

# Early Childhood Longitudinal Study, Birth Cohort (ECLS-B)

Website: <http://nces.ed.gov/ecls/birth.asp>

Updated: May 2017

## 1. OVERVIEW

The Early Childhood Longitudinal Study (ECLS) program is one of the active longitudinal surveys sponsored by NCES. The ECLS program includes three cohorts: a birth cohort and two kindergarten cohorts (the kindergarten class of 1998–99 and the kindergarten class of 2010–11). The birth cohort study (ECLS-B) followed a sample of children born in 2001 from birth through kindergarten; the first kindergarten study (ECLS-K) followed a sample of children who were in kindergarten in the 1998–99 school year through the eighth grade; and the second kindergarten study (ECLS-K:2011) is following a sample of kindergartners in the 2010–11 school year through the fifth grade. The ECLS provides comprehensive and reliable datasets with information about the ways in which children are prepared for school and how children develop within their family, early childhood, and school environments.

### Purpose

The ECLS provides national data on (1) children’s status at birth and at various points thereafter; (2) children’s transitions to nonparental care, early education programs, and school; and (3) children’s experiences and growth through the eighth grade. These data enable researchers to test hypotheses about the associations and interactions of a wide range of family, school, community, and child characteristics with children’s development, early learning, and performance in school.

### Components

The ECLS has three cohort studies—two *kindergarten* cohort studies (ECLS-K and ECLS-K:2011) and a *birth* cohort study (ECLS-B)—and each of these has its own components. This chapter describes the *birth* cohort study, ECLS-B. For details on the first *kindergarten* cohort study, see the handbook chapter for ECLS-K. Details on the 2011 *kindergarten* cohort study can be found in the ECLS-K:2011 handbook chapter.

**The Early Childhood Longitudinal Study, Birth Cohort.** The ECLS-B, which began in October 2001, was designed to study children’s early learning and development from birth through the fall of the kindergarten year. Over the course of the study, data were collected from multiple sources, including birth certificates, children, parents/guardians, nonparental care providers, and teachers. Data from the Common Core of Data (CCD) and the Private School Survey (PSS) were linked to provide information for the schools where the children attended kindergarten. These components are described below.

**Birth certificates.** These records provided information on the date of birth, child’s sex, parents’ education, parents’ race and ethnicity (including Hispanic origin), mother’s marital status, mother’s pregnancy history, prenatal care, medical and other risk factors during the pregnancy, complications during labor and birth, and child’s health characteristics at birth (such as congenital anomalies, abnormal conditions of the baby, and the baby’s Apgar score).

### EARLY CHILDHOOD LONGITUDINAL SAMPLE SURVEYS: BIRTH COHORT

ECLS-B collects data from:

- Children
- Parents/guardians
- Child care providers and preschool teachers
- Kindergarten teachers

*Parent/guardian interviews.* A parent/guardian interview was conducted in the children's home at each data collection point to capture information about the children's early health and development, their experiences with family members and other significant people in their lives, the parents/guardians as caregivers, the home environment, and the neighborhood in which they lived. In most cases, the parent/guardian interviewed was the child's mother or female guardian.

*Child assessments.* Beginning at 9 months, children participated in activities designed to measure important developmental skills in the cognitive, socioemotional, and physical domains.

*Cognitive domain.* The cognitive assessments at the 9-month and 2-year data collections assessed general mental ability, including problem solving and language acquisition. The Bayley Short Form-Research Edition (BSF-R), designed specifically for the ECLS-B, was utilized in the 9-month and 2-year data collections and consists of selected items from the Bayley Scales of Infant Development (BSID-II).

The cognitive assessments at the preschool, kindergarten 2006, and kindergarten 2007 data collections assessed early reading and mathematics and consisted of items from the ECLS-K as well as other studies and instruments. Color knowledge also was assessed in the preschool data collection.

*Socioemotional domain.* The Nursing Child Assessment Teaching Scale (NCATS) was used in the 9-month collection to assess child-parent interactions. An attachment rating, the Toddler Attachment Sort-45 (TAS-45), was used in the second round of data collection. A videotaped parent-child interaction (the Two Bags Task) was also used in the second and third rounds of data collection.

*Physical domain.* In the 9-month data collection, children's height, weight, and middle upper arm circumference were measured. Additionally, a measure of head circumference was taken for children born with very low birth weight. These physical measures were obtained again at all follow-up data collections. Additionally, children's fine and gross motor skills were assessed at all data collections. At the 9-month and 2-year collections, motor skills were assessed using the BSF-R motor scale. At the preschool, kindergarten 2006, and kindergarten 2007 collections an assessment was specifically designed for the ECLS-B, in part using items adapted from the Early Screening Inventory-Revised (ESI-R) and the Bruininks-Oseretsky Test of Motor Proficiency (BOT).

*Nonparental care and education providers.* Individuals and organizations that provided regular care for a child were interviewed with the permission of the child's parent/guardian. The care providers were asked about their backgrounds, teaching practices and experience, the children in their care, and children's learning environments. This information was collected from the 2-year data collection on. In the kindergarten 2006 and 2007 collections, a wrap-around early care and education provider interview was used for those children who were in kindergarten and had a before- or after-school care arrangement.

*Teacher questionnaires and school data.* Once the children entered kindergarten, their classroom teachers provided information on their classrooms and on children's cognitive and social development. Information for the school each child attended was obtained from NCES's school universe data files—the Common Core of Data (CCD) for public schools and the Private School Universe Survey (PSS) for private schools.

*Father questionnaires.* Fathers (both resident and nonresident fathers) completed a self-administered questionnaire, which asked questions about the particular role fathers play in their children's lives. The questionnaires collected information about children's well-being, the activities fathers engage in with their children, and key information about fathers as caregivers. Both resident and nonresident father questionnaires were included in the collections when the children were 9 months old and 2 years old. The resident father questionnaire was included in the preschool collection. No father questionnaires were included in the kindergarten collections.

