

Child disability screening, nutrition, and early learning in 18 countries with low and middle incomes: data from the third round of UNICEF's Multiple Indicator Cluster Survey (2005–06)

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Summary

Background Child disability is an emerging global health priority. To address the need for internationally comparable information about the frequency and situation of children with disabilities, UNICEF has recommended that countries include the Ten Questions screen for disability in the Multiple Indicator Cluster Survey (MICS) programme. We examined child disability screening and its association with nutrition and early learning in countries with low and middle incomes.

Methods Cross-sectional data for the percentage of children screening positive for or at risk of disability were obtained for 191 199 children aged 2–9 years in 18 countries participating in the third round of MICS in 2005–06. Screening results were descriptively analysed according to sociodemographic, nutritional, early-learning, and schooling variables. We constructed a weighted analysis to account for the sampling design in every country and tested for differences within countries using χ^2 analyses.

Findings A median 23% (range 3–48) of children aged 2–9 years screened positive for disability in the 18 participating countries. For children aged 2–4 years, screening positive for disability was significantly more likely in children who were not breastfed versus those who were (median 36% [9–56] vs 26% [4–51]) in eight of 18 countries, in children who had not received vitamin A supplementation versus those who had (36% [7–53] vs 29% [4–50]) in five of ten countries assessed, in children who met criteria for stunting (26% [6–54]) or being underweight (36% [3–61]) versus those who did not (25% [3–42] and 26% [4–43], respectively) in five of 15 countries assessed for stunting and in seven of 15 countries assessed for being underweight, and in those who participated in few early-learning activities versus others (31% [7–54] vs 24% [4–51]) in eight of 18 countries. Children aged 6–9 years who did not attend school screened positive for disability more often than did children attending school (29% [2–83] vs 22% [3–47]) in eight of 18 countries.

Interpretation Our results draw attention to the need for improved global capacity to assess and provide services for children at risk of disability. Further research is needed in countries with low and middle incomes to understand and address the role of nutritional deficiencies and restricted access to learning opportunities as both potential antecedents of childhood disability and consequences of discrimination.

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Introduction

Improvements in child survival in many low-income and middle-income countries in recent decades have coincided with a growing global awareness of children's functional status and the effects of childhood disabilities on individuals, families, and populations.^{1–4} Despite rising interest in child disability, little is known about the frequency and situation of children with disabilities in countries with low and middle incomes.³ According to the UN Convention on the Rights of Persons with Disabilities, disabilities are “long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder [a person's] full and effective participation in society on an equal basis with others.”⁵ Article 7 of this Convention draws attention to the rising profile of childhood disability and the need “to ensure the full enjoyment by children with disabilities

of all human rights and fundamental freedoms on an equal basis with other children.”⁵ This view of disability is consistent with UNICEF's focus on protection of children with disabilities against discrimination⁶ and with the framework of the International Classification of Functioning, Disability and Health, in which disability is regarded as an interaction between individual health conditions or abilities and contextual factors such as social support, culturally influenced perceptions of disability, and access to nutrition and education.⁷

In response to the need for information about children with disabilities in countries with low and middle incomes, UNICEF has recommended inclusion of the Ten Questions screen for child disability (panel) as an optional module in its Multiple Indicator Cluster Survey (MICS) programme. We present results of the disability module from 18 countries (figure 1) that participated in the third

