DEVELOPMENT OF THE EARLY CHILDHOOD DEVELOPMENT INDEX IN MICS SURVEYS

MICS METHODOLOGICAL PAPERS

Paper No. 6, 2017

Data and Analytics Section
Division of Data, Research and Policy

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About MICS

The Multiple Indicator Cluster Surveys, MICS, is one of the largest global sources of statistically sound and internationally comparable data on children and women. MICS data are gathered during face-to-face interviews in representative samples of households. The surveys are typically carried out by government organizations, with technical support from UNICEF.

Since the mid-1990s, MICS has supported more than 100 countries to produce data on a range of indicators in areas such as health, education, child protection and HIVS/AIDS. MICS data can be disaggregated by numerous geographic, social and demographic characteristics.

As of 2016, five rounds of surveys have been conducted: MICS1 (1995-1999), MICS2 (1999-2004), MICS3 (2004–2009), MICS4 (2009–2012) and MICS5 (2012-2015). The sixth round of MICS (MICS6) is scheduled to take place in 2016–2018. Survey results, tools, reports, micro-data and information on the MICS programme are available at <*mics.unicef.org*>.

About the MICS Methodological Papers

MICS Methodological Papers are intended to facilitate exchange of knowledge and to stimulate discussion on the methodological issues related to the collection, analysis, and dissemination of MICS data; in particular, the papers document the background methodological work undertaken for the development of new MICS indicators, modules, and analyses. The findings, interpretation and conclusions do not necessarily reflect the policies or views of UNICEF.

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Abbreviations

CDQ	Child Development Questionnaire
DIF	differential item functioning
ECD	early childhood development
ECDI	Early Childhood Development Index
EDI	Early Development Instrument
MICS	Multiple Indicator Cluster Surveys
SDG	Sustainable Development Goals
SDQ	Strengths and Difficulties Questionnaire
SPSS	Statistical Package for the Social Sciences
UNICEF	United Nations Children's Fund

1

Summary

This report documents the development and validation of the Early Childhood Development Index (ECDI). The ECDI is a population-based measure included in Multiple Indicator Cluster Surveys, the UNICEF-supported international household surveys known as 'MICS'. These surveys are central to UNICEF's strategy for helping countries improve data collection and analysis on the situation of children and women. The findings generated through MICS have been used extensively in policy decisions, programme interventions and public outreach.

The ECDI began to materialize when UNICEF, working with countries and partners, designed indicators to assess the quality of a child's home environment and access to early childhood care and education. Countries included these indicators during the third round of MICS (MICS3), which was implemented mainly in 2005 and 2006.

In early 2006, work towards further development of the index employed a multi-method approach to scale construction. To establish the reliability and validity of the survey items, analyses for psychometric validation of the ECDI were applied at each stage in the development process, which also included an extensive literature review and pilot testing.

The first version of the scale consisted of 48 items (questions) across six developmental domains. The final version was introduced in 2009 in the fourth round of MICS (MICS4) and also implemented in MICS5. It includes 10 items in four early developmental domains: language/cognitive (3 items), physical (2 items), social-emotional (3 items) and approaches to learning (2 items). Questions are included in the Early Childhood Development module of the Questionnaire for Children under Five in MICS and are addressed to mothers (or caretakers) of children aged 3 and 4 years.

The ECDI is one of the first population-based measures of early childhood development available at an internationally comparative level. It has been incorporated into around 80 national and subnational MICS in low- and middle-income countries since its introduction.

2

Introduction

Early childhood development (ECD) is a maturational and interactive process involving an ordered progression of motor, cognitive, language, socio-emotional and regulatory skills and capacities across the first few years of life. During these early years, from the prenatal periods to infancy and early childhood, a child's newly developing brain is highly plastic and responsive to change. This is evidenced by the billions of integrated neural circuits established through the interaction of genetics, environment and experience. While the overall developmental process is similar across cultures, children develop at different speeds and may reach developmental milestones at different times. What is considered 'normal' child development also varies across cultures and environments, since expectations and parenting strategies may differ between countries as well as among cultural, ethnic or religious groups within the same country.

Interest in early childhood development surged at the turn of the twenty-first century. Yet, despite a consensus on the importance of ECD, population-based measures were not readily available, particularly for low- and middle-income countries. Though population-based data provide one of the most effective ways to draw policy attention to the situation of children and propel action, the dearth of ECD population-based measures hampered progress in creating equity in outcomes for all children, from the start of life. In recognition of this gap, UNICEF initiated a systematic technical process to create the first global measure of developmental status in early childhood.

This methodological report describes how UNICEF, with an international group of ECD and statistical experts, developed and validated the Early Childhood Development Index (ECDI) during 2006–2009. The current ECDI is composed of 10 items (questions) covering four domains of early childhood development: language/cognitive, physical, social-emotional and approaches to learning. It is administered mainly through UNICEF's Multiple Indicator Cluster Surveys (MICS) in the Questionnaire for Children under Five as part of the Early Childhood Development Module (*see Annex A*). The ECDI was first introduced in 2009 during the fourth round of MICS (MICS4) and has been available in subsequent rounds.[1] The ECDI is one of the first international population-based measures of early childhood development that can be applied in low- and middle-income countries.

The report is presented in four sections. Section 3 introduces the rationale for developing an international population-based index on early childhood development – a call initiated by policymakers, ECD advocates, UNICEF staff and researchers – and includes a timeline of the process. Sections 4 and 5 present the two validation phases conducted for the construction of various iterations of the ECDI, in

[1] MICS4 was implemented primarily between 2009 and 2012; MICS5 data collection took place primarily between 2013 and 2016. Planning for MICS6 is under way.

Jordan and the Philippines, in 2008, and in Mombasa, Kenya, in 2009. Section 6 evaluates the application and validity of the ECDI as a population-based measurement tool in low- and middle-income countries since its introduction in MICS4, and considers the future role of the index as part of international and national efforts to improve ECD measurement.

3

General background

3.1 The need for a population-based measure of ECD

Learning and the acquisition of skills across an individual's life course are built on the foundational capacities established during the early years. Scientific evidence, particularly from the neurosciences, confirms that the first few years of life are critical periods of human development in which children are highly sensitive and responsive to environmental influences. Healthy early childhood development depends on formative experiences of 'nurturing care' that promote health and nutrition, provide a sense of security and safety, and ensure responsive caregiving and early opportunities for learning [1]. Research confirms that exposure during the early years to a broad range of risk factors – including poverty, poor health and nutrition, violence, and inadequate care and learning opportunities – can lead to irreversible outcomes that affect a child's potential for the remainder of his or her life. Evidence from multiple disciplines confirms that investing in the early years is one of the most cost-effective measures for improving education achievement and increasing skills, capabilities and productivity. The evidence also shows that the cost of inaction is an added burden, including economically, on both societies and countries.

The lack of "globally accepted indicators for child development to monitor progress or ensure accountability" has been identified as a key factor in low public investment in ECD [2, p. 237]. At the beginning of the century, several efforts to create individual-level assessments of child development outcomes were emerging in developed countries and being tested in developing countries. For example, the country-specific Early Learning Development Standards, supported by UNICEF, provided an approach to setting standards to inform national-level policy, but the outcomes were not comparable and did not produce representative estimates of child development.[2] During the 2000s, monitoring of early childhood development within the Education for All goals was limited to health, nutrition and preschool participation. At that time, there was no psychometrically robust, cross-culturally appropriate measure to assess young children's holistic development.

The lack of comprehensive measures of developmental outcomes at the population level has limited the ability to monitor the situation of young children, both nationally and internationally, and to advocate for policy and programmes to address the situation. Limited population-level data on ECD have also presented a barrier to increasing national and donor investment in early childhood development.[3]

[2] See, for example, the former Yugoslav Republic of Macedonia's Early Learning Development Standards. Open PDF from <www.unicef.org/tfyrmacedonia/MK_Pub_ELDS_ENG.pdf>.

[3] Unpublished interviews in 2016 with Y. Nonoyama-Tarumi and N. Ulkuer.

3.2 Multiple Indicator Cluster Surveys

MICS is a cost-effective household sample survey that produces statistically sound, internationally comparable data on more than 100 key indicators of the health and well-being of women and children. Since the initiation of the MICS programme in 1995, nearly 300 surveys have been implemented through five rounds of surveys in more than 100 low- and middle-income countries. Data are collected in face-to-face interviews with household members. The modular nature of the MICS questionnaires can be adapted for national and subnational monitoring priorities. The surveys are designed and implemented by national counterparts, mainly national statistical offices, with continuous technical support from UNICEF. A common survey methodology is employed to ensure that data are statistically sound, internationally comparable and nationally representative (with the exception of specially designed subnational surveys).

3.3 Overview of the ECDI development process[4]

The development of the ECDI followed methodological guidelines for instrument development and used a multi-stage, multi-method approach.

Stage 1: The first stage of the work focused on achieving consensus on the conceptual framework for identifying domains and generating items (*see section 4.1*). Between March 2006 and August 2007, three round-table discussions were held with a core team of international ECD experts, measurement experts and researchers. A major output of the second round-table discussion was to commission a literature review and background research report on existing international instruments to measure child development outcomes, with an emphasis on measures that had been used in low- and middle-income countries [3]. An initial set of domains and items were identified on the basis of the qualitative method of consultation with content experts (achieved through the round-table discussions) and the systematic review of the literature and existing measures.

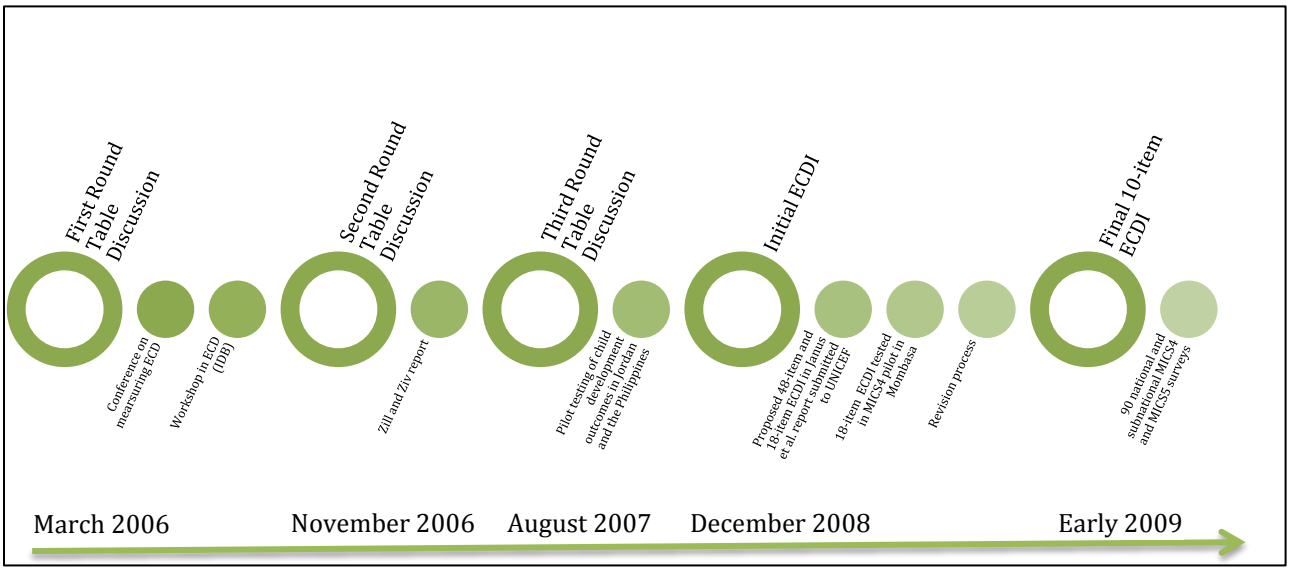
Stage 2: The framework and list of items to measure child developmental outcomes proposed in Stage 1 were pilot-tested in Jordan and the Philippines in 2008 (*see section 4.2*). In validation studies that followed, several iterations of the initial ECDI were constructed, including a long 48-item version and a short 18-item version (*see section 4.3*).