### **Periodicity**

The ECLS-B collected data when the children were about 9 months old (2001–02), about 2 years old (2003), about 4 years old (the preschool collection, 2005), and in kindergarten (2006 and 2007). Note that because of age requirements for school entry, children sampled in the ECLS-B entered kindergarten in two different school years. All study children were included in the kindergarten 2006 collection, regardless of their enrollment status or grade in school. The kindergarten 2007 collection included just a portion of the total ECLS-B sample: children who were not yet in kindergarten in the 2006 collection, children who were in kindergarten in the 2006 collection and were repeating kindergarten in the 2007 collection, and twins of children in these groups. The ECLS-B study ended with the kindergarten 2007 round of collection.

## 2. USES OF DATA

The ECLS-B provides descriptive data on children's health status at birth; children's experiences in the home, nonparental care, and school; and children's development and growth through kindergarten. The data collected in the ECLS-B can be used to explore the relationships between children's developmental outcomes and characteristics of their family, health care, nonparental care, school, and community. The longitudinal nature of the study enables researchers to study children's physical, social, and emotional growth and to relate trajectories of growth and change to variations in children's experience.

## 3. KEY CONCEPTS

**Item Response Theory (IRT) scale scores.** The ECLS-B direct cognitive assessment employed a two-stage design. As such, within any given domain, children received a routing set of items (stage 1) and then, based on their performance on the routing items, proceeded to a second set of items of a certain difficulty level (stage 2). Because not all children received all items, the assessment scores were modeled using Item Response Theory (IRT). Based on children's performance on the items they received, an ability estimate (theta) was derived for each domain. The IRT scale scores represent estimates of the number of items children would have answered correctly if they had received all of the scored questions in a given content domain. They are useful in identifying cross-sectional differences among subgroups in overall achievement levels and provide a summary measure of achievement useful for correlational analysis with status variables. The IRT scale scores are also used as longitudinal measures of overall growth. Gain scores may be calculated by subtracting children's scale scores at two points in time.

**Standardized scores (T-scores).** These scores are IRT based and derived from the child's ability estimate theta. They provide norm-referenced measurements of achievement; that is, estimates of achievement level relative to the population as a whole. A higher mean T-score for a particular subgroup indicates that the group's performance was high in comparison to that of other groups. A change in mean T-scores over time reflects a change in the group's status with respect to that of other groups.

**Race/ethnicity.** Office of Management and Budget guidelines for collecting information on race and ethnicity were followed. A respondent could select one or more of five dichotomous race categories when reporting their own race or that of their child. Each

respondent additionally had to identify whether he or she (as well as the study child if the respondent was a parent) was Hispanic. The study data files include several variables indicating race and ethnicity. There are six dichotomous race variables indicating whether a respondent or study child was of a certain race (White, Black, Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, and more than one race) as well as one dichotomous ethnicity variable indicating whether a respondent or study child was Hispanic. These variables were used to create one race/ethnicity composite variable with mutually exclusive categories: White, not Hispanic; Black, not Hispanic; Hispanic of any race; Asian, not Hispanic; Native Hawaiian or Other Pacific Islander, not Hispanic; American Indian or Alaska Native, not Hispanic; and Two or more races, not Hispanic.

**Socioeconomic status (SES).** For the 9-month through kindergarten 2006 rounds of data collection, the ECLS-B includes a measure of SES reflecting the SES of a child's household at the time of data collection. The components used to create the SES variable are father/male guardian's education, mother/female guardian's education, father/male guardian's occupational prestige, mother/female guardian's occupational prestige, and household income. In households with two mothers or two fathers, education and occupational prestige for both mothers/fathers were used. Each parent's occupation was scored using the average of the 1989 GSS prestige scores for the 2000 census occupational category codes that correspond to the ECLS-B occupation.

## 4. SURVEY DESIGN

### Target Population

The ECLS-B is nationally representative study of children born in the United States in 2001.<sup>1</sup>

### Sample Design

The ECLS-B followed a nationally representative sample of children born in 2001 from the time the children were about 9 months old through their kindergarten year.

**Base-year (i.e., 9-month) data collection.** The ECLS-B sampled approximately 14,000 babies born in 2001,

<sup>1</sup> The ECLS-B target population excludes children who were born to mothers younger than age 15 and children who died or were adopted prior to the 9-month home visit. Over time, the target population excludes children who died or moved abroad permanently.

yielding approximately 10,700 completed cases in the 9-month collection. The sample included children from different racial/ethnic and socioeconomic backgrounds. Chinese children, other Asian/Pacific Islander children, children born with moderately low birth weight (1,500–2,500 grams), children born with very low birth weight (under 1,500 grams), and twins were oversampled. There was also a special supplemental component to oversample American Indian/Alaska Native (AI/AN) children.

The ECLS-B is based on a multi-stage sampling design. Births were sampled within a set of primary sampling units (PSUs) and in some cases secondary sampling units (SSUs) in order to control data collection costs. The PSUs were MSAs, counties, or groups of counties. Among the 96 sampled PSUs, 24 were large enough to be selected with certainty. The remaining PSUs were selected from groups of PSUs that were stratified by census region; MSA status; minority status (high/low); median income (high/low); and a composite measure of size, which was the expected number of births in 2001 in the PSU. Two PSUs were selected per stratum with the probability of selection proportional to size, a function of the expected number of births occurring within the PSU in 2001.