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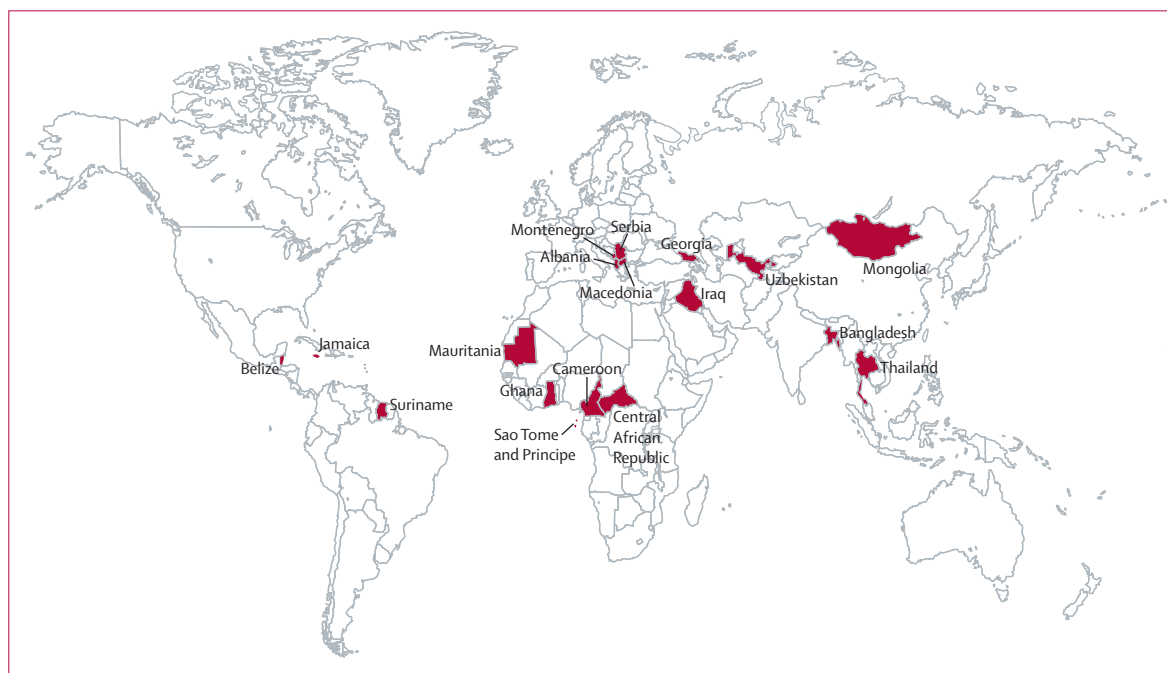


Figure 1: 18 countries that participated in the third round of the Multiple Indicator Cluster Survey (2005–06), for which data related to child disability were complete and comparable

round of MICS (MICS3) in 2005–06. Specifically, we aimed to estimate the percentage of children who screened positive for or were considered at risk of disability in these countries, and to assess the association between disability screening results and nutritional variables, exposure to early-learning activities, and school attendance.

Methods

Study design

MICS is a household survey programme that was developed by UNICEF to assist with monitoring of the health of women and children in countries with low and middle incomes. It is intended to measure progress towards an internationally agreed set of goals with use of uniform measures across countries. UNICEF provides training, materials, and support for standard methods of data collection across participating countries, although implementation of MICS3, including sample-size determination, sample-stratification variables, and decisions about which modules and measures to include, varied across countries. Indicators included in MICS have been selected on the basis of their relevance to international goals for maternal and child health within the Millennium Development Goals, the World Fit for Children Declaration and Plan of Action, the Abuja Declaration of the African Summit on Malaria, and the UN Assembly Special Session on HIV/AIDS.⁶

The first round of MICS was undertaken in the mid-1990s in more than 60 countries. It was followed by a second round of surveys in 2000 in 65 countries,⁶ and a third round in 2005–06 in 53 countries. In MICS3,

26 countries included some measure of childhood disability.⁸ Our study is based on data from 18 countries for which data related to child disability were complete and comparable, rather than a probability sample and, therefore, the results cannot be generalised to countries with low and middle incomes as a whole.

The disability module used in the MICS3, the Ten Questions, was developed as part of the International Pilot Study of Severe Childhood Disability⁹ for use in resource-poor settings. The Ten Questions was designed to be applicable in almost any cultural setting by including questions about a child's functional abilities relative to peers.^{9–13} It elicits parents' perceptions of their children's functioning by asking parents (or other primary caregivers) of children aged 2–9 years ten straightforward yes-or-no questions that screen for functional limitations in the domains of speech, cognition, hearing, vision, motor or physical, and seizure disorders. The Ten Questions approach has been the most widely used measure to screen for childhood disability in countries with low and middle incomes,⁴ and has been validated as a screen for serious disability in children aged 2–9 years through a series of studies in low-income countries.^{9–14} Results from this screen should not be interpreted as diagnostic; rather, children screening positive to the Ten Questions are considered at increased risk of disability. The usefulness of the Ten Questions is in identification of children at increased risk of disability who are most likely to benefit from referral for professional assessment and rehabilitation or other services.

