

DOCUMENT RESUME

ED 039 682

40

EC 005 714

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TITLE Educational and Behavioral Sequelae of Prenatal and Perinatal Conditions. Interim Report No. 3.
INSTITUTION Minnesota Univ., Minneapolis. Dept. of Special Education.
SPONS AGENCY Office of Education (DHEW), Washington, D.C. Bureau of Research.
BUREAU NO BR-6-1176
PUB DATE Sep 69
GRANT OEG-32-33-0402-6021
NOTE 13p.

EDRS PRICE MF-\$0.25 HC-\$0.75
DESCRIPTORS Academic Achievement, Behavior, *Exceptional Child Research, Followup Studies, *Handicapped Children, *Infancy, Medical Case Histories, *Medical Research, Pregnancy, *Prenatal Influences
IDENTIFIERS Collaborative Perinatal Research Project

ABSTRACT

The Educational Followup Study, a longitudinal investigation, is described. Concerned with at least 30,000 of the 50,000 children born into the Collaborative Perinatal Research Project, the study will determine pregnancy, birth, and infancy events likely to lead to educational and behavioral dysfunctions. Procedures to be used are reviewed. (JD)

INTERIM REPORT #3

Project No. 6-1176

Grant No. OEG-32-33-0402-6021

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PRENATAL AND PERINATAL CONDITIONS

September 1969

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education

Bureau of Research

ED039682

EC005714E

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September 1969

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The Research reported herein was performed pursuant to a grant from the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of this project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

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Educational and Behavioral Sequelae of
Prenatal and Perinatal Conditions*

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For many years people in education, psychology, and medicine have speculated about the antecedents of mental retardation, learning disabilities, personality disorders and similar educational and behavioral problems. Recently, investigations have produced evidence to support the hypothesis that behavioral and school achievement difficulties are related to specific anomalies occurring in pregnancy, birth, and infancy. Through the 1950's and up to the present time, a group at Ohio State University alone has produced a substantial number of research papers relating maternal and fetal factors to a variety of disorders (9, 10, 11, 12, 16, 17). Out of this work, Pasamanick and Lilienfeld have developed what they have come to call a "continuum of reproductive casualty" extending from fetal death through a descending gradient of neurological impairment manifested by cerebral palsy, epilepsy, mental deficiency, behavior disorders, and reading disability (9). In more recent years, the relationship of anomalies of pregnancy and birth with school learning disabilities and behavioral disorders has been supported by other studies as well (4, 15, 18).

However, with few exceptions, the studies thus far reported have selected samples on the basis of an established handicap or behavioral characteristic and then looked for peculiarities reported in the records of the sample subjects.

* This study is supported by the United States Office of Education Bureau for Handicapped Children under research grant #OEG-32-33-0402-6021 to the Department of Special Education, College of Education, University of Minnesota, Minneapolis 55455; Principal Investigators are Bruce Balow, John A. Anderson, and Maynard C. Reynolds; Rosalyn Rubin is Project Assistant Director. This is project report #03.

The sources of error inherent in such retrospective investigations are unavoidable but nonetheless serious. The sampling process introduces unknown biases; the records contain measurements and observations obtained under widely varying conditions, with little uniformity even in the types of observations made; and the deciphering of the recorded statements is frequently done years later by nonprofessional help.

The study to be described here mitigates these problems, to a large extent, because the observations and measurements obtained during pregnancy, birth, and infancy were made especially for research purposes by examiners trained for uniform measurement of the particular items involved. The data were then immediately transferred to punch cards for research purposes.

Before describing the foundation upon which the present study builds, it should be pointed out that several investigations utilizing a prospective design have compared children of low birth weight (premature birth) and various other complications at birth with normal controls (5, 6, 14, 19). Drillien (5) included educational data in her follow-up observations, but the others did not. Graham (6) found a greater incidence of intellectual, personality, and motor defects among the "experimental" subjects while Drillien (5), McDonald (14) and Stechler (19) all obtained results which varied with age of subjects, socio-economic level or specific birth condition.

In summary, there is good reason to hypothesize an influence on behavior and school achievement by difficulties of pregnancy, birth and infancy. Survey studies of several different design types generally support the hypothesis but contain sources of serious error, have quite limited sampling, or do not pursue subjects into the school years. The investiga-

tions to be described is an attempt to test the hypothesis in a prospective design which reduces the sources of error to a minimum for this type of study.