Births were sampled by place of occurrence, rather than by place of current residence. Within the sampled PSUs, children born in the year 2001 were selected by systematic sampling from registered births in the National Center for Health Statistics vital statistics record system. The sample was selected on a flow basis, beginning with January 2001 births (who were first assessed 9 months later, in October 2001). Approximately equal numbers of infants were sampled in each month of 2001. Different sampling rates were used for births in different subgroups, as defined by race/ethnicity, birth weight, and plurality (that is, whether or not the sampled newborn was a twin).

The sample of AI/AN newborns drew from an additional 18 PSUs selected from a supplemental frame consisting of areas where the population had a higher proportion of AI/AN births. These PSUs were located in the western region of the United States. Six of the PSUs were selected with certainty. The noncertainty PSUs were selected independently of the core sample PSUs, with the probability of selection proportional to the number of AI/AN births.

Due to state-imposed operational restrictions and required active consent procedures, certain sampled PSUs had low expected response rates. For states where expected response rates were only slightly lower than planned, a larger sample was selected in order to

achieve adequate numbers of respondents. Substitutions were made for PSUs in states where very low response rates were expected. The original PSU was matched with potential substitute PSUs on the criteria of median income; percentage of newborns in poverty; percentage of newborn Black, Hispanic, and other race/ethnicity children; population density; and birth rate. AI/AN PSUs also were matched on tribal similarity. Sampling rates from the original PSU were applied within the substitute PSU to obtain the original expected yield. A total of seven PSUs were used as substitutes for the original ECLS-B PSUs. Also, in two instances, an alternative frame was used to draw a sample of births occurring within PSUs with enrollment restrictions. Specifically, birth records were selected directly from hospital lists of births in counties that defined these original PSUs.

For the 9-month collection, approximately 14,200 children were eligible,<sup>2</sup> and approximately 10,700 participated.

*Two-year collection.* Only cases with a completed 9-month parent interview (about 10,700) were eligible for inclusion in the 2-year data collection. However, from that 10,700, about 100 cases where the child had died or moved abroad permanently between the 9-month and 2-year rounds were considered ineligible. There was no further sampling of cases. Approximately 9,850 cases participated (i.e. had a completed parent interview) in the 2-year data collection.

*Preschool collection.* All 9,850 cases with a complete 2-year parent interview and an additional 50 AI/AN cases who participated in the 9-month collection but not in the 2-year collection were fielded and considered eligible for the preschool data collection, with the exception of approximately 100 cases in which children had died or moved permanently abroad between the 2-year round and the preschool round. Approximately 8,950 cases participated (i.e., had a completed parent survey) in the preschool data collection.

*Kindergarten 2006 collection.* For budgetary reasons, the kindergarten 2006 data collection followed a reduced sample (approximately 85 percent) of children who were eligible for the round. The subsample was allocated disproportionately to certain race/ethnicity, birth weight, and plurality domains to maintain larger sample sizes for the smaller domains. AI/AN children and Chinese children who were eligible were included

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<sup>2</sup> Because the ECLS-B data are restricted-use only, the numbers provided in this section for the ECLS-B are all rounded to the nearest 50.

with certainty in the kindergarten 2006 subsample. Eligible children were those with a complete parent interview at all of the prior rounds (9 months, 2 years, and preschool) and children sampled in the AI/AN domain with a complete parent interview for the 9-month round and at least one of the 2-year or preschool rounds. AI/AN children who did not have a complete parent interview for either the 2-year or preschool rounds were not included in the kindergarten 2006 round. In addition, children who were identified as ineligible because they had died or moved out of the United States were not included in the kindergarten 2006 data collection.

After subsampling, approximately 7,700 children were eligible for the kindergarten 2006 wave and about 7,000 participated (i.e., had a completed parent survey).

*Kindergarten 2007 collection.* The kindergarten 2007 data collection included a subset of the ECLS-B sample children with a completed parent interview at kindergarten 2006 and who met one of the following conditions: the child had not started kindergarten at the time of the kindergarten 2006 data collection; the child was the twin of a child who had not started kindergarten at the time of the kindergarten 2006 data collection; the child was in kindergarten during the kindergarten 2006 data collection and repeating kindergarten in school year 2007–08; or the child was the twin of a child who was repeating kindergarten in school year 2007–08.

Of the 7,000 cases that participated in the kindergarten 2006 collection, based on the aforementioned criteria, about 2,050 were eligible for the kindergarten 2007 collection (1,770 as first time entering school and 280 as likely repeating kindergarten) and approximately 1,900 participated (i.e., had a completed parent interview).

### Assessment Design

The ECLS-B direct child assessment in the 9-month and 2-year data collections relied on instruments considered “gold standards” in the field. However, adaptations were necessary to take these instruments from a laboratory or clinical setting to a home setting. The preschool and kindergarten direct cognitive assessments, which primarily focused on early academic skills and knowledge in reading and mathematics, drew items from the ECLS-K cognitive assessments, as well as well-established standardized assessments such as the Peabody Picture Vocabulary Test, Third Edition (PPVT-III). All of the ECLS-B child assessments were designed for ease of and flexibility in administration while at the same time being psychometrically and substantively sound.