Study variables

Children aged 2–9 years were identified as screening positive if their parents or guardians suggested a problem in response to one or more of the ten questions. Disability screening results were missing for a small percentage (maximum 7.3%) of children in some countries. All analyses were restricted to children whose disability screening results were complete. Results for the nutrition, early-learning, and schooling covariates are presented for all countries for which data were available. For some analyses, countries were excluded because of a high percentage ($\geq 15\%$) of missing data for the variable in question.

Anthropometry and other nutritional variables were assessed only for children younger than 5 years; analyses of Ten Questions screening status by nutritional variables were thus restricted to children aged 2–4 years. We assessed Ten Questions screening status according to four nutritional variables: breastfeeding (ever breastfed: yes or no); receipt of vitamin A supplementation (ever received: yes or no); underweight status (National Center for Health Statistics [NCHS]/WHO criteria:¹⁵ weight-for-age measurements less than 2 SD lower than the reference population median); stunting status (NCHS/WHO criteria:¹⁵ height-for-age measurements less than 2 SD lower than the reference population median). Vitamin A results are presented for ten countries; the vitamin A question was not asked in seven countries, and data for an eighth country were excluded from analyses because of a high percentage of missing data. Stunting and underweight results were available and are presented here for 15 countries; these measurements were not reported for two countries, and were excluded for a third country because of a high percentage of missing data.

Questions about early-learning activities in the MICS3 asked whether, in the past 3 days, any household member had engaged each child aged younger than 5 years in any of the following activities: reading books or looking at picture books; telling stories; singing songs; taking outside of the home, compound, yard, or enclosure; playing; or spending time naming, counting, or drawing things. Consistent with UNICEF country reports,¹⁶ we compared Ten Questions screening results for children who participated in at least four of these six activities with those for children participating in fewer than four activities. Parents of children aged 5 years and older were asked about school attendance during the previous year. We assessed Ten Questions screening results by present school attendance status (yes or no) for children aged 6–9 years.

Weights were constructed to account for the sampling design in every country. All countries used a multistage, cluster sampling approach and calculated sampling weights on the basis of the inverse probability of selection. In most countries, investigators standardised (normalised) weights by dividing every household weight by the average household weight. Investigators in Thailand

Panel: The Ten Questions screen for childhood disability

- 1 Compared with other children, did (*name*) have any serious delay in sitting, standing, or walking? (Developmental milestones)
- 2 Compared with other children does (*name*) have difficulty seeing, either in the daytime or at night? (Vision)
- 3 Does (*name*) appear to have difficulty hearing? (Hearing)
- 4 When you tell (*name*) to do something, does he/she seem to understand what you are saying? (Comprehension)
- 5 Does (*name*) have difficulty in walking or moving his/her arms or does he/she have weakness and/or stiffness in the arms or legs? (Movement)
- 6 Does (*name*) sometimes have fits, become rigid, or lose consciousness? (Seizure)
- 7 Does (*name*) learn to do things like other children his/her age? (Learning)
- 8 Does (*name*) speak at all (can he/she make himself/herself understood in words; can he/she say any recognisable words)? (Speech)
- 9 a. Ages 3–9 years: Is (*name*)'s speech in any way different from normal?
b. Age 2 years: Can he/she name at least one object (animal, toy, cup, spoon)? (Speech and communication)
- 10 Compared with other children of his/her age, does (*name*) appear in any way mentally backward, dull, or slow? (Intellectual impairment)

used population weights (not standardised), resulting in a much larger weighted sample size. The weighting scheme might also account for intentional oversampling of some regions or ethnic groups within a country. Further details about the sampling characteristics of every country can be obtained from the Thailand MICS.¹⁶ Weighted percentages without absolute numbers of participants are presented in the text and tables.