Stage 3: The final stage of the work involved validation of the 18-item version of the ECDI as part of the MICS4 pilot that took place in Mombasa, Kenya, in 2009 (*see section 5.1*). On the basis of this validation study and further expert consultation, the ECDI was finalized in its current 10-item form. This final version is included in the MICS Questionnaire for Children under Five (*see section 5.2*).

The figure below illustrates a timeline of key steps and events in the process.

[4] This section is based on Janus and Duku [4] unless otherwise noted.

Figure. Overview of main stages in the development of the ECDI



4

Constructing the ECDI

4.1 Stage 1: Conceptual framing – Domain definition and item generation[5]

In 2007, UNICEF commissioned a systematic review of the literature and existing measures of ECD in order to identify and assess individual items of child development outcomes from existing surveys/measures implemented across multiple countries. The review also aimed to summarize available research on the validity of different data collection methods (e.g., child assessments, adult reporting) for child development outcomes.

Initial proposal of objectives and items

The debates on the objectives for a global indicator of ECD and what items to include were central to the early development phase of the index. The expert panel consultations and systematic review generated the following areas of consensus on properties and composition of the ECDI:[6]

- ***Measurement of a comprehensive set of developmental domains for a holistic perspective of the child's development with relevance for school readiness***. The ECDI should include the principal domains – cognition and general knowledge; language usage and emerging literacy; approaches towards learning; socio-emotional development; and physical well-being – to be a high-quality assessment [5]. Given the constraints (time, expense, methods of administration), a more abbreviated version should be developed. The domains that are most central to development in the early years of life should be prioritized.

- ***Combination of direct child observation and parent responses***. A direct, unbiased observation or assessment of a child's skills and behaviours is considered the most reliable and valid measure of early childhood development and is highly predictive of future achievement. Parental reporting is also considered a viable method of data collection on child development, especially for the early years, in regard to behaviours and skills that are typically difficult for external data collectors to observe. However, research shows that teacher and parent reports tend to be less internally consistent and more biased than direct observation. While multi-method approaches that combine direct observation and parental reporting are ideal, for the purpose of instrument development, direct observation could be used to validate parental report measures.

- ***Age ranges***. Children reach developmental milestones at different ages (within a range), which presents a challenge to developing a single assessment for the entire age spectrum of early

[5] This section is based on Zill and Ziv [3] unless otherwise noted.
[6] These specific points are supported by the extensive literature review available in Zill and Ziv [3].

childhood. Because children learn skills through iterative processes, manifestations of child behaviours are episodic, particularly during the first 1,000 days. There are few valid population-based tools that are able to reliably assess child behaviour, skills and competencies prior to 36 months of age. The initial recommendation was for the ECDI to measure child development from birth–5 years, but the range was restricted to 3–5 years due to time and resource constraints and limited availability of comparable measurement tools for children under age 3.

- *Sampling strategy*. The selected age band would influence the sample size calculation. The cost would depend on whether data collection was entirely new or follow-up to previous data collection using the same sample of households with children [6].

- *An outcome measure*. The ECDI overall score should include a cut-off level that provides a vulnerability ranking rather than whether or not the child has a developmental delay, or an IQ or general ability score. It would provide information on acquired skills, and should be predictive and sufficiently sensitive to show differences among children in their developmental levels.

- *A global indicator*. The ECDI should be consistent globally, with each of its parts defined and measured in the same way across multiple countries, cultures and subpopulations.[7] Given that the primary purpose of the ECDI was to inform policy about the collective well-being of children within a country, enabling cross-country comparisons was seen as a necessary feature.

4.2 Stage 2: Pilot testing in Jordan and the Philippines[8]

To identify the psychometrically robust and appropriate items of holistic early development across all developmental domains, the ECDI was subjected to a rigorous validation process that utilized qualitative, quantitative and clinical/observational methods [7]. The development of the first version relied primarily on qualitative and quantitative item validation on the basis of pilot tests in Jordan and the Philippines. This section provides an overview of these analyses for the construction of the 48-item and 18-item ECDI by measurement expert researchers.

Pilot studies

In Jordan, the UNICEF Country Office, located in Amman, partnered with research staff from the National Centre for Human Resources Development to undertake the fieldwork. Employing standard protocols, local experts validated the cultural and linguistic appropriateness of the questionnaire. Fieldwork was conducted in May 2008, and a data set was ready for analyses in mid-July that year.

In the Philippines, the UNICEF Country Office, based in Manila, worked with the Office of Population Studies at the University of San Carlos, Cebu City, to undertake the fieldwork component of the research across the country. Fieldwork was conducted during August 2008, and the completed data set was ready

[7] Creating a global indicator does not repudiate the reality of cultural variation. As noted by Zill and Ziv, "There are similarities in child development processes and timetables that cut across national boundaries, and universal needs that all developing children have in order to grow and flourish" [3, p. 35].

[8] This section is based on Janus et al. [8] unless otherwise noted.

in September. Due to differences in the school calendar, the Philippines sample was collected three to four months after the Jordan sample.

Pilot study samples

The total sample of the pilot studies in the two countries was projected to include 900 children in six groups selected by age and sex, with 150 children in each group: 3-year-old girls, 3-year-old boys, 4-year-old girls, 4-year-old boys, 5-year-old girls and 5-year-old boys. The sample design and final sample sizes for both pilot countries are presented in Annex C. Boys and girls were equally represented in the total sample as well as the age subsamples. Given the disparity noted in outcomes for children across rural and urban areas, the sampling strategy also took into consideration place of residence, with both urban and rural areas selected.

The Jordan pilot collected data on a total of 1,102 children. Of those, 25 had data missing for sex, region or place of residence and were excluded from the analyses, resulting in a final sample of 1,077 children with complete data. Region 2 (Central/Amman), which was also the main urban area, contributed most of the sample. Without considering any potentially missing data on actual test measures, it was possible to undertake a three-level analysis by age, sex and area, although not by age, sex and region as some cells had sample sizes lower than 20. The pilot sample reflects the country's population balance, but there is no indication that the sample can be considered representative of the country's total population.

In the Philippines, data were collected on a total of 1,004 children. Of those, 49 had data missing for sex, region or place of residence, leaving a final sample of 955 children with complete data on all the variables of interest. The sample was well balanced among the three regions in the country, each contributing almost one third to the total sample. Similarly, children living in rural and urban centres were equally represented. Both of the reliability samples were also well balanced.

Instruments

Based on the systematic review and expert consultation from Stage 1, items from different instruments measuring early childhood development at the individual level was collected in the pilot tests in Jordan and the Philippines (*see Table 1*). In the finalized instrumentation, the set of questions recommended by Zill and Ziv [3] was tested along with selected questions from the Philippines Questionnaire and Ages & Stages.[9] To assess convergent validity, additional questions were extracted from two pre-existing, internationally validated ECD assessments – the Strengths and Difficulties Questionnaire (SDQ) [9] and the Early Development Instrument (EDI) [10]. In addition to this set of parental interview questions, task-based child assessments were utilized (e.g., "Can you draw a circle?", "Can you stand on one foot?"), as well as a direct test of mental skills (i.e., executive functioning) using cards to sort colours and shapes [11]. Items from selected modules of standard MICS questionnaires were used to collect sociodemographic and contextual information.

[9] The Philippines Questionnaire was developed by the World Bank in conjunction with the Government of the Philippines, academic consultants and the University of San Carlos. Ages & Stages is a development screening tool designed for use by early educators and health professionals.

Each parent/caregiver was asked more than 100 questions about their child's skills and behaviour. The questions were adjusted to be developmentally appropriate for the child's age (available upon request). The list of ECD items to be tested was organized by six equally weighted developmental domains: language and emergent literacy; cognitive development; approaches to learning; social-emotional development; gross motor development; and fine motor development. Within each domain, items were also organized according to age bands (i.e., 3, 4 and 5 years of age).

Items included a combined set of direct observations of the child during the field interview and parental reporting. Zill and Ziv recommended this approach to develop an index with "the greatest validity, credibility and impact" [3, p. 7]. Children aged 3–5 years had an extended direct assessment to include measures of fine motor, cognitive and language development that were related to school readiness. The selected benchmark tasks for direct observation of the children serve to balance out the tendency for parental reporting of child achievements to be more skewed and biased than that of teachers or professional caregivers. In addition, a direct test of executive functioning was administered to each child. At the time, executive functioning skills were emerging in the field of developmental psychology as the within-child factors contributing strongly to school readiness [3]. The results of direct observation questions are available upon request.

Table 1. Instruments used in the 2008 pilot tests in Jordan and the Philippines

Instrument	ECD Domain	Respondent	Notes
MICS Household Questionnaire	Demographic, health and household information Activities with child	Parent/caregiver	Based on MICS3 module
Child Development Questionnaire (CDQ)	Gross motor Fine motor Cognitive Language Social-emotional Approaches to learning	Parent Child (some direct tasks)	Items based on Zill and Ziv [3], the Philippines Questionnaire, and Ages & Stages; the selection of items per age group varied, but all six domains were represented
Early Development Instrument (EDI)	Physical health and well-being Social competence Emotional maturity Language and cognitive development Communication skills and general knowledge	Parent/caregiver	Janus and Offord [10]
Strengths and Difficulties Questionnaire (SDQ)	Emotional Conduct Hyperactivity Peer problems Pro-social	Parent/caregiver	Goodman [9]
Dimensional Change Card Sort	Direct cognitive task	Child	Zelazo [11]

Source: Janus et al. [12]

Data collection

A combination of qualitative and quantitative data collection methods was used to assess content, construct and concurrent validity in the different cultural settings. Focus groups with local experts (e.g., early childhood academics, teachers, health workers, key government employees) were conducted in both countries to assess content validity. The results were used to inform the instrument's back translation and retranslated versions. To determine construct and concurrent validity, questions from previously established and standardized instruments were collected in addition to the items recommended by Zill and Ziv [3], as outlined in the previous section. A series of analyses correlating, comparing and contrasting the various instruments against each other was investigated, in addition to validation of the items and instruments against age, sex, sociodemographic and interaction with parents.

A multiple informant data collection method (i.e., direct interviews with parents, short observations and direct tasks with children) was employed to assess reliability of the items and instruments. Two weeks after the initial assessment for test-retest reliability, about one third of the sample in each country, subgrouped by age and sex, was retested with the same informants and surveyors. For those questions relying on an informant's response (rather than direct child observation), an additional portion of the sample was repeat-tested with a second informant (e.g., other parent, family member or teacher) and the same surveyor for the inter-rater reliability analysis.

The lead researchers observed the fieldwork in the Philippines to provide further pragmatic and practical insight and guidance throughout the course of data collection. This enabled the researchers to investigate such issues as social response bias, family burden, timing of the various components, interviewer bias, the impact of prompting on respondents (parents and children) and training implications. They also interviewed the fieldwork teams to identify how they felt about the various instruments, if and how parents/caregivers were responding, how the children were able to attend to and complete the tasks, and practical issues such as space and lighting. In Jordan, two of the lead researchers also participated in fieldwork team training sessions.

Data analyses and validation

To establish the reliability and validity of the proposed items, psychometric properties of the proposed instrument were explored with a view to administering the same instrument across several different countries and cultures. Psychometric Rasch modelling (for analysing categorical data) and the more traditional confirmatory factor analyses were conducted on the data collected in Jordan and the Philippines to determine the underlying constructs across all items (independent of the instrument from which the item was drawn). The internal structure of the instrument was examined in order to confirm its validity with regard to its intended structure. Items that did not meet the validation measures were discarded. These rigorous statistical methodologies were applied so that the ECDI could be reliable, psychometrically acceptable and adaptable to different cultures and languages, and also so it could be included as part of the MICS battery of instruments. The objective was to identify a finite set of items to cover each developmental domain (and subconstruct).