➤ *Cognitive development and fine and gross motor skills:* The Bayley Scales of Infant Development, Second Edition (BSID-II) is considered a gold standard for assessing early childhood development from ages 1 to 42 months. In the 9-month and 2-year collections, children’s cognitive development, memory, means-end behavior, exploratory competence, object permanence, expressive communication, and receptive communication were assessed using an adaptation of the mental scale of the BSID-II. Children were observed doing specific things such as exploring objects and looking at picture books, and their production of vowel-consonant combinations was noted. Fine and gross motor skills were assessed using an adaptation of the motor scale of the BSID-II. Children were observed doing specific things such as grasping small objects, crawling, and walking. The study had intended to field the entire BSID-II assessment, as it was originally expected to take about 20 minutes to complete. However, a field test for the 9-month data collection revealed that the full BSID-II took too long and was too cumbersome for administration in a nonclinical setting. As a result, modifications were made to the original BSID-II. The ECLS-B data collection contractor worked with experts to identify a reduced item set, referred to as the Bayley Short Form-Research Edition (BSF-R), that could be administered in less time and could produce reliable, valid scores equivalent to the full set of Bayley items. The BSF-R took approximately 25 minutes to administer. Because the BSF-R was not appropriate for children older than 42 months of age, a new direct child cognitive assessment was developed for use in the preschool and kindergarten collections. These assessments were patterned after the ECLS-K assessments and incorporated items from the ECLS-K, as well as other published assessments, such as the *preLas* 2000, Test of Early Mathematics Ability, Third Edition (TEMA 3), and the PPVT-III. The cognitive domains covered in the preschool-kindergarten assessments were early reading and mathematics skills. The preschool collection also included a measure of children’s color knowledge, which involved asking the children to name the colors of each bear presented to them in picture format. Children’s fine and gross motor skills at preschool and kindergarten were measured using an assessment specifically designed for the ECLS-B, in part using items adapted from the Early Screening Inventory-Revised (ESI-R) and the Bruininks-Oseretsky

Test of Motor Proficiency (BOT). To assess fine motor skills, children were asked to copy a series of forms (e.g., circle, triangle, square) that were first drawn by an assessor and to build a structure with blocks that was first demonstrated by the assessor. To assess gross motor skills, children were asked to hop, skip, jump forwards, walk backwards, balance on one foot, and catch a beanbag tossed to them by the assessor.

- *Socioemotional development:* The Two Bags Task was used in the 2-year and preschool data collections to measure socioemotional development. The Two Bags Task is a simplified version of the Three Bags Task that was used successfully in such large-scale studies as the Early Head Start Research and Evaluation Project and is intended to capture children's socioemotional functioning. It is a semistructured activity completed by the parent and child in interaction. During this 10-minute task, the parent-child dyad was asked to play with two different sets of toys, each placed within a separate numbered bag. In the 2-year collection, bag number 1 contained a children's picture book and bag number 2 contained a set of dishes. In the preschool collection, bag number 1 also contained a children's picture book but bag number 2 contained PlayDoh. The rating scales derived from the Two Bags Task provide information on parents' behaviors during the interaction (parental sensitivity, intrusiveness, simulation of cognitive development, positive regard, negative regard, and detachment) and children's behaviors during the interaction (child engagement of parent, sustained attention, and negativity toward parent).

In the preschool and kindergarten collections, information on children's socioemotional functioning was collected indirectly through questions asked of parents and teachers.

- *Children's security of attachment:* The TAS-45 is a modified version of the Attachment Q-Sort (AQS), a widely used observational measure of children's security of attachment. It includes 45 items describing children's behaviors. After being in the home with the child and parent for several hours, the ECLS-B assessors completed a task in which they indicated whether each of the 45 selected behaviors applied to the child and how strongly the behavior either applied or did not apply, based upon their observations of the child in the home. These items/behaviors

cluster around common attachment-related constructs, such as "cooperativeness," "independence," or "attention-seeking." Nine clusters, or "hot spots," were identified in the data. These hot spots, along with a traditional attachment classification (Avoidant, Secure, Ambivalent, and Disorganized) and traditional security and dependency scores were developed from the TAS-45. The TAS-45 was only administered in the 2-year data collection.

### Data Collection and Processing

The ECLS-B compiled data from multiple sources, including administrative records, children, children's parents/guardians, nonparental care providers, teachers, and NCES school universe files. Data collection began in 2001 and continued through 2008. The primary mode of data collection was in person, with a home visit during which parent respondents were interviewed and children were directly assessed. Self-administered questionnaires and telephone interviews also were used to collect data. Westat was the 9-month and 2-year data collection contractor. RTI International conducted the preschool and kindergarten data collections.

*Reference dates.* For the ECLS-B, baseline data were collected from October 2001 through December 2002.

*Data collection.* In the fall of 1999, a field test of the ECLS-B instruments and procedures was conducted. The study design that was tested involved numerous tasks and, early in the field test, it was determined that while separately no one task was difficult the total data collection protocol was complex. It was necessary to simplify these tasks in order to reduce the burden on field staff and to ensure the reliable and valid administration of all tasks. As a result, several modifications were made to the original data collection design.

In September 2000, a second field test of the ECLS-B instruments and procedures began. A field test sample consisting of 1,060 children born between January and April 2000 was drawn. Home visits were conducted when the children were 9 months old and again when they were 18 months old. Results from this field test indicated that the changes to the design that resulted from the first field test were successful.

The ECLS-B design called for information to be gathered on the children and from the parents during an in-home visit. The children's mother or primary caregiver was the respondent for the parent interview at each round of data collection. Child assessments were conducted in the child's home by trained assessors at every round of data collection as well. Resident fathers (defined as the spouse or partner of the female parent

respondent) were asked to complete a self-administered questionnaire with questions regarding their involvement in their children's lives in the 9-month, 2-year, and preschool data collections. Biological, non-resident fathers were asked to complete a self-administered questionnaire in the 9-month and 2-year data collections if the mother gave permission for these fathers to be contacted. In the 2-year and preschool data collections, information was collected from children's primary nonparental care providers through a telephone interview. In these two rounds, direct observations to assess child care quality also were conducted by trained observers for a subsample of children with regular nonparental care. In the kindergarten 2006 collection, the child care provider telephone interview used in the preschool collection was again fielded for children who had not yet entered kindergarten. A wrap-around care and education provider (WECEP) telephone interview was introduced in this collection to obtain information on children's before- and after-school care arrangements for those children who were in kindergarten. The WECEP interview was used in the kindergarten 2007 collection as well. Observations of care settings were not conducted in the kindergarten collections. Teachers of children in kindergarten in 2006 and 2007 were asked to complete a self-administered questionnaire similar to those used in the ECLS-K that asked about the child's classroom, the child's behaviors and performance in the classroom, and their own background. Although the ECLS-B did not include a school administrator questionnaire, information on children's schools was obtained from the NCES school universe files, the Common Core of Data (CCD) for public schools and the Private School Survey (PSS) for private schools.