Statistical analysis

Descriptive analyses were done to estimate and describe the proportion of children screening positive to the Ten Questions in every participating country by covariates of interest, with recommended weights applied. All statistical analyses were done with SAS (version 9.1.3). For individual country results, 95% CIs were generated with the SAS `surveymeans` procedure and accounting for the cluster sampling design, and Rao-Scott χ^2 analyses were done to test for between-group differences in percentage of children screening positive to the Ten Questions. All tests of significance and estimation of variances accounted for the sampling weights and design. Children for whom values for variables in an analysis were missing were excluded from that analysis. This approach assumes that data are missing at random. After

	Number of children aged 2–9 years (n)	Weighted number of children	Language of TQ screen	Completed TQ screens (%)	Urban (%)	Boys (%)	Children aged 2–4 years (%)	Stunting (%) [*]	Underweight (%) [*]	Children screening positive for disability (%) [†]
Albania	2354	2445	Albanian	>99%	38%	53%	31%	21%	8%	16%
Bangladesh	58 441	58 592	Bangla	99%	26%	51%	37%	‡	‡	21%
Belize	1537	1505	English	98%	44%	48%	32%	18%	8%	44%
Cameroon	10 116	10 368	French	97%	45%	50%	36%	34%	20%	33%
Central African Republic	14 219	14 542	French	95%	37%	51%	40%	§	§	48%
Georgia	3992	3922	Georgian	95%	48%	54%	34%	12%	2%	30%
Ghana	5946	5391	English	99%	36%	51%	36%	26%	17%	21%
Iraq	25 775	24 826	Arabic, Kurdish	100%	58%	51%	37%	22%	8%	21%
Jamaica	2509	2498	English	94%	32%	51%	36%	‡	‡	24%
Macedonia	5921	2887	Albanian, Macedonian	100%	56%	51%	36%	8%	2%	21%
Mauritania	15 193	15 429	Arabic, French	94%	40%	51%	35%	31%	34%	30%
Mongolia	4921	4910	Mongolian	100%	50%	52%	41%	23%	8%	26%
Montenegro	1595	1187	Montenegrin, Albanian	93%	63%	52%	34%	5%	3%	14%
Sao Tome and Principe	5353	5040	Portuguese	100%	55%	51%	33%	23%	9%	29%
Serbia	4829	2628	Serbian, Albanian, Hungarian	93%	54%	52%	36%	6%	2%	14%
Suriname	3896	3831	Dutch	97%	27%	49%	37%	8%	11%	39%
Thailand	16 564	7 678 852	Thai	100%	64%	51%	38%	11%	11%	15%
Uzbekistan	8038	8185	Uzbek, Russian	100%	29%	51%	36%	17%	5%	3%
Median	..	..	..	99%	44%	51%	36%	20%	8%	23%
Overall pooled value (unweighted)	191 199	..	..	98%	41%	51%	37%	22%	14%	24%

All percentages (except for overall pooled values) are weighted to account for differences in sampling designs. TQ=Ten Questions. *Children aged 2–4 years only. †Positive response to any question of the TQ; among completed surveys. ‡Data not obtained for the third round of the Multiple Indicator Cluster Survey. §Country excluded from analyses because of a high percentage (>15%) of missing data.

Table 1: Characteristics of children aged 2–9 years who were screened with the Ten Questions in the 2005–06 Multiple Indicator Cluster Survey, by country

extensive analyses of missing responses, we noted no evidence that missing versus complete disability screening information was correlated with variables of interest, including sex, age, school attendance, or nutritional or early-learning variables.

Because of the differences in survey designs between countries, data for several countries cannot be readily combined. For all variables, we computed two overall measures incorporating data for all countries to help to summarise the findings: median values (median of all countries, with the survey weights within every country) and overall pooled values (ignoring weights and with survey responses as a convenience sample). These measures are intended to serve as succinct summaries of the various country results, and not as a global value or representative of any specific population.

This research was based on secondary analysis of anonymous data files and was deemed exempt from ethics committee approval by the Social Sciences Institutional Review Board at the University of Wisconsin–Madison.

