Thus, the impact of earlier interventions requires further examination.

Second, one of the issues in studying early childhood behavior is the reliance on proxy reporting as noted above. The interpretation of even positive findings is not straightforward. Since the assessment instruments require the respondent to make a judgement about the child's behavior, the basis of that judgement is important. Thus, for example, the effect of early interventions may be to bring the caretaker's assessment more in line with what is normal child development so as not to view the behavior as problematic. There are few readily administered observational measures available to researchers. Using alternative observers is also not straightforward. In IHDP, the correlation of the assessments of the teachers in the developmental centers with that of the mothers was small; whereas, those among the teachers and teacher's assistants was quite substantial (20), in part because the observers (teachers and aids) were observing the child in a setting with quite different behavioral issues than the home.

Some studies do provide evidence of the validity of proxy reporting. In an analysis of those in the National Early Intervention Longitudinal Study, Litt *et al.* (21) found that the intensity of early intervention services in terms of number of sessions and duration, controlling for each six-month assessment, was associated with higher ratings of child functioning by the kindergarten teacher 1–2 years after the end of the intervention. The results provide some support for early intervention having a behavioral effect as assessed by those not involved with the intervention

nor in the routine care of the child. However, this is an observational cohort of a heterogeneous group of children all receiving early intervention services. The extent to which results would differ if the child could report independently is speculative. In unpublished analyses from IHDP, self-report of maternal and youth at age 18 correlated highly both in average scores and the number of behaviors that would be considered problematic. This suggests that the longer term results were not influenced by differences in observers.

Nonetheless, the literature is quite consistent that early intervention, be it based in home-visiting or developmental centers, as well child approaches do reduce the report of problem behaviors in the short term, that is at the end of the intervention. However, none have documented longer term differences in behavior problems due to early intervention. To the extent that behavior problem inventories map onto psychiatric diagnoses, the current experience does not support a direct early intervention effect on later mental health.

However, another consistent finding from the early intervention literature is a reduction in risky behaviors, juvenile delinquency, incarceration and dependence on welfare among those who have had these early programs (9,15,16). Since these outcomes are often correlated with psychiatric morbidity, then an indirect effect can be posited and has been observed in one study (14). The pathway by which these better outcomes occur appears to be through better scholastic achievement as a result of the early intervention, especially avoidance of special educational placement (14).

In summary, early childhood interventions do reduce the rate of reported behavior problems, including among children in whom these behaviors may reflect neurological impairment. This effect is seen in a variety of modalities of early intervention. The effect on behavior problems does not go beyond the intervention period itself, so that it is difficult to conclude that early intervention alters mental health outcomes later in childhood and adolescence. Evidence from trials of early intervention do reveal late (adolescent and young adult) outcomes in terms of less risky behavior, delinquency, incarceration and welfare dependence. In at least one study, these findings are associated with decreased depression. Thus, it would appear that early intervention may have an indirect effect on mental health, largely through greater success in school that leads to improved performance in work and other adult realms. Of particular note, however, is that the effect of early

intervention on mental health has not been systematically examined. There is not a strong theoretical framework for designing interventions nor longitudinal experience with the effect of well-designed trials on mental health. Clearly a research agenda is needed.

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Footnote

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References

- Shonkoff JP, Meisels SJ, Zigler EF. Handbook of Early Childhood Intervention. Second edition. Cambridge University Press, 2000.
- Shonkoff JP, Phillips D. From Neurons to Neighborhoods: the Science of Early Childhood Development. Washington: National Academies Press, 2000.
- Achenbach System of Empirically Based Assessment (ASEBA). Accessed June 28, 2020. Available online: <https://aseba.org/wp-content/uploads/catalog-1.pdf>
- National Academies of Sciences E, Medicine. Vibrant and Healthy Kids: Aligning Science, Practice, and Policy to Advance Health Equity. Washington, DC: The National Academies Press, 2019.
- McCormick MC, Litt JS, Smith VC, et al. Prematurity: an overview and public health implications. *Annu Rev Public Health* 2011;32:367-79.
- McCormick MC, Litt JS. The Outcomes of Very Preterm Infants: Is It Time to Ask Different Questions? *Pediatrics* 2017;139:e20161694.
- Gross RT, Spiker D, Haynes C. Helping Low Birth Weight Premature Babies: the Infant Health and Development Program. Palo Alto, CA: Stanford University Press, 1997.
- McCormick MC, McCarton C, Brooks-Gunn J, et al. The Infant Health and Development Program: interim summary. *J Dev Behav Pediatr* 1998;19:359-70.
- McCormick MC, Brooks-Gunn J, Buka SL, et al. Early intervention in low birth weight premature infants: results at 18 years of age for the Infant Health and Development Program. *Pediatrics* 2006;117:771-80.
- McCormick MC, McCarton C, Tonascia J, et al. Early educational intervention for very low birth weight infants: results from the Infant Health and Development Program. *J Pediatr* 1993;123:527-33.
- Spittle A, Orton J, Anderson P, et al. Early developmental intervention programmes post-hospital discharge to prevent motor and cognitive impairments in preterm infants. *Cochrane Database Syst Rev*. 2012;12:CD005495.
- Guralnick MJ. Effectiveness of early intervention for vulnerable children: a developmental perspective. *Am J Ment Retard* 1998;102:319-45.
- Barnett WS. Long-term effects of early childhood programs on cognitive and school outcomes. *Future Child* 1995;5:25-50.
- Reynolds AJ, Mondi CF, Ou SR, et al. Generative mechanisms of early childhood interventions to well-being. *Child Dev* 2017;88:378.
- Yoshikawa H. Long-term effects of early childhood programs on social outcomes and delinquency. *Future*

- Child 1995;5:51-75.
16. Perry Preschool Project. Accessed 9/20, 2020. Available online: <https://highscope.org/perry-preschool-project/>
 17. HomeVEE. Department of Health and Human Services, Agency for Children and Families, 2019.
 18. Kitzman H, Olds DL, Knudtson MD, et al. Prenatal and Infancy Nurse Home Visiting and 18-Year Outcomes of a Randomized Trial. *Pediatrics* 2019;144:e20183876.
 19. Boat TF, Kelleher KJ. Fostering Healthy Mental, Emotional, and Behavioral Development in Child Health Care. *JAMA Pediatr* 2020;174:745-6.
 20. Spiker D, Kraemer HC, Constantine NA, et al. Reliability and validity of behavior problem checklists as measures of stable traits in low birth weight, premature preschoolers. *Child Dev* 1992;63:1481-96.
 21. Litt JS, Glymour MM, Hauser-Cram P, et al. Early Intervention Services Improve School-age Functional Outcome Among Neonatal Intensive Care Unit Graduates. *Acad Pediatr* 2018;18:468-74.

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