The ECLS-B 9-month data collection began in October 2001 and continued through December 2002. The 2-year data collection began in January 2003 and continued through April 2004. While the 9-month and 2-year data collection schedules were designed to collect information on children as close as possible to the date on which they turned the age of interest for the collection (i.e., 9 months and 2 years), the collection schedules for the preschool and kindergarten rounds were changed to correspond with an academic calendar. Thus, the preschool wave of data collection began in late August 2005 and ended in mid-July 2006. The kindergarten 2006 collection began in fall 2006 and continued through spring 2007. The kindergarten 2007 collection began in fall 2007 and continued through spring 2008.

In all collections, CAPI was the principal mode of data collection for the parent interview, and self-administered questionnaires were used to gather

information from the resident father, nonresident father, and teacher. A self-administered questionnaire was used to obtain information on potentially sensitive topics from the parent respondent at 9 months and 2 years; starting with the preschool collection, potentially sensitive items were administered using audio computer-assisted self-interviewing technology (ACASI). Data were collected from the child by several means: a series of structured, standardized activities were scored in the home by the field interviewer; structured interactions with the parent were videotaped for later coding; physical measurements were obtained; and behavior was observed throughout the home visit.

Child-parent interactions were assessed using the NCATS during the 9-month data collection, and again using the Two Bags Task during the 2-year and preschool data collections. In all cases, the ECLS-B field staff videotaped these structured interactions during the home visit, and trained staff coded the interactions from the videotapes at a later time. Although it is more typical for a health or social service professional to complete NCATS via live coding (i.e., while the interaction is occurring), the ECLS-B field staff needed to observe and score numerous items related to parent and child behavior. Given the other tasks the field staff had to learn and complete, live coding would have limited the number of measures that could realistically be used, thereby reducing the amount of information that could be gathered.

Data were collected from child care providers using CATI for both the early care and education provider (ECEP) and the wrap-around early care and education provider (WECEP) interviews. A subset of child care providers was sampled for on-site observations in the 2-year and preschool collections; observers recorded data in booklets that contained standardized scales of items designed to assess care quality. Child care center directors were asked to complete a self-administered paper questionnaire during the observation visit.

**Editing.** Within the CATI/CAPI instruments, the ECLS-B respondent answers were subjected to both "hard" and "soft" range edits during the interviewing process. Responses outside the soft range of reasonably expected values were confirmed with the respondent and entered a second time. For items with hard ranges, out-of-range values (i.e., those that were not considered possible) were usually not accepted. If the respondent insisted that a response outside the hard range was correct, the interviewer could enter the information as a comment. Data preparation and project staff reviewed these comments. Out-of-range values were accepted if the comments supported the response.

Consistency checks were also built into the CATI/CAPI data collection. When a logical error occurred during an interview, the assessor saw a message requesting verification of the last response and a resolution of the discrepancy, if possible. In some instances, if the verified response still resulted in a logical error, the assessor recorded the problem either in a comment or in a problem report.

The overall data editing process consisted of running range edits for soft and hard ranges, running consistency edits, and reviewing frequencies of the results. Where applicable, these steps also were implemented for hard-copy questionnaire instruments, videotaped instruments, and observational instruments.

### Estimation Methods

**Weighting.** Weights are used to adjust for disproportionate sampling at each sampling stage, survey nonresponse, and noncoverage of the target population when analyzing complex survey data. The weights are designed to eliminate or reduce bias that would otherwise occur with analyses of unweighted data. Several sets of weights were computed for each round of data collection. The ECLS-B weights were developed in three steps: First, base weights were calculated using the overall selection probabilities; next, weights were adjusted for survey nonresponse; finally, raking was used to adjust for undercoverage and to improve the precision of survey estimates.

The base weight gives the approximate representation of each sampled birth record. The base weight for a given birth record was calculated as the reciprocal of the overall probability of selection, computed as the product of each sampling stage's probability of selection. These overall probabilities of selection and base weights are used to compute analysis weights for all ECLS-B children in each round of data collection.

The base weights were adjusted for survey nonresponse. A selected set of variables related to child and family characteristics was used to construct nonresponse adjustment cells for each set of weights. Respondents and nonrespondents were compared on the characteristics selected based on analyses using segmentation modeling via CHAID. In the first round of data collection, data from the birth certificate were used to compare respondents and nonrespondents, because these data were available for all sampled cases regardless of participation status. In later collections, respondents and nonrespondents were compared on both birth certificate data and data collected in prior rounds. A nonresponse adjustment factor was calculated for each cell as the ratio of the sum of

weights for eligible cases in the cell to the sum of weights for eligible and responding cases in the cell. Finally, the nonresponse-adjusted weights were raked to 11 dimensions to ensure that sums of weights matched known population totals, thus correcting for survey undercoverage. The 11 dimensions were selected because of their substantive interest as well as their relationship to response propensity, as indicated by the CHAID modeling and also some preliminary logistic regression analyses.

The development of the ECLS-B weights was a sequential process. The 9-month weights were developed first, starting with the base weights; the 2-year weights were developed as adjustments to the 9-month weights; the preschool weights started with the 2-year weights; the kindergarten 2006 weights started with the preschool weights; and the kindergarten 2007 weights started with the kindergarten 2006 weights. A set of weights also was developed to allow for analysis of children in their first year of kindergarten, whether that year was in the 2006 collection or the 2007 collection. These weights were developed as adjustments to the preschool weights.