Role of the funding source

The sponsors of the study had no role in study design, data collection, data analysis, data interpretation, or

writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Primary caregivers of 191 199 children completed the Ten Questions screen in 25 languages across 18 countries. Table 1 shows the characteristics of all children (aged 2–9 years) who were screened, by country. Boys and girls, and both age groups (2–4 and 6–9 years), were nearly evenly represented. The percentage of children residing in urban areas was highest in Thailand and lowest in Bangladesh (table 1). The median percentage of children meeting criteria for stunting was lowest in Montenegro and highest in Cameroon (table 1). In all countries, at least 87% of children aged 2–4 years had been breastfed in infancy (table 2). Receipt of vitamin A supplementation in this age group ranged from 12% in Iraq to 97% in Bangladesh (table 3). The proportion of children aged 2–4 years who were underweight ranged from 2% in Georgia to 34% in Mauritania (table 1). At least 93% of Ten Questions screens were completed in all participating countries (table 1). The median percentage of children screening positive to the Ten Questions

	Children aged 2–4 years screening positive for disability overall (%)*	Children ever breastfed (%)	Children screening positive for disability, by breastfeeding status			Children not breastfed, by 3-category TQ screening result			
			Breastfed (%)	Never breastfed (%)	p value	TQ- (%)	TQ+ (one item) (%)	TQ+ (>one item) (%)	p value†
Albania	17%	95%	17%	27%	0.1211	4%	7%	10%	0.2213
Bangladesh	24%	99%	24%	37%	0.0007‡	1%	1%	2%	0.0009‡
Belize	43%	90%	43%	48%	0.5637	9%	7%	17%	0.1002
Cameroon	37%	98%	37%	46%	0.2703	2%	3%	3%	0.4338
Central African Republic	51%	92%	51%	56%	0.4542	6%	7%	9%	0.5206
Georgia	30%	87%	29%	35%	0.2617	12%	12%	20%	0.0759
Ghana	24%	98%	24%	43%	0.0926	1%	3%	4%	0.0971
Iraq	27%	94%	27%	30%	0.2118	5%	6%	7%	0.2705
Jamaica	24%	94%	14%	26%	0.0006‡	5%	8%	15%	0.0327§
Macedonia	21%	97%	21%	24%	0.5759	6%	8%	7%	0.3950
Mauritania	37%	97%	37%	49%	0.0060¶	2%	3%	5%	0.0009‡
Mongolia	27%	97%	27%	40%	0.0143§	2%	4%	5%	0.0311§
Montenegro	14%	87%	14%	15%	0.8313	13%	15%	12%	0.9276
Sao Tome and Principe	33%	99%	32%	51%	0.0336§	1%	2%	2%	0.1289
Serbia	15%	89%	14%	21%	0.0289§	10%	14%	17%	0.0671
Suriname	39%	90%	38%	51%	0.0251§	7%	12%	11%	0.0464§
Thailand	16%	94%	15%	20%	0.1073	3%	3%	6%	0.2330
Uzbekistan	4%	97%	4%	9%	0.0289§	3%	5%	11%	0.0248§
Median	26%	95%	26%	36%	..	5%	6%	8%	..
Overall pooled value (unweighted)	27%	96%	27%	35%	..	3%	4%	6%	..

All percentages (except for overall pooled values) are weighted to account for differences in sampling designs. TQ=Ten Questions. --=negative. +=positive. * Among completed surveys. † Test for comparison of three groups, TQ-, TQ+ for one item, TQ+ for >one item. Rao-Scott χ^2 p value shows significant difference at ‡p<0.001, §p<0.05, and ¶p<0.01.

Table 2: Children aged 2–4 years who screened positive for disability to the Ten Questions in the 2005–06 Multiple Indicator Cluster Survey, by breastfeeding status and country

(or at increased risk for disability) was 23% and ranged from 3% in Uzbekistan to 48% in Central African Republic (table 1). The median percentage of children aged 2–4 years screening positive for disability was 26%, ranging from 4% in Uzbekistan to 51% in Central African Republic (table 2).