Prenatal and Perinatal Data

The foundation for the educational and behavioral follow-up study is provided by the Collaborative Project for the Study of Cerebral Palsy, Mental Retardation, and other Neurological and Sensory Disorders of Childhood--most commonly referred to as the Collaborative Perinatal Research Project. It represents the joint efforts of 12 medical centers (11 of which are in the eastern half of the United States) together with the National Institute of Neurological Diseases and Blindness. Following five years of planning activity between 1954 and 1959, the Perinatal Research Project began collection of data in January of 1959. The University of Minnesota and University of Oregon Hospitals are participants in the Perinatal Project and thus have research data, gathered in a prospective design, on conditions of pregnancy, birth, and developmental history of approximately 6000 children, about 700 of whom are now coming of school age each year.

The main purpose of the Collaborative Perinatal Project was to investigate the relationships among factors and conditions affecting parents (especially mothers) and the occurrence and course of abnormalities in their children, with special attention to sensory and neurological difficulties. The Collaborative Study is almost entirely a medical project in which elements of physical medicine are given the primary attention. While limited psychological information has been obtained, more extensive speech, language and hearing data have been gathered. Gross information is also obtained on socioeconomic and educational factors.

The original sample was to be 50,000 pregnancies encountered at the 12

collaborating hospitals in the years 1959 through 1965. Data are to be gathered on the offspring of these pregnant women for eight years following birth. It is expected that the long term follow-up of at least 30,000 children will be possible from the original sample of 50,000 pregnancies.

The study of the mother includes a vast amount of detail on medical history, physical examinations and laboratory tests, examination at labor and delivery, observations of the progress and complications of labor and delivery, and observations of anesthesia. Additionally, genetic and socioeconomic data are gathered during pregnancy. Blood studies, examination of the placenta and, where pregnancy results in fetal death, pathological post-mortem examination is made.

Studies of the child include the observation of the immediate neo-natal period, pediatric examinations in the nursery and neurological examination in the nursery, laboratory studies during the neonatal period, and regular physical examinations at specified periods throughout the years of infancy. These include neurological, physical and psychological examinations. At three and four years of age representative psychological and speech, language and hearing information is gathered on the child. A final, relatively comprehensive, examination is made at seven to eight years of age to provide an ending checkpoint in neurology, pediatrics, psychology, speech and audiology.

This is a very large and complicated pool of data which is quite strong at perinatal medical points and somewhat weak in socioeconomic, functional and descriptive records of life events, psychology, and educational data. However, even with those minor caveats this foundation data provides an unprecedented opportunity to obtain evidence on some of the problems of etiology in many areas of exceptionality.

The Educational Follow-Up Study

The Educational Follow-Up Study, financed by the U.S. Office of Education, begins to gather data on the children at four years of age and follows them yearly from that point on, thus overlapping with the Collaborative Study during the

years from four to seven. The intent is to follow the youngsters at least through the elementary school years. Currently, the University of Minnesota and the University of Oregon* are engaged in coordinated efforts to obtain identical measures on the children being followed. This paper will describe only the Minnesota part of the follow-up, however the general statements pertain equally to the Oregon part of the study for the most part.

Objectives

In broad terms the objectives of the Educational Follow-Up Study are:

1. To assess the relationships of prenatal and perinatal conditions with school achievement and school behavior. We want to find out the limiting effect, if any, of early physical anomalies on readiness for learning of school skills and on the learning of those skills with readiness level controlled; to find the antecedents of such gross problems as mental deficiency, learning disability, speech handicap, behavior disorders and other categories of handicap; and to try to obtain information regarding the efficacy of symptom treatment in schools for various categories of exceptionality.
2. To establish effective instruments and procedures as a prototype for others of the 12 hospitals with data from the Collaborative Study.

Procedures

The Educational Follow-Up Study is currently gathering data on children and their parents throughout the States of Minnesota and Oregon. All children born into the Collaborative Perinatal Project at the University of Minnesota Hospitals or the University of Oregon Hospitals since the inception of the Collaborative Project in 1959 are potential subjects for the follow-up. However, between birth and four years of age many of the original subjects leave the state,

*The University of Oregon project is directed by John Isom, M.D., University of Oregon Medical School, Portland, Oregon 97201.

or for other reasons cannot be included in the follow-up, reducing the sample somewhat.