As there are three main components in the 9-month round (parent interview data, child assessment data, and father data) and five or more components in each of the following rounds (parent interview data, child assessment data, father data, child care provider data, child care observation data, teacher data, and/or school data, depending on the round), several sets of weights were developed, taking into account the level of nonresponse for the different components and the combinations of completed components that would be of most analytic interest. For example, the 9-month parent-father-child weight is valid for cases for which all three components are complete and adjusts for nonresponse to these components, whereas the 9-month parent weight is valid for all cases for which the parent component is complete, regardless of whether the child or father components are complete, and adjusts for nonresponse to the parent interview. Both weights for analysis of data at one round and weights for analysis of data from multiple rounds of the study were computed.

**Scaling.** To maximize information on which each estimate of ability is based, the majority of the direct cognitive assessment scores computed for the study are based on item response theory (IRT). IRT uses patterns of correct and incorrect answers to compute estimates on a scale that may be compared across different assessment forms. IRT was employed in the ECLS-B to calculate ability estimates and then derive assessment

scores from those ability estimates that can be compared both within a round and across rounds.

**Imputation.** Variables used to derive the SES composite variable were imputed using a hot-deck methodology. These variables include mother's and father's education, mother's and father's occupation, and household income. Imputation cells were defined by respondent characteristics that were the best predictors of the variables to be imputed, as determined using a CHAID analysis. Hot-deck imputation was done in a sequential order, separately, by type of household (female single parent, male single parent, and both parents present). Missing data were first filled with data obtained in a prior round, if available. For households with both parents present, the mother's and father's variables were imputed separately. Imputed as well as reported values were used to define imputation cells; missing values for donor characteristics were treated as a separate category. No imputed value was used as a donor. No donor was used more than once. The order of hot-deck imputation for all variables was from the lowest percentage missing to the highest.

### Future Plans

The ECLS-B study ended with the kindergarten 2007 round of collection. The final ECLS-B restricted-use data file was released in December 2009 and contains data from all rounds of the ECLS-B as well as some supplemental data (e.g., from a joint book-reading supplemental study).

## 5. DATA QUALITY AND COMPARABILITY

### Sampling Errors and Weighting

The sample of children born in the United States in 2001 selected for the ECLS-B is just one of many possible samples of births in 2001 that could have been selected. Therefore, estimates produced from the ECLS-B sample may differ from estimates that would have been produced from other samples. This type of variability is called sampling error because it results from collecting data on a sample of children, rather than all children born in the United States in 2001. The standard error is a measure of variability due to sampling when estimating a statistic. Standard errors can be used as a measure of the precision expected from a particular sample.

For a complex sample design such as the one employed in the ECLS-B, replication and Taylor Series methods have been developed to correctly estimate variance. These methods take into account the clustered, multistage sampling design and the use of differential

sampling rates to oversample targeted subpopulations. Both replication and Taylor Series methods can be used to accurately analyze data from the studies. The paired jackknife replication method using replicate weights can be used to compute approximately unbiased estimates of the standard errors of the estimates. When using the Taylor Series method, a different set of stratum and first-stage unit (i.e., PSU) identifiers should be used for each set of weights. Both replicate weights and Taylor series identifiers are provided as part of the ECLS-B data files.

**Design effects.** An important analytic consideration is how the statistical efficiency of survey estimates from a complex sample survey such as the ECLS-B compares with estimates that would have been obtained had a simple random sample (SRS) of the same size been used. In a stratified clustered design, stratification generally leads to a gain in efficiency over simple random sampling, but clustering has the opposite effect because of the positive intraclass correlation of the units in the cluster. The basic measure of the relative efficiency of the sample is the design effect. Design effects were computed for different survey estimates produced using these different weights. Using the weights designed for use with data from the parent interviews, the median design effect is 2.1 for the 9-month data collection, 2.4 for the 2-year collection, 2.1 for the preschool collection, 2.0 for the kindergarten 2006 collection, and 2.2 for the kindergarten 2007 collection. The median design effects for other weights across all components and all rounds of collections range from a low of 1.2 for the 2-year weight associated with response to the child care observation (W22PO) and a high of 4.2 for the 9-month weight associated with response to the 9-month child assessment (W1C0).

It was found that the design effects for estimates associated with the child assessments are higher than the design effects for some other types of estimates using data from other survey components. This can be due to either naturally occurring higher intraclass correlations for assessment estimates or interviewer effects. In the ECLS-B, where the general relationship between interviewer and cluster is one-to-one, the two are difficult, if not impossible, to disentangle.

### Nonsampling Error

Nonsampling error is the term used to describe variations in the estimates that may be caused by population coverage limitations, as well as data collection, processing, and reporting procedures. The sources of nonsampling errors are typically nonresponse, differences in respondents' interpretations of the meaning of the questions, response differences related to the particular time the survey was conducted,

and mistakes in data preparation. Steps are taken to reduce nonsampling error.

In order to reduce nonsampling error associated with respondents misunderstanding what was being asked of them, the survey design phase included focus groups and cognitive laboratory interviews for the purposes of assessing respondent knowledge of different topics covered in the instruments, comprehension of questions and terms, and item sensitivity. The design phase also included testing of the CAPI/CATI instruments and a field test that evaluated the implementation of the survey in order to reduce the potential for error to be introduced as a result of errors in administration.

Another potential source of nonsampling error is respondent bias that occurs when respondents systematically misreport (intentionally or unintentionally) information in a study. One potential source of respondent bias in the ECLS surveys is social desirability bias. If there are no systematic differences among specific groups under study in their tendency to give socially desirable responses, then comparisons of the different groups will accurately reflect differences among the groups. An associated error occurs when respondents give unduly positive assessments about those close to them. For example, parents may give more positive assessments of their children's experiences than might be obtained from institutional records or from the teachers.