Specific analytical techniques were used to assess three basic aspects of psychometric testing: dimensionality (assessed using confirmatory factor analysis), measurement invariance across population

subgroups (differential item functioning to test item-level invariance) and internal reliability (Cronbach's alpha coefficient, inter-item and item-total correlations).[10] Combined, these psychometric analyses aim to detect the integrity of the items, both individually and as a set.

In order to identify those factors that explain most of the variance observed in the population, tests were performed on more than 100 items extracted from the instruments summarized in Table 1. The 48-item and 18-item ECDI instruments were built on the basis of the results of these psychometric and validation analyses of the data collected during the two pilots. Data were analysed using the Statistical Package for the Social Sciences (SPSS) software.

Results

In terms of external reliability, content validity of the items was confirmed in both countries with acceptable test-retest and inter-rater reliabilities. Annex B includes the main results of the test-retest to measure the consistency of an item over time and inter-rater reliability tests to measure the consistency of estimates among different interviewers [8].

The psychometric analyses demonstrated that the items of the instruments used in Jordan and the Philippines (CDQ, SDQ and EDI) have acceptable internal consistency in the pilot samples.

The result tables of the dimensionality analysis using confirmatory factor analysis of the items piloted in Jordan by age group are available upon request. The purpose of the confirmatory factor analysis is to determine whether the questions/items adequately measure the factor (domain) as intended by theory. The determination of the number of factors to extract is guided by theory, but also informed by running the analysis extracting different numbers of factors and seeing which number of factors yields the most interpretable results.

Result tables of the internal reliability analysis of the items piloted in Jordan and the Philippines, organized by domain and by instrument (i.e., origin of the items as mentioned in Table 1), are available upon request. Corrected item-total correlations and Cronbach's alpha were calculated for the domains. Item-total correlations indicate correlation between each item and the total score in the domain, with values below 0.3 usually indicating a weak correlation. Cronbach's alpha values range from 0–1, with higher values indicating higher consistency.[11] As summarized in Table 2, most items in each developmental domain had high internal reliability, with some variation by age.[12] The Cronbach's alpha varies across the four domains, by age, instrument and subdomain. Inter-item and item-total correlations were also available for the literacy play-based activities scale.

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[10] For a brief description of these aspects and relevant testing methods, see, for example, Rios and Wells [13].

[11] Internal validity is considered acceptable when Cronbach's alpha is 0.70 or higher, although lower values of alpha can result when there are fewer questions/items [14].

[12] It is difficult to identify a pattern by age group since Cronbach's alpha varies per item and subdomain in each set. For example, for the EDI components, gross and fine motor skills items fared poorly for 4-year-olds, while language and cognitive development and basic literacy skills measured highest for 4-year-olds.

Table 2. Internal reliability results of items tested in Jordan, by ECD domain	
ECD domain	**Cronbach's alpha**
Language-cognitive	
EDI language and cognitive development	0.915
EDI communication skills and general knowledge	0.707
Physical	
CDQ index (age 3)	0.662
CDQ index (age 4)	0.666
CDQ index (age 5)	0.752
EDI physical health and well-being	0.470
Social-emotional	
SDQ total difficulties scale	0.725
SDQ pro-social symptoms scale	0.701
EDI social competence	0.797
EDI emotional maturity	0.756
Approaches to learning	
EDI approaches to learning (subscale)	0.649
EDI readiness to explore new things (subscale)	0.617

Note: Cronbach's alpha value is for overall age groups 3–5 years unless otherwise noted.

4.3 Construction of the long 48-item and short 18-item ECDI[13]

Data analyses

The construction of the 48-item and 18-item versions of the ECDI was based on a two-step psychometric validation process using standard statistical and conceptual techniques to analyse the proposed items for the ECDI (i.e., items from the pilots). A series of analytical techniques successfully identified a small number of factors that explained most of the variance observed. Each of the resultant factors was then tested for internal consistency. The findings were used to established a set of items for each developmental domain, and within these, a series of subdomains. The items used to develop the indicators appear to be reliable and valid for children aged 3–5 years.

The first step in the process involved selection of items that were interpreted consistently across all subgroups (i.e., between two countries, both sexes or up to five age groups) using differential item functioning (DIF) analysis. Statistical tests were then carried out to eliminate items due to significant differences in DIF values (indicating that items operated differently in the two countries, both sexes and up to five age groups).

[13] This section is based on Janus et al. [8] unless otherwise noted.

In the second step, items identified in the first step were included in a Rasch model analysis to further reduce the number and create the best set of items with which to assess children's performance across the domains or aspects of child development. The Rasch modelling is the recommended analytical technique because the process of item reduction is done on an iterative basis, drawing on similar underlying constructs and high statistical dependency [15]. All data analyses were performed using SPSS version 16.0.2 and Mplus version 5.

Results

After every item in the pilot questionnaires was examined for its distribution among the major developmental domains, the long 48-item ECDI was generated using the items with best fit and smallest DIF. A low DIF indicated invariance between populations, suggesting that comparison across groups is statistically and theoretically justifiable. A high DIF indicated that there is variance among the item for persons in different groups with the same total score, and that comparisons should not be made across groups. In other words, such items had different meanings for different groups and therefore could not be integrated into an international household survey. Further, the items were reanalysed and deleted one at a time until the misfits and variances were minimized. The 48 items selected were deemed to be the best in terms of differentiating between abilities of children and in demonstrating the best invariance across countries, age and sex, as shown through non-significant DIF values and misfit.[14]

The first proposed version of the 48-item ECDI was organized by the following six developmental domains (*see Annex D for specific items within each domain*):

1. Physical/gross motor (9 items)
2. Language development (10 items)
3. Cognitive development (5 items)
4. Social development (7 items)
5. Approaches to learning (6 items)
6. Emotional development (11 items)

The average interview was estimated to take a mean of 9.8 minutes for completion, with a 95 per cent confidence interval of 9.5–10.1 minutes (estimated from 900 interviews in the Philippines).

The results of the confirmatory factor analysis of parent items and the results of internal reliability testing (including corrected item-total correlations and Cronbach's alpha) of the six developmental domains identified in the 48-item ECDI are available upon request. The internal consistency of the whole 48-item instrument was very good; Cronbach's alpha was found to have very high values when the 48 items were considered together (0.896 for Jordan and 0.823 for the Philippines).[15] The physical domain had the

[14] Janus et al. [8] did note some differences between the two countries in the performance of specific items or domains, but these were deemed to be negligible.

[15] Janus et al. [8].

lowest Cronbach's alpha (0.470 in Jordan and 0.398 in the Philippines) while the remaining five domains in both countries have an alpha at or above 0.65. The results of these analyses are summarized in Table 3.

Table 3. Internal reliability results (Cronbach's alpha) of the 48-item ECDI in Jordan and the Philippines

ECD domain	Jordan	Philippines
Language	0.846	0.749
Cognitive	0.835	0.675
Physical	0.470	0.398
Social	0.697	0.734
Emotional	0.765	0.689
Approaches to learning	0.685	0.658
All 48 items	***0.896***	***0.823***

Source: Janus et al. [8].

A set of additional psychometric analyses (iterative Rasch modelling and DIF) was carried out on the 48-item instrument to identify further items for possible deletion, the assumption being that the new subset would form the best set of items to assess children's performance across all developmental domains.[16] In addition to including the pilot data, comparative DIF analyses were carried out on data from two larger data sets from Australia and Canada that had collected similar items for comparative validation.[17] This work yielded a 25-item set, eliminating 23 items from the original set of 48 items due to significant DIF values, indicating that the concept of what these items meant operated differently in the two countries in the study.

In comparison with the 48-item structure, the 25-item solution showed that the high DIF values were usually found in items in the language, communication and cognitive domains. This could be due to the broad age range in the sample, cultural differences in promoting literacy and numeracy, or other factors. However, it also suggests a slightly less prominent role for literacy items as indicators of child development. Items in the area of physical health had low DIF values, suggesting that health and more broadly, poverty, may be of greater importance, at least in some countries. These considerations supported the need to provide a broad range of items to ensure that the concepts of outcomes for young children, relevant to each country, were captured. The 25-item structure did not represent all the areas of development as identified through previous factor analyses. In conclusion, these considerations supported the 48-item ECDI to ensure international validity.

[16] The software used was the Rasch Unidimensional Models for Measurement 2030 (RUMM2030). The detailed procedures and every step of the analysis are available in Janus et al. (2008), Appendix 3.1.

[17] Australia data were collected from 2004–2006 on a total sample of 31,561 children, from which a random subset of 1,100 children was selected. Canada data were collected between 1999–2000 and 2003–2004 on a total sample of about 120,000 children, from which a random subset of 1,100 children was selected. Children from Jordan and the Philippines were younger (3–5 years) than those from Canada and Australia (5–7 years).

The next step in the systematic process of item reduction involved development of the short 18-item ECDI. Based on the full database results of the pilot countries, Jordan and the Philippines, data analyses and expert consultations were used to identify the smallest possible set of items that could be accommodated in the MICS. Using item-scale consistency analyses and factor analyses with principal axis factoring extraction and promax rotation, the top three items that loaded onto each of the six domains were selected for each country. Subsequently, the best three items common to both countries were selected. The same set of three items came with the highest internal reliability scores (Cronbach's alpha) for both countries in the physical and motor and cognitive domains. However, for the remaining four domains, more analyses were needed, as there were at least four potential items. Data from Jordan and the Philippines were then combined, and the same set of analyses described above was repeated. The best three-item combination with the highest internal reliability for corrected item-total correlations and Cronbach's alpha was then selected.

Results of internal reliability tests of the domains and the overall 18-item instrument are presented in Table 4. The physical domain showed the lowest Cronbach's alpha in Jordan (0.548), and the cognitive domain showed the lowest in the Philippines (0.544). Two domains in Jordan (language and cognitive) and two in the Philippines (physical and emotional) had an alpha at, or higher than, the desired 0.700. In conclusion, for both countries, the reduction of items from 48 to 18 did not result in a loss of internal reliability.

Table 4. Internal reliability results (Cronbach's alpha) of the 18-item ECDI, by domain and overall

ECD domain	Overall	Jordan	Philippines
Language	0.816	0.849	0.658
Cognitive	0.687	0.764	0.544
Physical	0.736	0.548	0.828
Social	0.590	0.581	0.579
Emotional	0.749	0.647	0.713
Approaches to learning	0.634	0.649	0.601
All 18 items	***0.810***	***0.803***	***0.651***

Source: Janus et al. [8], Table 3.27.

The final step was to conduct a confirmatory factor analysis with the selected 18 items. This produced estimates for 'goodness-of-fit' based on the six domains and included a test of invariance (results available upon request).

5

Validation of the 18-item ECDI

5.1 Stage 3: MICS4 pilot study in Mombasa, Kenya, 2009[18]

The fourth round of the MICS (MICS4) pilot study was conducted in Mombasa, Kenya, from 26 January to 18 February 2009. It contained several new questions compared to MICS3, including the 18-item ECDI administered as part of the Questionnaire for Children under Five (*see Part A of Annex E*).

Sampling and procedures[19]

The study site was chosen following an earlier initiative by the Kenya National Bureau of Statistics to conduct a survey in Mombasa informal settlements (slum areas) using MICS methodology. The pilot survey was conducted in two of the city's districts (Kwale and Mombasa), which are located in Coast Province.[20]

A sample of 320 randomly selected households in purposefully selected locations (urban, rural and informal settlements) was targeted for face-to-face interviews. No replacement of households was permitted in cases of non-response or non-contactable households. Both English and Kiswahili questionnaires were piloted.