In all countries, children aged 2–4 years who were breastfed in infancy screened positive for disability less frequently than did those who were not; this finding was significant for eight countries (table 2). In all ten countries that were included in the vitamin A analysis, the percentage of children who screened positive for disability was lower for those who had received vitamin A supplements than for those who had not (table 3). This difference was significant for five countries (table 3). Children who were underweight screened positive (median 36% [range 3–61]) more frequently than did other children (26% [4–43]) (figure 2). In seven of 15 countries this difference was significant (figure 2). Similarly, in 12 of 15 countries, children who were stunted screened positive for disability (median 26% [range 6–54]) more frequently than did those who did not report stunting (25% [3–42]) (figure 3). This difference was significant for results from five countries (figure 3). In most countries, the most common item from the Ten Questions endorsed for children with

stunting was the first item, which related to developmental milestones (data not shown).

Children aged 2–4 years who had recently participated in at least four of the six early-learning activities with an adult in their household generally screened positive to the Ten Questions less frequently than did those who had participated in fewer than four activities (table 4). For results from eight countries of the 14 countries with the association in this direction, this difference was significant (table 4). However, in Ghana and Sao Tome and Principe, significantly more children who participated in at least four early-learning activities screened positive for disability than did those who participated in fewer activities (table 4). Children aged 6–9 years who attend school were less likely to screen positive for disability than were those who do not attend school (table 4). For data from seven countries, this difference was significant (table 4).

Discussion

Inclusion of the Ten Questions child disability module in UNICEF's MICS3 has provided population-based information from many countries with low and middle incomes about the proportion of young children (aged 2–9 years) screening positive for or at high risk of disability. Screening results vary across countries, with

	Children who have received vitamin A supplements within past 6 months (%)	Children who have ever received vitamin A supplements (%)	Children screening positive to any one or more of the TQ questions, by vitamin A supplement status				Children screening positive to the vision question of the TQ, by vitamin A supplement status			
			Received in past 6 months (%)	Ever received (%)	Never received (%)	p value*	Received in past 6 months (%)	Ever received (%)	Never received (%)	p value*
Bangladesh	94%	97%	24%	24%	31%	0.0006†	1%	1%	3%	<0.0001†
Belize	24%	58%	44%	36%	53%	0.0032‡	2%	3%	16%	<0.0001†
Cameroon	65%	83%	37%	37%	39%	0.5174	2%	2%	3%	0.1945
Central African Republic	64%	80%	51%	50%	52%	0.4329	3%	3%	3%	0.4754
Ghana	74%	94%	22%	23%	43%	<0.0001†	2%	3%	9%	0.0039‡
Iraq	1%	12%	26%	21%	28%	<0.0001†	3%	2%	2%	0.9201
Mauritania	61%	83%	35%	35%	47%	<0.0001†	1%	2%	2%	0.8401
Mongolia	72%	87%	27%	27%	29%	0.4902	2%	2%	3%	0.1467
Sao Tome and Principe	31%	71%	35%	32%	34%	0.6197	1%	1%	2%	0.3327
Uzbekistan	74%	90%	4%	4%	7%	0.0547	0%	<1%	0%	..
Median	65%	83%	31%	29%	36%	..	2%	2%	3%	..
Overall pooled value (unweighted)	64%	77%	28%	28%	32%	..	1%	1%	2%	..

All percentages (except for overall pooled values) are weighted to account for differences in sampling designs. TQ=Ten Questions. *Test for comparison of ever received versus never received. Rao-Scott χ^2 p value shows significant difference at †p<0.001, and ‡p<0.01.