As each Follow-Up study child reaches pre-kindergarten age (4-0 to 4-11), specially trained educational examiners visit the child in his home and individually administer a battery of tests, including the Illinois Test of Psycholinguistic Abilities (ITPA) [McCarthy and Kirk, 1961]. is a measure of language development, and tests of school readiness such as the Metropolitan Readiness Tests (Hildreth, et al., 1965). This same battery of tests is readministered at pre-first grade age (5-0 to 5-11). In addition to testing the children each mother is interviewed to help determine the type of learning environment provided by the home. Parental attitudes toward various child-rearing practices are explored, information is obtained regarding the amount and types of reading material in the home, the use of television, and the child's interests and favored play activities. Information is also obtained regarding the reading skills of other family members, both parents and siblings, and a brief word pronunciation test is administered to the mother.

By September, 1968, the initial battery of tests had been administered to 1240 subjects in Minnesota alone, and approximately one-half of this group had been tested at both pre-kindergarten and pre-first grade ages. Interviews had been conducted with 96 per cent of the mothers of these children. As the children born in succeeding years reach pre-kindergarten age they too will be tested and their scores added to the Educational Follow-Up Study data pool.

Every year classroom teachers of study children from kindergarten through the elementary grades, are asked to rate the subjects on the School Behavior Profile (Balow, 1965), a descriptive checklist covering such areas as language and thought, intrapersonal behavior, and problem behavior. Data on school progress is also obtained through a review of the cumulative records to determine patterns of school attendance, involvement of special services such as psychological, medical, or speech help, and possible retention or special class placement.

Reading achievement tests are administered at the conclusion of each school year, beginning with first grade, to aid in determining the amount of academic progress being made. The full schedule of measures and observations planned through the elementary school years is found in Table 1.

Initial analysis of the data is underway in an effort to assess the influence of various types of prenatal and perinatal events on school progress and behavior. Beyond extensive analysis of the early medical data in relation to educational outcomes, plans for the future include exploration of a variety of interactions of medical history, home environment, school readiness, and the record of school events at important junctures in school life.

Summary

The Educational Follow-Up Study is a long term, longitudinal investigation of the educational progress and behavior of children born into the Collaborative Perinatal Research Project. Thus it follows a prospective design. Primary interest is directed at pregnancy, birth, and infancy

Table 1

Minnesota-Oregon Educational Follow-Up Coordinated Research
Project Tests Administered to the Children

Pre-Kindergarten:	During Kindergarten:
<ol style="list-style-type: none"> 1. ITPA 2. Metropolitan Readiness 3. Family Environment Interview 4. Print name and any other words or letters known 	<ol style="list-style-type: none"> 1. School Behavior Profile 2. School Record Review (Special services, attendance, etc.)
Pre-First Grade:	During First Grade:
<ol style="list-style-type: none"> 1. ITPA 2. Metropolitan Readiness 3. Piaget Right-Left 4. If not done earlier, Family Environment Interview and M-F Scale 	<ol style="list-style-type: none"> 1. School Behavior Profile 2. Stanford Reading Achievement (Teacher administered) 3. School Record Review
Pre-Fourth Grade:	During Fourth Grade:
<ol style="list-style-type: none"> 1. Birch Tap Patterns 2. Piaget Right-Left 3. Auditory Syllable Sequencing 4. Stanford Achievement Tests 5. Ten-minute Written Composition 	<ol style="list-style-type: none"> 1. Stanford Reading Achievement (Teacher administered) 2. School Behavior Profile 3. School Record Review
Pre-Seventh Grade:	During Sixth Grade:
<ol style="list-style-type: none"> 1. Same as Fourth Grade 	<ol style="list-style-type: none"> 1. School Behavior Profile 2. School Record Review (Special services, attendance, etc.)
<hr/> Separate Tests: Pre-First Grade (Oregon)	
<ol style="list-style-type: none"> 1. Bender Visual Motor Gestalt 2. Neurological Exam 	

events that are likely to lead to educational handicaps and to educational disabilities and dysfunctions that suggest the probability of anomalous events in the perinatal period. The oldest study subjects are currently in the primary grades of school; all subjects are tested yearly, beginning at four years of age, with a variety of educational measures.

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