Interviewers underwent a 10-day training on the MICS questionnaires and survey methodology to ensure the accuracy and reliability of the data coming from the field. Separate training and practice sessions on the Kiswahili questionnaires (in addition to the English version) were held during the fieldwork staff training. The Kenyan National Bureau of Statistics in collaboration with members of the UNICEF team conducted an additional two-day training session for interviewers.

Data collection took place in February 2009 under direct supervision of UNICEF facilitator teams. Of the 320 sampled households in the pilot, 291 were interviewed (92 per cent response rate). There were 153 eligible children under age 5 and interviews were conducted with the mothers/caregivers of 146 of them (95 per cent response rate). Of these, 58 were 3 and 4 years old [16]. These pilot data were combined with data on 160 children aged 3 and 4 years collected during the actual implementation of the survey for a final sample size used in the analyses of 218 children aged 36–59 months.

[18] This section is based on Janus et al. [12] unless otherwise noted.
[19] This subsection is based on UNICEF [16].
[20] Following the completion of the Mombasa pilot, fieldwork and data entry staff continued data collection for the MICS Mombasa Informal Settlement Survey using the same MICS4 pilot survey tools, including the 18-item ECDI.

Data analyses and validation testing

In feedback sessions with teams conducting the field testing, several challenges to implementation of the ECDI questions emerged [12]. They included:

- Many questions were taking too long, as they required use of a probe (*see Part B of Annex E*).
- Some questions appeared to be similar to other questions in the same module.
- Some concepts were difficult to grasp.
- It was uncertain whether illiterate parents could respond to questions about cognitive skills.
- Parents appeared to be answering randomly to the questionnaires.
- The 18-item ECDI appeared to have questions that overlapped with the child disability module and questions on physical well-being in other modules of the MICS, although these modules are often selected independently [16].

Statistical analyses were undertaken to explore the consistency and reliability of the items composing the 18-item ECDI piloted in Mombasa. The results of the reliability analyses conducted with the Mombasa pilot data for each of the three-item domains (language, cognitive, physical, social, emotional and approaches to learning) are available upon request. Resulting statistics included Cronbach's alpha, inter-item correlation and corrected item-total correlations. Cronbach's alpha was found to be near or above 0.700 for four of the six domains – language, cognitive, emotional and approaches to learning – and lower for the physical and social domains, as shown in Table 5).[21]

Table 5. Internal reliability results (Cronbach's alpha) of the Mombasa 18-item ECDI

ECD domain	Cronbach's alpha
Language	0.754
Cognitive	0.698
Physical	0.407
Social	0.411
Emotional	0.626
Approaches to learning	0.606

Source: Janus et al. [12].

Comparing internal consistency of the Mombasa three-item domains with data from Jordan and the Philippines revealed a high degree of similarity across the three locations.

Content validity was confirmed as the majority of the items showed expected variation by demographic characteristics and by age. Regarding concerns about similar questions, cross-tabulations showed that the overlap in answers was not greater than expected of items that asked about similar areas of behaviour.

[21] Internal validity is considered acceptable when Cronbach's alpha is 0.700 or higher, although lower values of alpha can result when there are fewer questions/items [14].

Concerns about parental literacy and competency to answer questions on cognitive development were explored, and no statistical differences were identified in the pattern of responses to the cognitive and language items by the parent's school attendance.[22]

5.2 Revision process: Creation of the 10-item ECDI

Despite the positive validity findings of the 18-item questionnaire in the Mombasa pilot, the ECDI required several modifications and refinements to fit the format and methodology of the MICS. This revision process resulted in the current version of the ECDI – as included in the MICS4 and MICS5 Questionnaire for Children under Five in the Early Childhood Development module – and consists of 10 items organized across four domains.

Table 6 shows the differences between the 18- and 10-item ECDI (*see full 10-item question set with interviewer guidelines in Annex A*). Questions deleted between the two versions are indicated in red. All questions were revised and rewritten to allow only for binary responses (yes or no). Several questions were simplified to include just one or, at most, two, concepts. To streamline MICS reporting, the number of domains was reduced to four from the original six. The separate language and cognitive domains were collapsed into one domain (renamed 'literacy-numeracy') consisting of three items, and the social and emotional domains were also collapsed into one domain (renamed 'social-emotional'), also consisting of three items.

[22] This item asked the responding parent whether they have attended school (yes or no).

Table 6. Question changes between the 18-item and 10-item ECDI	
18-item ECDI	**10-item ECDI**
LANGUAGE	**LITERACY-NUMERACY**
CE6. Can (name) identify/name at least ten letters of the alphabet?	EC8. Can (name) identify or name at least ten letters of the alphabet?
CE7. Can (name) attach sounds to most or more than half of the letters?	
CE8. Can (name) read at least four simple, one-syllable, popular words?	EC9. Can (name) read at least four simple, popular words?
COGNITIVE	
CE9. Is (name) interested in numbers, counting, sorting or adding?	
CE10. Does (name) know the name and recognize the symbol of all numbers from 1 to 10 most of the time?	EC10. Does (name) know the name and recognize the symbol of all numbers from 1 to 10?
CE11. When you compare two numbers up to 10, does (name) know which one is bigger most of the time?	
PHYSICAL	**PHYSICAL**
CE12. Is (name) able to use and manipulate small objects and toys?	EC11. Can (name) pick up a small object with two fingers, like a stick or a rock, from the ground?
CE13. Is (name) sometimes too tired, sleepy or sick to play?	EC12. Is (name) sometimes too sick to play?
CE14. Is (name) sometimes too hungry to play?	
APPROACHES TO LEARNING	**APPROACHES TO LEARNING**
CE15. Does (name) do everyday routine activities without being reminded? Activities such as brushing teeth, tidying up after play or a meal, or helping with chores?	
CE16. Does (name) follow simple directions on how to do something correctly?	EC13. Does (name) follow simple directions on how to do something correctly?
CE17. Is (name) able to work on a task, including play tasks, by himself/herself?	EC14. When given something to do, is (name) able to do it independently?
SOCIAL	**SOCIAL-EMOTIONAL**
CE18. Does (name) play with siblings or other children for a considerable time without getting into trouble?	
CE19. Does (name) show respect for other children?	
CE20. What is (name)'s ability to get along with other children? Would you say it is very good, average, or poor/bad?	EC15. Does (name) get along well with other children?
EMOTIONAL	
CE21. How often does (name) bully other children or is mean to other children?	
CE22. How often does (name) kick, bite, or hit other children or adults?	EC16. Does (name) kick, bite, or hit other children or adults?
CE23. Does (name) often get very easily/quickly distracted?	EC17. Does (name) get distracted easily?

Note: Items in aqua were deleted between the two versions.

Modification of the 18-item ECDI

This section describes the validation process that led to the changes between the 18-item and 10-item ECDI. Improving the index's validity was an iterative process in which items were removed in two steps, from 18 items to 12 and then from 12 items to 10.

Inter-item and item-total correlations were calculated to determine the weakest items in the 18-item ECDI. Two statistics can assist in analysis to decide which items to remove:

- Inter-item correlation (columns 2 and 3) – if items overall within a domain measure similar attributes, then inter-item correlation is high.
- Item-total correlation (columns 4 and 5) – if items are not correlated with their overall domain score, then item-total is low.

Table 7 identifies which items could be removed based on their high values (inter-item correlation) or low values (item-total correlation) by domain. In this first step, six items were removed: CE7, CE9, CE15, CE19, CE20, CE21 (indicated in red in the table).

Table 7. Summary of inter-item and item-total correlations

ECD domain	Highest inter-item correlations		Lowest item-total correlations	
	Philippines	Mombasa, Kenya	Philippines	Mombasa, Kenya
Language	CE6 and CE7	CE6 and CE7	CE8	CE8
Cognitive	CE10 and CE11	CE10 and CE11	CE9	CE9 or CE11
Physical	CE13 and CE14	CE13 and CE14	CE12	CE12
Approaches to learning	CE15, CE16 and CE17	CE15, CE16 and CE17	CE15, CE16 and CE17	CE15, CE16 and CE17
Social	CE18 and CE19	CE19 and CE20	CE20	CE20
Emotional	CE21 and CE22	CE21 and CE22	CE23	CE23

Note: Items in aqua were removed between the 18-item and 12-item versions of the ECDI. 'CE6', and so forth, refer to the names of items; Table 6 lists the item names with their associated questions.
Source: Author communication with Janus (2016).

Exploratory factor analyses of the remaining 12 items were conducted on the Mombasa, Jordan and Philippines samples (results available upon request). The three samples behaved similarly in a rotated component analysis using an orthogonal rotation (assuming factors are independent). Each factor output – three in total per combined ECD domain – was tested for internal reliability. The results are shown in Table 8.

Table 8. Internal reliability results (Cronbach's alpha) of a 12-item exploratory factor analysis			
ECD domain	Jordan	Philippines	Mombasa, Kenya
Language + cognitive	0.831	0.614	0.740
Social + emotional	0.521	0.611	0.424
Physical + approaches to learning + behaviour	0.565	0.589	0.468

Source: Author communication with Janus (2016).

Following the validation analysis, two additional items were removed: CE14 (too hungry) was eliminated because it demonstrated unclear internal reliability due to a negative correlation with CE12 (manipulation), and CE11 (comparing two numbers) because it reacted similarly to CE10 (counting).

The Mombasa pilot raised several implementation challenges. Respondents found the length and complexity of the questions confusing. To address this concern and reduce errors related to questionnaire design, several items were simplified to include one, or at most, two, concepts. For example, the question on the child's fine motor skills was simplified from "Is (name) able to use and manipulate small objects and toys?" (CE12) to "Can (name) pick up a small object with two fingers, like a stick or a rock from the ground?" (EC11). The revised item uses the same examples (stick, rock) as mentioned in the earlier question about objects the child plays with (CE3). In addition, the interviewer can also easily demonstrate the skill in EC11. All questions were revised and rewritten to allow only for binary responses (yes or no) in order to reduce the implementation problems observed during the pilot.

Representatives from MICS, ECD staff at UNICEF and consulting teams reached a consensus on the ECDI domain compositions and wording based on a number of psychometric, pragmatic and implementation factors. The final 10-item ECDI covered four domains (literacy-numeracy, physical, socio-emotional and approaches to learning) for children aged 3 and 4 years (36–59 months). It was incorporated into MICS4 (*see Annex A*) in 2009 and maintained during MICS5.

5.3 Computation of the individual domain scores and the ECDI

The computation syntax for reaching the overall ECDI score was changed to reflect the questionnaire modifications. Every surveyed child is identified first as being on track in each of the four domains. If three out of the four domains are on track, the child is considered to be on track overall (or ECDI = 1). At the country level, aggregated results are calculated separately for each of the four domains, and the total ECDI (ranging from 0–1) is constructed as the proportion of children who are developmentally on track in at least three of the four domains (*see Box below*).

Box: Construction of the individual domain scores and total ECDI

Responses to questions EC8–EC17 are used to determine whether children are developmentally on track in four domains:

(1) Literacy-numeracy – Developmentally on track if at least two of the following are true: EC8=1 (Can identify/name at least ten letters of the alphabet), EC9=1 (Can read at least four simple, popular words), EC10=1 (Knows the name and recognizes the symbol of all numbers from 1 to 10)

(2) Physical – Developmentally on track if one or both of the following are true: EC11=1 (Can pick up a small object with two fingers, like a stick or a rock from the ground), EC12=2 (Is not sometimes too sick to play)

(3) Social-emotional – Developmentally on track if at least two of the following are true: EC15=1 (Gets along well with other children), EC16=2 (Does not kick, bite or hit other children), EC17=2 (Does not get distracted easily)

(4) Approaches to learning – Developmentally on track if one or both of the following are true: EC13=1 (Follows simple directions on how to do something correctly), EC14=1 (When given something to do, is able to do it independently)

Total ECDI – Percentage of children who are developmentally on track in at least three of the four domains (literacy-numeracy, physical, social-emotional and approaches to learning).