Table 3: Children aged 2–4 years who screened positive for disability to the Ten Questions in the 2005–06 Multiple Indicator Cluster Survey, by vitamin A supplementation and country

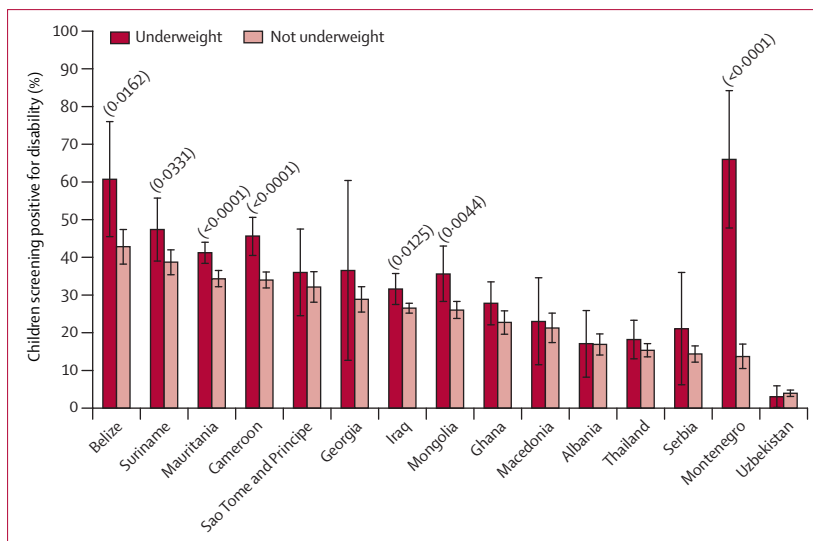


Figure 2: Children aged 2–4 years who screened positive for disability on the Ten Questions in the 2005–06 Multiple Indicator Cluster Survey, by underweight status and country
Error bars show 95% CIs. Significant p values shown in parentheses.

more than 10% of children screening positive for disability in 17 of the 18 countries, with a median prevalence of about one in four children. These findings are higher than are those of previous population-based surveys with the Ten Questions and with a similar screening criterion in low-income countries, which range from 4% to 16%.^{10,12,14,17–21}

Unfortunately, within the context of MICS3, follow-up or diagnostic information to confirm the frequency of

disabilities in the children surveyed could not be obtained. Results of previous validation studies of the Ten Questions have shown a high sensitivity (80–100%) for serious developmental disabilities, and that up to 75% of children screening positive have some impairment or disability.¹⁷ Additionally, past results have shown the positive predictive value of the Ten Questions to be no higher than 33% for serious disabilities.¹⁸ If we assume a positive predictive value of 33%, the estimated prevalence of serious disability might be as high as 15.8% in the Central African Republic and as low as 1% in Uzbekistan. Without confirmatory or diagnostic information, we cannot establish whether the variability in screening results is attributable to variability in prevalence of disability across countries. In the absence of confirmatory information about the frequency of specific disabilities in the populations surveyed, these results serve to raise awareness of the number of children at high risk of disability in countries with low and middle incomes and of the need for resources and policies to improve access to diagnostic and treatment services and interventions.

An important advantage of inclusion of the Ten Questions child disability module within MICS3 is the resulting opportunity to assess associations between disability screening results and nutritional and early-learning variables. The associations in some countries between specific Ten Questions items and nutritional exposure are notable (tables 2 and 3). This advantage is accompanied by an important disadvantage—namely, the cross-sectional design of the surveys, which restricts

	Children aged 2–4 years who participated in four or more early-learning activities (%)	Children aged 2–4 years screening positive for disability, by number of activities taken part in			Children in school, aged 6–9 years (%)	Children aged 6–9 years screening positive for disability, by school attendance		
		0–3 activities (%)	4–6 activities (%)	p value		Do not attend school (%)	Attend school (%)	p value
Albania	82%	23%	16%	0.0381*	95%	12%	16%	0.4317
Bangladesh	53%	26%	22%	<0.0001†	84%	22%	18%	<0.0001†
Belize	87%	54%	41%	0.0748	98%	83%	42%	<0.0001†
Cameroon	53%	37%	37%	0.9947	77%	34%	28%	0.0043‡
Central African Republic	60%	52%	51%	0.4780	52%	44%	47%	0.2291
Georgia	91%	41%	29%	0.0258*	95%	43%	28%	0.0064‡
Ghana	48%	20%	29%	<0.0001†	82%	15%	19%	0.1311
Iraq	55%	30%	24%	<0.0001†	82%	19%	17%	0.0574
Jamaica	90%	31%	23%	0.2045	99%	75%	25%	<0.0001†
Macedonia	91%	25%	21%	0.3913	90%	34%	18%	0.0259*
Mauritania	43%	40%	34%	0.0001†	42%	26%	25%	0.3561
Mongolia	75%	36%	24%	<0.0001†	86%	28%	27%	0.6452
Montenegro	96%	30%	13%	0.0220*	92%	17%	15%	0.7508
Sao Tome and Principe	19%	31%	39%	0.0385*	84%	30%	25%	0.1613
Serbia	92%	14%	15%	0.8089	95%	20%	15%	0.1970
Suriname	72%	35%	40%	0.1370	96%	37%	40%	0.7059
Thailand	88%	20%	15%	0.0181*	99%	49%	14%	<0.0001†
Uzbekistan	88%	7%	4%	0.0983	77%	2%	3%	0.5777
Median	79%	31%	24%	..	88%	29%	22%	..
Overall pooled value (unweighted)	62%	31%	25%	..	80%	27%	20%	..