Response bias may also be present in the responses teachers provide about each individual student. For example, each teacher filled out a survey for each of the sampled children they taught in which they answered questions on the child's socioemotional development. Since the kindergarten surveys in the ECLS-B were first conducted in the fall, it is possible that the teachers did not have adequate time to observe the children, and thus some of their responses may be influenced by their expectations based on the children's outward characteristics (e.g., sex, race, ELL status, disability status). In order to minimize bias, all items were subjected to cognitive interviews and field tests. Actual teachers were involved in the design of the ECLS-K cognitive assessment battery and questionnaires on which some components of the ECLS-B assessment battery and teacher questionnaire are based. When designing the ECLS-K teacher questionnaires, NCES also followed the criteria recommended in a working paper on the accuracy of teachers' judgments of students' academic performances (see Perry and Meisels 1996).

As in any survey, response bias may be present in the data for the ECLS-B. It is not possible to state precisely

how such bias may affect the results. NCES has tried to minimize some of these biases by conducting one-on-one, untimed assessments, and by asking some of the same questions about the sampled child of both teachers and parents.

**Coverage error.** Undercoverage occurs when the sampling frame from which a sample is selected does not fully reflect the target population of inference.

For the ECLS-B, the 9-month target population is all infants born in the United States in 2001 to mothers 15 years of age and older who were not adopted prior to, and who were alive during, the 9-month data collection period. The target population for later rounds of collection also excludes children who died or moved abroad permanently. Concern about noncoverage in the ECLS-B relates mainly to a few PSUs where births were sampled from hospital frames. In addition, the main sampling frame consisted of birth certificates available from state registrars. This sampling frame failed to cover unregistered births, but the number of these was thought to be negligible, according to the National Center for Health Statistics.

**Nonresponse error.** Bias can exist in survey data if too few sampled units responded for the data collected to be representative of the target population or if nonresponse is significantly higher for sample entities with certain characteristics. The unit response rate is a round-specific rate in that it indicates the proportion of the eligible sample responding to a survey at a particular time point. For a longitudinal study such as the ECLS-B, it is also useful to calculate a longitudinal response rate, also called an overall unit response rate, which takes into account response for all rounds of collection. Response rates for all rounds of data collection are determined first and foremost by completion of the corresponding round's parent interview. The parent interview was chosen as the primary vehicle for determining the overall response rate because there were very few cases (e.g., 0.3 percent at 9 months and 0.06 percent at 2 years) in which other components of the study (e.g., direct child assessments or father questionnaires) were completed but the parent interview was not. Response rates are also calculated for the other components of the ECLS-B: the child assessments; the resident and nonresident father questionnaires; the care provider interview; the child care observation; the teacher questionnaire; and the school data. In all rounds of the ECLS-B, response rates for these other components are conditioned on the completion of the parent interview. All response rates are computed at the child level.

In the 9-month data collection, the weighted unit response rate for the parent CAPI instrument was 74.1 percent. Because this was the first round of data collection, no overall (i.e., longitudinal) response rate was computed. For the 2-year collection, the weighted unit response rate for the parent interview was 93.1

percent and the overall weighted response rate was 69.0 percent (74.1 percent times 93.1 percent, with rounding). Table B-1 presents weighted unit response rates and table B-2 presents overall weighted unit response rates for all survey components for all rounds of data collection.

**Table ECLS-B-1. Weighted unit response rates for all children in the ECLS-B, by collection and component: Various years 2001–2007**

Component	9-month	2-year	Preschool	Kindergarten	
				2006	2007
Parent CAPI	74.1	93.1	91.3	91.8	92.5
Child assessment	95.6	94.2	98.3	98.6	99.4
Resident father	76.1	77.7	87.7	†	†
Nonresident father	50.0	39.8	†	†	†
Early care and education provider	†	70.0	87.4	92.0	†
Child care observation	†	51.3	56.8	†	†
Wrap-around early care and education provider	†	†	†	81.2	92.1
Teacher questionnaire	†	†	†	75.6	77.4
School data				95.9	96.9

† Not applicable.

SOURCE: Denton Flanagan, K., and McPhee, C. (2009). *The Children Born in 2001 at Kindergarten Entry: First Findings From the Kindergarten Data Collections of the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B)* (NCES 2010-05). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Jacobson Chernoff, J., Flanagan, K. D., McPhee, C., and Park, J. (2007). *Preschool: First Findings From the Preschool Follow-up of the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B)* (NCES 2008-025). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Nord, C., Edwards, B., Andreassen, C., Green, J. L., and Wallner-Allen, K. (2006). *Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), User's Manual for the ECLS-B Longitudinal 9-Month–2-Year Data File and Electronic Codebook (NCES 2006–046)*. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Nord, C., Edwards, B., Hilpert, R., Branden, L., Andreassen, C., Elmore, A., Sesay, D., Fletcher, P., Green, J.L., Saunders, R., Dulaney, R., Reaney, L., and Flanagan, K.D. (2004). *User's Manual for the ECLS-B Nine-Month Restricted-Use Data File and Electronic Codebook* (NCES 2004-092). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, D.C.

**Table ECLS-B-X. Overall (longitudinal) weighted response rates after substitution for all children in the ECLS-B, by collection and component: Various years 2001–2007**

Component	9-month	2-year	Preschool	Kindergarten	
				2006	2007
Parent CAPI	†	69.0	63.1	58.0	53.7
Child assessment	†	65.0	62.0	57.2	53.3
Resident father	†	53.6	55.3	†	†
Nonresident father	†	27.5	†	†	†
Early care and education provider	†	48.3	55.1	53.3	†
Child care observation	†	35.4	35.8	†	†
Wrap-around early care and education provider	†	†	†	47.1	49.4
Teacher questionnaire	†	†	†	43.8	41.5
School data	†	†	†	55.6	52.0

† Not applicable.