Source: UNICEF [17], MICS4 Child Development Tabulation Plan, CD.5.

6

Application of the 10-item ECDI

Since its introduction in MICS4, in 2009, the 10-item Early Childhood Development Index has been incorporated into around 80 national and subnational MICS4 and MICS5 surveys (available upon request). Several reports – including a technical analysis and a technical consultation meeting report – include results obtained from countries that have collected data on the 10-item ECDI. A rapid literature review also found that several analyses have incorporated ECDI data. This sheds light on some of the ways the ECDI has been applied since 2009.[23]

6.1 Technical analysis of the ECDI in MICS4[24]

A technical analysis of the validity of the 10-item ECDI was conducted using data from 12 countries,[25] plus data on Roma subpopulations within two of these countries (the former Yugoslav Republic of Macedonia and Serbia). In this analysis, the ECDI was compared with two other early childhood development indicators collected in MICS4, the availability of children's books and playthings, and inadequate care. For most of the surveys, expected outcomes were found: Children with more books, playthings from more sources, and left alone less had higher mean item values on the ECDI than children with fewer books, playthings from fewer sources, and left alone more often. The differences were statistically significant. Having books and participating in early learning programmes were found to be the strongest predictors of children's outcomes as measured by the ECDI.

6.2 Utilization of the ECDI in current early childhood research

The ECDI data are currently the largest source of internationally comparable information on children's developmental status for low- and middle-income countries.[26] The inclusion of the ECDI in MICS enriches its research capacities by enabling the exploration of associations between child development outcomes (as measured by the ECDI) and other relevant child indicators collected in the MICS. Other items in the Early Childhood Development module focus on such issues as children's access to toys and reading materials, the nature of toys (home-made, manufactured, household objects), participation in early learning programmes and child supervision. Other modules within the Questionnaire for Children under

[23] A systematic review of how countries have utilized the ECDI for analysis or policy development is recommended.

[24] This section is based on Janus and Duku [4] unless otherwise noted.

[25] Bhutan, Chad, the Democratic Republic of the Congo, the Gambia, Iraq, Kazakhstan, the former Yugoslav Republic of Macedonia, Nepal, Serbia, Suriname, Swaziland and Viet Nam.

[26] The ECDI has been collected in some Demographic and Health Surveys, including in Cambodia (2014), Cameroon (2011), Chad (2014–2015), the Congo (2011–2012), the Democratic Republic of the Congo (2013–2014), Honduras (2011–2012), Jordan (2012), Rwanda (2014–2015) and Togo (2013–2014).

Five in MICS4 include questions on birth registration, breastfeeding, care of illness, malaria, immunization and anthropometry.

Beyond the descriptive analysis of the MICS report, subsequent analyses could examine the following associations at a national or international level:[27]

- Associations between the ECDI and other ECD module variables as independent variables, such as parenting activities, number of children's books or children's attendance in an early learning programme.
- Associations as above, but using contextual information from other modules. An example of this would be association between the ECDI and activities the child engaged in with the father, and then a frequency of households in the sample where the father was absent.
- Associations between ECDI and its components and relevant variables/indicators from other modules. For example, the ECDI outcomes can be explored in relation to child health indicators (stunting, underweight, diarrhoea, respiratory illness, vaccinations), parent indicators of education and wealth (mother's and father's education, mother's functional literacy, wealth index), family composition and practices (single female/child headed household, violent disciplinary practices) and environmental factors (iodized salt consumption, access to sanitation, housing quality).
- At a national or subnational level, the data sets could be compiled with other MICS indicators to identify marginalized children with lower levels of early childhood development as well as their protective and risk factors to improving ECD outcomes. An online survey of MICS data set users identified that about one quarter intended to utilize the survey for analysing ECD [19].[28]

An external evaluation of UNICEF's early childhood development programme in MICS4 concluded the following about the new ECD module (as a whole):

> UNICEF's promotion and use of findings from the MICS4 ECD module data are expected to continue to produce substantial benefits to all levels of the organization and to country counterparts. In particular, the resulting summary ECD indicators will facilitate national monitoring and international comparisons of children's progress in key developmental domains. Because the module does not include items on infants and toddlers, however, it does not cover the full conception-to-8 age span, which remains a gap [20, p. xiv].

[27] Examples from Janus and Duku [18].

[28] It would be relevant to further analyse these results to determine the purpose of the ECD analysis, e.g., to inform national policy, plans or programmes, for academic purposes, to identify new measurement methods, or to monitor international goals.

A rapid review of the academic and grey literature conducted in early 2016 found few published studies that included the ECDI.[29] However, three recent studies have conducted cross-country comparisons using the index. Miller et al. [21] analysed the relationship between stunting and child development using the ECDI in 15 low- and middle-income countries (MICS4). Severe stunting was negatively associated with being developmentally on track. Moderate and severe stunting was negatively associated with physical development and learning domains, but had no relationship with the socio-emotional development domain. McCoy et al. [22] used pooled ECDI data collected in 35 low- and middle-income countries between 2005 and 2015 to estimate the number of preschool-age children with low cognitive and/or socio-emotional scores. The results suggested that around one third of all children aged 3 and 4 years living in low- and middle-income countries fail to meet some basic milestones in their cognitive or socio-emotional development. In addition, the authors found positive associations between low scores in these two domains and stunting, poverty, being a boy, rural residence and lack of stimulation by caregivers.

Yao et al. [23] explored the relationship between the ECDI and its components with 50 possible determinants in 22 low- and middle-income countries. The most influential factor in improving the overall ECDI value was attending early childhood education programmes, followed by being age 4, having toys from a shop, and having more than three children's books in the home.[30] All four variables had a positive, significant influence in keeping development on track in the domains of literacy-numeracy and approaches to learning (not children's books for the latter). The size of the effect on the physical development or social-emotional domains was smaller and less consistent overall. The study also found that both the ECDI and the effect sizes of its determinants varied by sex, place of residence, age, mother's education and household income.

A regional study of eight countries in West and Central Africa found that the ECDI increased with age.[31] Disparities in levels of ECDI were observed based on children's region of residence (with differences of up to 45 percentage points between the lowest and highest scoring regions), household wealth quintiles (29 percentage point differences), mother's level of education (20 percentage point differences) and urban/rural residence (16 percentage point differences). Using a linear regression model, participating in an early childhood education programme and availability of stimulating support for learning at home (engaging in four or more activities with a parent) and household wealth were among the strongest predictors of being developmentally on track [24].[32]

A national study of the MICS4 conducted in Viet Nam identified protective and risk factors for being developmentally on track, using the ECDI and each domain separately. The risk factors associated with being off track on the overall developmental trajectory included low level of maternal education, family

[29] Because a literature review was not the primary purpose of this report, rapid searches in English, French and Spanish were performed using the term 'Early Childhood Development Index' (and its translations) in several databases, including JSTOR, Google Scholar and ProQuest. A more comprehensive search might have yielded additional results.

[30] The positive association with age of the child (namely being 4 years old, rather than 3 years old) is expected given the way in which the ECDI is constructed and that children develop and mature, advancing skills as they get older.

[31] Chad, the Democratic Republic of the Congo, the Gambia, Ghana, Mauritania, Nigeria, Sierra Leone and Togo.

[32] Mother's education level is separated into two categories: (1) secondary and higher; and (2) less than secondary.

ethnicity, lack of preschool attendance, inadequate learning support, physical punishment, not being breastfed and stunting. Girls were less likely than boys to be physically developmentally on track [25].[33]

In examination of survey results generated through use of the 10-item ECDI, patterns appear in the measurement of individual domains. Literacy-numeracy levels of on track development tend to be quite low, compared to levels of on track physical development. In most countries with available data, for example, less than one third of children are developmentally on track in the literacy-numeracy domain.

6.3 Future of the ECDI

When the Early Childhood Development Index was first being developed, there were few population-based measures for examining ECD beyond basic health, nutrition and preschool enrolment indicators. Since then, several inter-agency groups and academics have worked on developing additional national or international measures.[34] In some cases, international efforts to improve advocacy for early childhood development have been based on research conducted during the past decade, and middle-income countries have expressed a growing interest in collecting data on ECD.[35]

The timeline for achieving the goals set out in Education for All and the Millennium Development Goals came to an end in 2015. The early childhood population was included as a focused policy group in Education for All through early childhood education and in the Millennium Development Goals through poverty reduction, and maternal and infant health and nutrition. The development phase 2016–2030 is being guided by the 17 Sustainable Development Goals (SDGs) finalized in September 2015. By including ECD as a target under Goal 4, "inclusive and quality education for all", the international community has recognized ECD as a central component of global and national development. Target 4.2 calls on countries to "ensure that, by 2030, all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education" [27].

The global indicator framework for the SDGs outlines the set of indicators that will be used as a monitoring infrastructure to track progress on a global scale towards achievement of the goals. Indicator 4.2.1, one of three global-level indicators that will be used to track progress on target 4.2, is the percentage of children under 5 years old who are developmentally on track in health, learning and psychosocial well-being. UNICEF has been named as custodian agency for global reporting on this indicator. As evidence of the ECDI contribution to generating comparable data on the status of children's development in a variety of settings, the index has been identified as one of the preferred measures for monitoring progress towards target 4.2. In addition, ECDI data were featured in two publications released in 2016: the United Nations Secretary-General's report *Progress towards the Sustainable Development*

[33] UNICEF Mongolia also commissioned an analysis of the ECDI, which was measured against indicators of the home environment, early childhood education participation and socio-economic characteristics (unpublished).

[34] See, for example, the inter-agency effort to measure early learning quality and outcomes (MELQO), available at <www.brookings.edu/about/centers/universal-education/learning-metrics-task-force-2/melqo>. Also, the Hong Kong Early Child Development Scale was designed with 95 items to measure the holistic development of preschool children in Hong Kong [26].

[35] UNICEF report (unpublished) on the Technical Consultation on Measuring Early Childhood Development, 13–14 January 2015, New York.

Goals and the companion *Sustainable Development Goals Report 2016*.[36]

In light of new monitoring requirements set by the SDGs, ongoing growth in the field of ECD measurement, and increasing recognition of the importance of continuing to improve data quality and relevance, UNICEF has developed a plan for methodological work towards developing a new measure of ECD, building on the existing ECDI. This presents an important opportunity to ensure that data collected through the index, within the context of MICS and other household surveys, align closely with indicator 4.2.1. Work is under way to develop, test and validate the new measure – which will be available for use by all countries, including high-income countries, to collect internationally comparable, nationally representative and statistically sound data to monitor and track progress towards achieving target 4.2. A global inter-agency expert advisory and coordination body involving national statistical offices, United Nations agencies and international non-governmental organizations will oversee this methodological work. The body will be guided by an expert advisory group led by UNICEF and comprising academic experts in the field of ECD measurement and tool development, and technical experts in validity and reliability testing and cognitive testing for tool/instrument validation.[37]

[36] ECDI data were also submitted as part of the official SDG reporting for 2017.

[37] UNICEF workplan for revision of the ECDI as a measurement tool for SDGs indicator 4.2.1. Unpublished.

7

Conclusion

The 10-item ECDI was created through a series of validation testing and iterative analyses of data collected in Jordan, the Philippines and Kenya (Mombasa) to determine the best fit for an internationally comparable population-based measure of ECD outcomes. The analyses tested the psychometric and statistical properties of the proposed ECDI, beginning with a 48-item version, followed by an 18-item version and then the current 10-item version. This version was introduced in 2009, during MICS4, as part of the Early Childhood Development Module included in the Questionnaire for Children under Five (*see Annex A*). Data are collected on the basis of parental/caregiver reporting on 10 items about children's skills and behaviour in four areas of development: physical, literacy-numeracy, learning and social-emotional. The resulting scores reflect whether children are developmentally on track in each of the four domains and overall. The ECDI reflects the population-based normative distribution of developmental status. It is not a measure of developmental delay nor can it be used as a diagnostic tool.

From 2009–2016, the ECDI has been collected in several Demographic and Health Surveys and other national household surveys, as well as around 80 MICS, making it the largest source of internationally comparable data on children's developmental outcomes in low- and middle-income countries. Due to its brevity and simplicity, the ECDI is easy to administer, calculate and interpret. However, this ease of use comes with some limitations, many of which are associated with the concise nature of the ECDI and mode of data collection within a large household survey. Despite its shortcomings, several research reports and studies indicate that the ECDI does perform as expected.

As evidence of its contribution to generating comparable data on the status of children's development in a variety of settings, the ECDI has been identified as one of the preferred measures to monitor global progress towards achieving target 4.2 of the SDGs (specifically as a measure of indicator 4.2.1). As custodian agency for global reporting on indicator 4.2.1, UNICEF has commenced methodological work to develop, test and validate a new measure of ECD, building on the existing ECDI, for use by all countries (including high-income countries) to collect internationally comparable, nationally representative and statistically sound data to monitor and track progress towards achieving target 4.2.

8

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Annex A

Optional Early Childhood Development module containing the ECDI included in MICS4 and interviewer instructions

Selected portion of the Optional Early Childhood Development module containing the ECDI included in the Questionnaire for Children under Five

EARLY CHILDHOOD DEVELOPMENT	
EC4. *Check AG2: Age of child* ☐ *Child age 3 or 4 ⇨ Continue with EC5* ☐ *Child age 0, 1 or 2 ⇨ Go to Next Module*	
EC8. I WOULD LIKE TO ASK YOU SOME QUESTIONS ABOUT THE HEALTH AND DEVELOPMENT OF YOUR CHILD. CHILDREN DO NOT ALL DEVELOP AND LEARN AT THE SAME RATE. FOR EXAMPLE, SOME WALK EARLIER THAN OTHERS. THESE QUESTIONS ARE RELATED TO SEVERAL ASPECTS OF YOUR CHILD'S DEVELOPMENT. CAN (*NAME*) IDENTIFY OR NAME AT LEAST TEN LETTERS OF THE ALPHABET?	Yes..... 1 No ..... 2 DK..... 8
EC9. CAN (*NAME*) READ AT LEAST FOUR SIMPLE, POPULAR WORDS?	Yes..... 1 No ..... 2 DK..... 8
EC10. DOES (*NAME*) KNOW THE NAME AND RECOGNIZE THE SYMBOL OF ALL NUMBERS FROM 1 TO 10?	Yes..... 1 No ..... 2 DK..... 8
EC11. CAN (*NAME*) PICK UP A SMALL OBJECT WITH TWO FINGERS, LIKE A STICK OR A ROCK FROM THE GROUND?	Yes..... 1 No ..... 2 DK..... 8
EC12. IS (*NAME*) SOMETIMES TOO SICK TO PLAY?	Yes..... 1 No ..... 2 DK..... 8
EC13. DOES (*NAME*) FOLLOW SIMPLE DIRECTIONS ON HOW TO DO SOMETHING CORRECTLY?	Yes..... 1 No 2

	DK..... 8
EC14. WHEN GIVEN SOMETHING TO DO, IS (*NAME*) ABLE TO DO IT INDEPENDENTLY?	Yes..... 1 No ..... 2 DK..... 8
EC15. DOES *(NAME)* GET ALONG WELL WITH OTHER CHILDREN?	Yes .....1 No .....2 DK 8
EC16. DOES (*NAME*) KICK, BITE, OR HIT OTHER CHILDREN OR ADULTS?	Yes .....1 No .....2 DK 8
EC17. DOES (*NAME*) GET DISTRACTED EASILY?	Yes .....1 No .....2 DK 8

Interviewer instructions

EC8. I WOULD LIKE TO ASK YOU SOME QUESTIONS ABOUT THE HEALTH AND DEVELOPMENT OF *(NAME)* YOUR CHILD. CHILDREN DO NOT ALL DEVELOP AND LEARN AT THE SAME RATE. FOR EXAMPLE, SOME WALK EARLIER THAN OTHERS. THESE QUESTIONS ARE RELATED TO SEVERAL ASPECTS OF YOUR CHILD'S DEVELOPMENT.

CAN *(NAME)* IDENTIFY OR NAME AT LEAST TEN LETTERS OF THE ALPHABET?

CIRCLE THE CODE CORRESPONDING TO THE RESPONSE. A 'YES' ANSWER MEANS THAT THE CHILD CAN NAME TEN OR MORE LETTERS OF THE ALPHABET WHILE A 'NO' ANSWER MEANS THAT THE CHILD CAN NAME LESS THAN TEN OR NONE AT ALL.

EC9. CAN *(NAME)* READ AT LEAST FOUR SIMPLE, POPULAR WORDS?

CIRCLE THE CODE CORRESPONDING TO THE RESPONSE. A 'YES' RESPONSE MEANS THAT THE CHILD CAN READ AT LEAST FOUR SIMPLE, POPULAR WORDS WHILE A 'NO' RESPONSE MEANS THAT THE CHILD CAN ONLY READ ONE OR TWO, OR NONE AT ALL.

SURVEY COORDINATORS: DURING FIELDWORK TRAINING, TOGETHER WITH THE INTERVIEWERS AND OTHER FIELDWORK STAFF, TRY TO CREATE A LIST OF LOCALLY USED SIMPLE AND POPULAR WORDS (FROM POEMS, LULLABIES OR SONGS). THIS MAY HELP THEM TO GIVE EXAMPLES, IF NECESSARY, WHILE ASKING THIS QUESTION.

EC10. DOES *(NAME)* KNOW THE NAME AND RECOGNIZE THE SYMBOL OF ALL NUMBERS FROM 1 TO 10?

CIRCLE THE CODE CORRESPONDING TO THE RESPONSE. IF PARENT SEEMS HESITANT, PROMPT WITH "DOES THE CHILD KNOW '1'? DOES THE CHILD KNOW 2?" ETC. A "YES" ANSWER MEANS THAT THE CHILD CAN RECOGNIZE THE SYMBOL OF ALL NUMBERS FROM 1 TO 10 WHILE A "NO" ANSWER MEANS THAT THE CHILD CAN RECOGNIZE LESS THAN TEN OR NONE AT ALL.

EC11. CAN *(NAME)* PICK UP A SMALL OBJECT WITH TWO FINGERS, LIKE A STICK OR ROCK FROM THE GROUND?

CIRCLE THE CODE CORRESPONDING TO THE RESPONSE. IF NECESSARY, USE THE PEN YOU ARE HOLDING TO DEMONSTRATE THE GRIP. CONSIDER THE SMALL OBJECTS MENTIONED BEFORE WHEN ASKING ABOUT THE ITEMS CHILDREN PLAY WITH (STICKS, ROCKS, ANIMAL SHELLS OR LEAVES). A "YES" ANSWER MEANS THAT THE CHILD IS ABLE TO PICK UP SMALL OBJECTS WITHOUT DIFFICULTY WHILE A "NO" ANSWER MEANS THAT THE CHILD SEEMS TO HAVE DIFFICULTY WITH SMALL ITEMS.

EC12. IS *(NAME)* SOMETIMES TOO SICK TO PLAY?

CIRCLE THE CODE CORRESPONDING TO THE RESPONSE. A "YES" ANSWER MEANS THAT THE CHILD OFTEN GETS SICK AND CANNOT PLAY OR DO MANY PHYSICAL ACTIVITIES WHILE A "NO" ANSWER IS IN CASES WHEN THE CHILD IS CONSISTENTLY READY TO BE ACTIVE AND PLAY AND ONLY APPEARS TIRED WHEN IT IS APPROPRIATE FOR HIM/HER TO BE SO (E.G., IN THE EVENING; AT THE USUAL NAP TIME).

EC13. DOES *(NAME)* FOLLOW SIMPLE DIRECTIONS ON HOW TO DO SOMETHING CORRECTLY?

CIRCLE THE CODE CORRESPONDING TO THE RESPONSE. A "YES" ANSWER MEANS THAT THE CHILD CAN DO THINGS EASILY AND CORRECTLY WHEN ASKED TO DO SO WHILE A "NO" ANSWER MEANS THAT THE CHILD USUALLY DOES NOT ACCOMPLISH THE SIMPLE TASKS SHE/HE IS GIVEN SUCCESSFULLY. DO NOT CONCERN YOURSELF WITH THE REASONS WHY NOT.

EC14. WHEN GIVEN SOMETHING TO DO, IS *(NAME)* ABLE TO DO IT INDEPENDENTLY?

CIRCLE THE CODE CORRESPONDING TO THE RESPONSE. A "YES" ANSWER MEANS THAT THE CHILD IS ABLE TO OCCUPY HERSELF/HIMSELF INDEPENDENTLY FOR AN APPROPRIATE LENGTH OF TIME WITHOUT CONSTANT ASKING FOR ASSISTANCE OR GIVING UP QUICKLY (E.G., COLOURING, BUILDING STRUCTURES, ETC.) WHILE A "NO" ANSWER MEANS THAT THE CHILD CANNOT OCCUPY HERSELF/HIMSELF INDEPENDENTLY, ASKS FOR HELP OR ASSISTANCE, OR GIVES UP THE WORK/PLAY EASILY IF NOT PROVIDED WITH HELP.

EC15. DOES *(NAME)* GET ALONG WITH OTHER CHILDREN?

CIRCLE THE CODE CORRESPONDING TO THE RESPONSE. A "YES" ANSWER MEANS THAT THE CHILD DOES WELL PLAYING AND INTERACTING WITH OTHER CHILDREN WHILE A "NO" ANSWER MEANS THAT THE CHILD IS UNCOMFORTABLE AROUND OTHER CHILDREN, PREFERS TO BE ALONE, OR GETS INTO CONFLICTS.

EC16. DOES *(NAME)* KICK, BITE, OR HIT OTHER CHILDREN OR ADULTS?

CIRCLE THE CODE CORRESPONDING TO THE RESPONSE. A "YES" ANSWER MEANS THAT THE PARENT HAS NOTICED THAT THE CHILD CAN PHYSICALLY HURT (KICK, BITE, HIT) OTHER CHILDREN WHILE A "NO" ANSWER MEANS THAT THE CHILD DOES NOT DO IT. DO NOT CONCERN YOURSELF WITH WHAT MAY BE THE REASON OF SUCH BEHAVIOUR (E.G., IF PARENT TRIES TO EXPLAIN THE REASONS OR EXCUSE THE CHILD).

EC17. DOES *(NAME)* GET DISTRACTED EASILY?

CIRCLE THE CODE CORRESPONDING TO THE RESPONSE. A "YES" ANSWER MEANS THAT THE CHILD HAS DIFFICULTY STICKING WITH/CONTINUING ANY ACTIVITY FOR THE NECESSARY LENGTH OF TIME, GETS EASILY DISTRACTED BY ANYTHING HAPPENING AROUND HER/HIM, OR FINDS OTHER ACTIVITIES BEFORE COMPLETING THE ONE STARTED WHILE A "NO" ANSWER MEANS THAT THE CHILD DOESN'T GET EASILY DISTRACTED.

Note: The same module was kept for MICS5.

Source: UNICEF [28]. MICS4 Questionnaire for Children under Five, MICS4 Manual Instructions for Interviewers.