SOURCE: Denton Flanagan, K., and McPhee, C. (2009). *The Children Born in 2001 at Kindergarten Entry: First Findings From the Kindergarten Data Collections of the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B)* (NCES 2010-05). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Jacobson Chernoff, J., Flanagan, K. D., McPhee, C., and Park, J. (2007). *Preschool: First Findings From the Preschool Follow-up of the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B)* (NCES 2008-025). National Center for Education

Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Nord, C., Edwards, B., Andreassen, C., Green, J. L., and Wallner-Allen, K. (2006). *Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), User's Manual for the ECLS-B Longitudinal 9-Month–2-Year Data File and Electronic Codebook (NCES 2006–046)*. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Nord, C., Edwards, B., Hilpert, R., Branden, L., Andreassen, C., Elmore, A., Sesay, D., Fletcher, P., Green, J.L., Saunders, R., Dulaney, R., Reaney, L., and Flanagan, K.D. (2004). *User's Manual for the ECLS-B Nine-Month Restricted-Use Data File and Electronic Codebook (NCES 2004-092)*. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, D.C.

An analysis was conducted to assess the potential bias in survey estimates due to unit or item nonresponse for the various components of the survey. This evaluation consisted of several types of comparisons. First, data obtained from children's birth certificates were compared between cases in the sampling frame and sample respondents; data for sample respondents were weighted first using base weights and then using final weights. These comparisons were made for respondents to the parent CAPI interview, the father questionnaires, the child care provider interview, and the child care observation component. In another analysis, birth certificate and survey data were compared between 9-month respondents (using final 9-month weights) and 2-year respondents (using both final 9-month weights and final 2-year weights). These comparisons were done for respondents to the parent interview, the child assessments, the father questionnaires, and the child care provider interview. The analysis found little or no evidence of potential for bias due to unit nonresponse. Differences between sample respondents and sample frame data were generally small and largely corrected by nonresponse corrections and other adjustments to the base weights. An evaluation comparing the demographic characteristics of respondents and nonrespondents for selected items with less than an 85 percent response rate found no evidence of potential for bias due to item nonresponse. Similar analyses of nonresponse bias were conducted for later rounds of data collection, with no evidence found for bias due to item nonresponse.

**Measurement error.** A potential area for measurement error occurs with the NCATS and Two Bags Task components of the ECLS-B home visit. The parent-child interactions for these two components of the study were videotaped and coded later. The process of coding the tapes, however, is not problem-free. The videotape of the interaction must be of high quality to ensure valid coding. For example, field staff needed to tape the very beginning of the interaction and not interrupt it. The task of coding is further complicated by the coding staff's experience. Like the ECLS-B home visit field staff, the NCATS and Two Bags Task coders did not, for the most part, possess an extensive background in child development. Training the coding staff to reach

90 percent reliability proved difficult at times and often required additional training.

## 6. CONTACT INFORMATION

For content information about the ECLS project, contact:

Jill McCarroll  
Phone: (202) 304-2920  
E-mail: [jill.mccarroll@ed.gov](mailto:jill.mccarroll@ed.gov)

### Mailing Address:

National Center for Education Statistics  
Institute of Education Sciences  
U.S. Department of Education  
Potomac Center Plaza  
550 12<sup>th</sup> Street SW  
Washington, DC 20202

## 7. METHODOLOGY AND EVALUATION REPORTS

### General

Anderson, C., Fletcher, P., and Park, J. (2007). *Early Childhood Longitudinal Study, Birth Cohort (ECLS-B) Psychometric Report for the 2-year Data Collection*. (NCES 2007-084). Washington, DC: National Center for Education Statistics.

Mather, N., and Woodcock, R.W. (2001). *Woodcock-Johnson III Tests of Cognitive Abilities: Examiner's Manual*. Itasca, IL: Riverside Publishing.

Najarian, M., Snow, K., Lennon, J., and Kinsey, S. (2010). *Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), Preschool–Kindergarten 2007 Psychometric Report* (NCES 2010-009). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

NIH. (n.d.). *Executive Function*. Retrieved February 09, 2013 from <http://www.nihtoolbox.org/WhatAndWhy/Cognition/ExecutiveFunction/Pages/default.aspx>.

Zelazo, P.D. (2006). The Dimensional Change Card Sort (DCCS): A Method of Assessing Executive Function in Children. *Nature Protocols*, 1(1): 297-301.

### Uses of Data

Denton, F. K., and McPhee, C. (2009). *The Children Born in 2001 at Kindergarten Entry: First Findings From the Kindergarten Data Collections of the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B)* (NCES 2010-05). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

Jacobson, C. J., Flanagan, K. D., McPhee, C., and Park, J. (2007). *Preschool: First Findings From the Preschool Follow-up of the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B)* (NCES 2008-025). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

Nord, C., Edwards, B., Andreassen, C., Green, J. L., and Wallner-Allen, K. (2006). *Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), User's Manual for the ECLS-B Longitudinal 9-Month-2-Year Data File and Electronic Codebook* (NCES 2006-046). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

Nord, C., Edwards, B., Hilpert, R., Branden, L., Andreassen, C., Elmore, A., Sesay, D., Fletcher, P., Green, J.L., Saunders, R., Dulaney, R., Reaney, L., and Flanagan, K.D. (2004). *User's Manual for the ECLS-B Nine-Month Restricted-Use Data File and Electronic Codebook* (NCES 2004-092). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, D.C.