Annex B

External reliability analyses for pilot studies conducted in 2008

1. *Jordan sample*

Table 1.7: Test-retest reliabilities (paired samples correlations)

Scales/domains	N	Correlation	Sig.
CDQ age 3 (mean of 8 items)	91	.718	<0.001
CDQ age 4 (mean of 6 items)	88	.700	<0.001
CDQ age 5 (mean of 6 items)	163	.557	<0.001
Card Sorting Task - Stage 1 (shape only)	87	.585	<0.001
Card Sorting Task - Stage 1 (shape and colour)	85	.578	<0.001
Card Sorting Task - Stage 2	162	.184	0.019
SDQ emotional symptoms scale	358	.674	<0.001
SDQ conduct problems scale	359	.680	<0.001
SDQ hyperactivity scale	358	.575	<0.001
SDQ peer problems scale	359	.564	<0.001
SDQ prosocial scale	359	.668	<0.001
SDQ total difficulties score	359	.677	<0.001
EDI Physical well-being	282	.628	<0.001
EDI Social competence	359	.789	<0.001
EDI Emotional maturity	355	.782	<0.001
EDI Language and cog devt	349	.910	<0.001
EDI Communication and gen knowledge	360	.799	<0.001

Table 1.8: Inter-rater reliabilities (paired samples correlations)

Scales/domains	N	Correlation	Sig.
CDQ age 3 (mean of 8 items)	85	.507	<0.001
CDQ age 4 (mean of 6 items)	89	.684	<0.001
CDQ age 5 (mean of 6 items)	148	.486	<0.001
Card Sorting Task - Stage 1 (shape only)	82	.656	<0.001
Card Sorting Task - Stage 1 (shape and colour)	87	.707	<0.001
Card Sorting Task - Stage 2	145	.411	<0.001
SDQ emotional symptoms scale	335	.517	<0.001
SDQ conduct problems scale	335	.515	<0.001
SDQ hyperactivity scale	334	.565	<0.001
SDQ peer problems scale	335	.326	<0.001
SDQ prosocial scale	336	.437	<0.001
SDQ total difficulties score	336	.551	<0.001
EDI Physical well-being	305	.500	<0.001
EDI Social competence	333	.613	<0.001
EDI Emotional maturity	331	.536	<0.001
EDI Language and cog devt	328	.827	<0.001
EDI Communication and gen knowledge	336	.622	<0.001

2. *Philippines sample*

Table 2.7: Test-retest reliabilities (paired samples correlations)

Scales/domains	N	Correlation	Sig.
CDQ age 3 (mean of 8 items)	66	.668	<0.001
CDQ age 4 (mean of 6 items)	65	.450	<0.001
CDQ age 5 (mean of 6 items)	70	.433	<0.001
Card Sorting Task - Stage 1 (shape only)	197	.657	<0.001
Card Sorting Task - Stage 1 (shape and colour)	194	.233	<0.001
Card Sorting Task - Stage 2	194	.377	<0.001
SDQ emotional symptoms scale	205	.544	<0.001
SDQ conduct problems scale	205	.511	<0.001
SDQ hyperactivity scale	205	.548	<0.001
SDQ peer problems scale	205	.409	<0.001
SDQ prosocial scale	205	.519	<0.001
SDQ total difficulties score	205	.612	<0.001
EDI Physical well-being	202	.595	<0.001
EDI Social competence	203	.657	<0.001
EDI Emotional maturity	202	.683	<0.001
EDI Language and cog devt	194	.774	<0.001
EDI Communication and gen knowledge	203	.517	<0.001

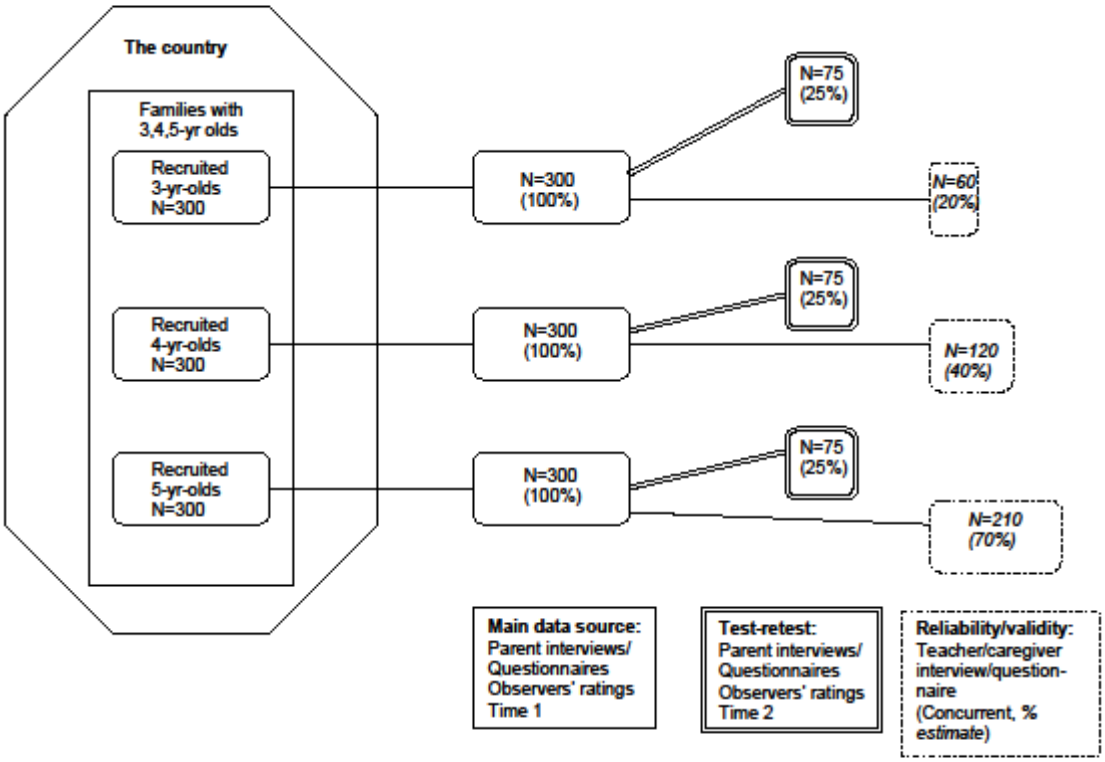
Table 2.8: Inter-rater reliabilities (paired samples correlations)

Scales/domains	N	Correlation	Sig.
CDQ age 3 (mean of 8 items)	44	.563	.000
CDQ age 4 (mean of 6 items)	39	.308	.056
CDQ age 5 (mean of 6 items)	37	.199	.237
SDQ emotional symptoms scale	381	.345	<0.001
SDQ conduct problems scale	381	.209	<0.001
SDQ hyperactivity scale	381	.203	<0.001
SDQ peer problems scale	381	.218	<0.001
SDQ prosocial scale	381	.292	<0.001
SDQ total difficulties score	381	.299	<0.001
EDI Physical well-being	375	.460	<0.001
EDI Social competence	380	.373	<0.001
EDI Emotional maturity	376	.535	<0.001
EDI Language and cog devt	346	.660	<0.001
EDI Communication and gen knowledge	379	.365	<0.001

Source: Janus et al. [8].

Annex C

ECDI pilot studies – Sample design



PROJECTED SAMPLE/COUNTRY	**900**	**225**	**397**
FINAL SAMPLES			
JORDAN	1102	390	367
PHILIPPINES	963	236	397

Source: Janus et al. [8].

Annex D

48-item ECDI module proposed in 2008

Table 3.1: ECDI items for the 48-item scale. Average time of completion: 9.8 minutes.

Question (Domain)
PHM1 Would you say that your child is sometimes over or underdressed for activities
PHM2 Would you say that your child is sometimes too tired or sick for play activities
PHM3 Would you say you're your child is sometimes too hungry for play activities
PHM4 Would you say that your child is independent in washroom/toileting habits most of the time
PHM5 Would you say that your child shows an established hand preference (right vs. left or vice versa)
PHM6 Would you say that your child is well coordinated (i.e., moves without running into or tripping over things)
PHM7 How would you rate your child's ability to manipulate objects
PHM8 How would you rate your child's ability to climb stairs
PHM9 How would you rate your child's overall physical development
LANG1 How would you rate your child's ability to use language effectively in *language of region*
LANG2 How would you rate your child' ability to tell a story
LANG3 How would you rate your child's ability to communicate their own needs in a way understandable to adults and peers
LANG4 Would you say that your child is interested in reading (inquisitive/curious about the meaning of print)
LANG5 Would you say that your child is able to identify at least 10 letters of the alphabet
LANG6 Would you say that your child is able to attach sounds to letters
LANG7 Would you say that your child is able to read simple words
LANG8 Would you say that your child is able to read simple sentences
LANG9 Would you say that your child is able to write his/her own name in *language of region*
LANG10 Would you say that your child is able to write simple sentences
COG1 Would you say that your child is interested in mathematics
COG2 Would you say that your child is interested in games involving numbers
COG3 Would you say that your child is able to count to 20
COG4 Would you say that your child is able to recognize numbers 1 - 10
COG5 Would you say that your child is able to say which number is bigger of the two
SOC1 How would you rate your child's overall social/emotional development
SOC2 How would you rate this child's ability to get along with peers
SOC3 Would you say that your child plays and works cooperatively with other children at the level appropriate for his/her age
SOC4 Would you say that your child respect the property of others
SOC5 Would you say that your child demonstrates respect for other children
SOC6 Would you say that your child accepts responsibility for actions
SOC7 Would you say that your child offers to help other children who have difficulty with a task
AL1 Would you say that your child follows directions
AL2 Would you say that your child works independently
AL3 Would you say that your child is able to follow routines without reminders
AL4 Would you say that your child is eager to play with a new toy
AL5 Would you say that your child is eager to play a new game
AL6 Would you say that your child is eager to play with/read a new book
EM1 Would you say that your child comforts a child who is crying or upset
EM2 Would you say that your child helps other children who are feeling sick
EM3 Would you say that your child gets into physical fights
EM4 Would you say that your child bullies or is mean to others
EM5 Would you say that your child kicks, bites, hits other children or adults
EM6 Would you say that your child can't sit still, is restless
EM7 Would you say that your child is distractible, has trouble sticking to any activity
EM8 Would you say that your child fidgets
EM9 Would you say that your child seems to be unhappy, sad, or depressed
EM10 Would you say that your child appears fearful or anxious
EM11 Would you say that your child appears worried

Note: PHM = physical/gross motor; LANG = language development; COG = cognitive development; SOC = social development; AL = approaches to learning; EM = emotional development
Source: Janus et al. [8].

Annex E

18-item ECDI module tested in Mombasa, Kenya, in 2009

Part A. Selected portion of the Early Childhood Development module containing the 18-item ECDI included in the Questionnaire for Children under Five

CHILD DEVELOPMENT		CE
CE5. *Check UF11: Age of child 3 or 4?* ☐ *Age 0, 1 or 2 ⇨ Go to Next Module* ☐ *Age 3 or 4 ⇨ Continue with CE6*		
CE6. I WOULD LIKE TO ASK YOU SOME QUESTIONS ABOUT THE HEALTH AND DEVELOPMENT OF YOUR CHILD. CHILDREN DO NOT ALL DEVELOP AND LEARN AT THE SAME RATE. FOR EXAMPLE, SOME WALK EARLIER THAN OTHERS. THESE QUESTIONS ARE RELATED TO SEVERAL ASPECTS OF YOUR CHILD'S DEVELOPMENT. CAN (*NAME*) IDENTIFY/NAME AT LEAST TEN LETTERS OF THE ALPHABET?	Yes ..... 1 No ..... 2 DK 8	
CE7. CAN (*NAME*) ATTACH SOUNDS TO MOST OR MORE THAN HALF OF THE LETTERS?	Yes ..... 1 No ..... 2 DK 8	
CE8. CAN (*NAME*) READ AT LEAST FOUR SIMPLE, ONE-SYLLABLE, POPULAR WORDS?	Yes ..... 1 No ..... 2 DK 8	
CE9. IS (*NAME*) INTERESTED IN NUMBERS, COUNTING, SORTING OR ADDING?	Yes ..... 1 No ..... 2 DK 8	
CE10. DOES (*NAME*) KNOW THE NAME AND RECOGNIZE THE SYMBOL OF ALL NUMBERS FROM 1 TO 10 MOST OF THE TIME?	Yes ..... 1 No ..... 2 DK 8	
CE11. WHEN YOU COMPARE TWO NUMBERS UP TO 10, DOES (*NAME*) KNOW WHICH ONE IS BIGGER MOST OF THE TIME?	Yes ..... 1 No ..... 2 DK 8	
CE12. IS (*NAME*) ABLE TO USE AND MANIPULATE SMALL OBJECTS AND TOYS?	Yes ..... 1 No 2	

	DK 8	
CE13. Is (*NAME*) sometimes too tired, sleepy or sick to play?	Yes ..... 1 No ..... 2 DK 8	
CE14. Is (NAME) sometimes too hungry to play?	Yes ..... 1 No ..... 2 DK 8	
CE15. Does (NAME) do everyday routine activities without being reminded? Activities such as brushing teeth, tidying up after play or a meal, or helping with chores? If yes: Would you say often or sometimes?	Often/Most of the time ..... 1 Sometimes ..... 2 Rarely or never ..... 3 DK 8	
CE16. Does (NAME) follow simple directions on how to do something correctly? If yes: Would you say often or sometimes?	Often/Most of the time ..... 1 Sometimes ..... 2 Rarely or never ..... 3 DK 8	
CE17. Is (NAME) able to work on a task, including play tasks, by himself/herself? If yes: Would you say often or sometimes?	Often/Most of the time ..... 1 Sometimes ..... 2 Rarely or never ..... 3 DK 8	
CE18. Does (NAME) play with siblings or other children for a considerable time without getting into trouble? If yes: Would you say often or sometimes?	Often/Most of the time ..... 1 Sometimes ..... 2 Rarely or never ..... 3 DK 8	
CE19. Does (NAME) show respect for other children? Probe: Does (NAME) listen to what another child has to say and recognize that he or she may be different or want different things? If yes: Would you say often or sometimes?	Often/Most of the time ..... 1 Sometimes ..... 2 Rarely or never ..... 3 DK 8	

CE20. WHAT IS (NAME)'S ABILITY TO GET ALONG WITH OTHER CHILDREN? WOULD YOU SAY IT IS VERY GOOD, AVERAGE, OR POOR/BAD?	Very good ..... 1 Average ..... 2 Poor/Bad ..... 3 DK 8	
CE21. HOW OFTEN DOES (NAME) BULLY OTHER CHILDREN OR IS MEAN TO OTHER CHILDREN? PROBE: DOES (NAME) OFTEN MAKE OTHER CHILDREN AFRAID OF HIM/HER, OR SAY MEAN/BAD WORDS TO OTHER CHILDREN? IF YES: WOULD YOU SAY OFTEN OR SOMETIMES?	Often/Most of the time ..... 1 Sometimes ..... 2 Rarely or never ..... 3 DK 8	
CE22. HOW OFTEN DOES (*NAME*) KICK, BITE, OR HIT OTHER CHILDREN OR ADULTS? IF YES: WOULD YOU SAY OFTEN OR SOMETIMES?	Often/Most of the time ..... 1 Sometimes ..... 2 Rarely or never ..... 3 DK 8	
CE23. DOES (*NAME*) OFTEN GET VERY EASILY/QUICKLY DISTRACTED? IF YES: WOULD YOU SAY OFTEN OR SOMETIMES?	Often/Most of the time ..... 1 Sometimes ..... 2 Rarely or never ..... 3 DK 8	

Source: UNICEF (2009), Appendix 6.

Part B. Pilot instructions for interviewers

CE6. I WOULD LIKE TO ASK YOU SOME QUESTIONS ABOUT THE HEALTH AND DEVELOPMENT OF YOUR CHILD. CHILDREN DO NOT ALL DEVELOP AND LEARN AT THE SAME RATE. FOR EXAMPLE, SOME WALK EARLIER THAN OTHERS. THESE QUESTIONS ARE RELATED TO SEVERAL ASPECTS OF YOUR CHILD'S DEVELOPMENT.

CAN (*NAME*) IDENTIFY/NAME AT LEAST TEN LETTERS OF THE ALPHABET?

CE7. CAN (*NAME*) ATTACH SOUNDS TO MOST OR MORE THAN HALF OF THE LETTERS?

If parent hesitates and cannot recall, try naming letters and asking whether child would know how that sound looks like.

CE8. CAN (*NAME*) READ AT LEAST FOUR SIMPLE, ONE-SYLLABLE, POPULAR WORDS?

Give parent examples from the list created during training – need 7-10 example words from children's poems, songs etc.

CE9. IS (*NAME*) INTERESTED IN NUMBERS, COUNTING, SORTING OR ADDING?

Circle 'Yes' if child likes playing games involving numbers; likes counting objects, food items, toys; finds pleasure in knowing how many there are of different things, asks questions about how many and/or how big things are.

CE10. DOES (NAME) KNOW THE NAME AND RECOGNIZE THE SYMBOL OF ALL NUMBERS FROM 1 TO 10 MOST OF THE TIME?

If parent seems hesitant, prompt with "does s/he know 1? Does s/he know 2?" etc.

CE11. WHEN YOU COMPARE TWO NUMBERS UP TO 10, DOES (*NAME*) KNOW WHICH ONE IS BIGGER MOST OF THE TIME?

Either when compared directly by asking the child, or as observed in household activities – e.g., knows when gets more/fewer pieces of food than a sibling, gets more/fewer toys to play with.

CE12. IS (*NAME*) ABLE TO USE AND MANIPULATE SMALL OBJECTS AND TOYS?

Consider the manipulation or use of small objects, like beads, ability to fasten small buttons on clothing, small pebbles.

CE13. IS (*NAME*) SOMETIMES TOO TIRED, SLEEPY OR SICK TO PLAY?

A "Yes" answer means that the child often or occasionally appears sleepy, or tired. Also if child or often gets sick and cannot play or do many physical activities, while a "No" answer is in cases when the child is consistently ready to be active and play or do chores, and only appears tired when it is appropriate for him/her to be so (e.g., in the evening; at the usual nap time)

CE14. IS (*NAME*) SOMETIMES TOO HUNGRY TO PLAY?

If the child sometimes or regularly doesn't have breakfast, child may complain of hunger and/or appear lethargic – which visibly affects his/her ability to play and be active.

CE15. DOES (*NAME*) DO EVERYDAY ROUTINE ACTIVITIES WITHOUT BEING REMINDED? ACTIVITIES SUCH AS BRUSHING TEETH, TIDYING UP AFTER PLAY OR A MEAL, OR HELPING WITH CHORES?

IF YES: WOULD YOU SAY OFTEN OR SOMETIMES?

"Often/Most of the time" – child remembers that certain things are always done and can successfully move between regular activities without prompting.

"Sometimes" – child requires a little prompting most of the time, or a lot of prompting every now and then.

"Rarely or never" – child either does not remember or requires a lot of prompting and reminders most of the time.

Age-appropriate examples should be given when necessary (e.g., hand washing, brushing teeth, putting things away etc.).

CE16. DOES (*NAME*) FOLLOW SIMPLE DIRECTIONS ON HOW TO DO SOMETHING CORRECTLY?

IF YES: WOULD YOU SAY OFTEN OR SOMETIMES?

"Often/Most of the time" means that the child can do things easily and correctly when asked to do so.

"Sometimes" means as above, but it does not happen consistently.

"Rarely or never" means that the child usually does not accomplish successfully simple tasks that s/he is given.

CE17. IS (*NAME*) ABLE TO WORK ON A TASK, INCLUDING PLAY TASKS, BY HIMSELF/HERSELF?

IF YES: WOULD YOU SAY OFTEN OR SOMETIMES?

"Often/Most of the time" means that the child is able to work on a task independently for an appropriate length of time without constant asking for assistance or giving up quickly, while "Sometimes" means the same, with the exception that this does not happen consistently.

"Rarely or never" means that the child is not independent in doing tasks; asks for help, assistance or gives up the work/play easily if not provided with help.

CE18. DOES (*NAME*) PLAY WITH SIBLINGS OR OTHER CHILDREN FOR A CONSIDERABLE TIME WITHOUT GETTING INTO TROUBLE?
IF YES: WOULD YOU SAY OFTEN OR SOMETIMES?

"Often/Most of the time" means that the child is able to solve any problems arising in her/his play with other children with sharing and without resorting to fights; or child is able to play alongside other children and either follow the play suggestions or contribute his/her own in a way that is acceptable to others.

If child is usually able to play with others, then code 2.

"Rarely or never" means that the child has difficulty in playing cooperatively with other children most of the time; there are conflicts, or s/he cries a lot, or prefers to stay around adults or play alone

CE19. DOES (*NAME*) SHOW RESPECT FOR OTHER CHILDREN?
PROBE:
DOES (NAME) LISTEN TO WHAT ANOTHER CHILD HAS TO SAY AND RECOGNIZE THAT HE OR SHE MAY BE DIFFERENT OR WANT DIFFERENT THINGS?
IF YES: WOULD YOU SAY OFTEN OR SOMETIMES?

"Often/Most of the time" means that the child easily accepts the idea of taking turns in play or other activities; child listens to other children without constant interruptions; child can talk with other children about different preferences (likes and dislikes) without getting into fights.

CE20. WHAT IS (*NAME*)'S ABILITY TO GET ALONG WITH OTHER CHILDREN? WOULD YOU SAY IT IS VERY GOOD, AVERAGE, OR POOR/BAD?

"Good/Very good" means that the child usually does well playing and interacting with other children – in a group of children, and just with one or two other children. "Average" will be circled when the child does only moderately well in getting along with others, or if the child does well in a small group of two or three but not in bigger groups. "Poor/bad" category will be used when the child is uncomfortable around other children, prefers to be alone or gets into conflicts.

CE21. HOW OFTEN DOES (*NAME*) BULLY OTHER CHILDREN OR IS MEAN TO OTHER CHILDREN?
PROBE:
DOES (NAME) OFTEN MAKE OTHER CHILDREN AFRAID OF HIM/HER, OR SAY MEAN/BAD WORDS TO OTHER CHILDREN?

"Often/Most of the time" – child is mean in a verbal way, or physically asserts himself using force, making other children afraid of him/her.

"Sometimes" – if parent indicates that it only happens occasionally.

"Rarely or never" – child does not show such behaviour, or only showed it once or twice.

CE22. HOW OFTEN DOES (*NAME*) KICK, BITE, OR HIT OTHER CHILDREN OR ADULTS?
IF YES: WOULD YOU SAY OFTEN OR SOMETIMES?

"Often/Most of the time" – child shows these behaviours regularly, whether provoked or unprovoked, or as a part of what child may call "play", but does them intentionally.

"Sometimes" – when these behaviours only happen occasionally.

"Rarely or never" – child does not show such behaviours, or only showed it once or twice.

CE23. DOES (*NAME*) OFTEN GET VERY EASILY/QUICKLY DISTRACTED?
IF YES: WOULD YOU SAY OFTEN OR SOMETIMES?
"Often/Most of the time" – child has difficulty sticking with/continuing any activity for the necessary length of time, gets easily distracted by anything happening around him/her, or finds other activities before completing the one started.

"Sometimes" – child has difficulty only occasionally.

"Rarely or never" – child doesn't get easily distracted.

For information on the report, please contact:

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