All percentages (except for overall pooled values) are weighted to account for differences in sampling designs. Rao-Scott χ^2 p value shows significant difference at *p<0.05, †p<0.001, and ‡p<0.01.

Table 4: Children who screened positive for disability to the Ten Questions in the 2005–06 Multiple Indicator Cluster Survey, by participation in early-learning activities, school attendance, and country

their usefulness for drawing inferences about causality or direction of effects. Nonetheless, we recorded significant associations between screening status and nutritional and early-learning variables for most countries, raising important questions for further research. For example, do the results summarised in table 2 suggest that breastfeeding protects against vulnerability to developmental disabilities in countries with low and middle incomes, or that infants at risk of disability are less likely to be breastfed than are those who are not at risk?

The significant associations between anthropometric evidence of nutritional deficiency and positive disability screening results in eight of the 15 countries with available data are notable. These associations might result from nutritional deficiencies being a risk factor for disability, from children with disabilities having reduced growth potential or reduced access to food, or from a combination of these explanations. Although further studies are needed to understand the causal sequence leading to these associations, these results substantiate conclusions of previous studies that rehabilitation programmes for children with developmental disabilities in at least some resource-poor settings should be coordinated with nutritional services and primary health care.^{22,23} However, in seven of the 15 countries with

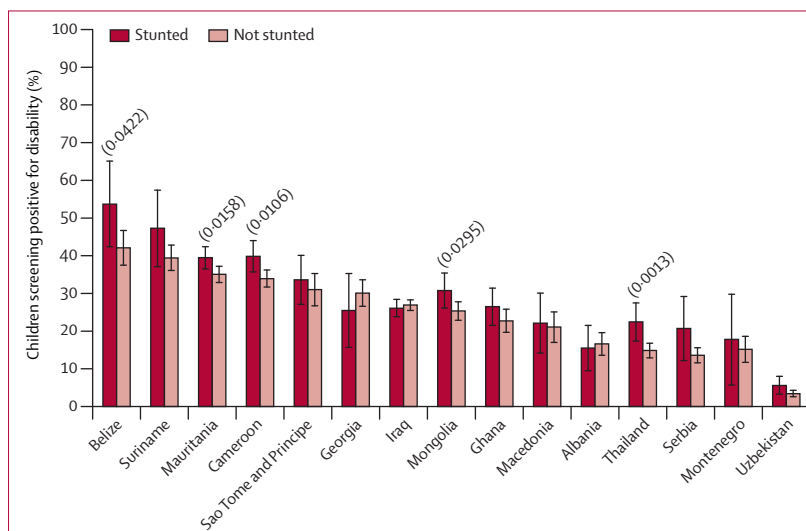


Figure 3: Children aged 2–4 years who screened positive for disability on the Ten Questions in the 2005–06 Multiple Indicator Cluster Survey, by stunting status and country. Error bars show 95% CIs. Significant p values shown in parentheses.

anthropometric data, we recorded no significant association between nutritional deprivation and positive disability screening results. Further research is needed to establish whether an absence of association in some countries is attributable to methodological factors, such

as sample-size limitations or response error, to possible selective survival, or to other factors.

The MICS3 findings provide evidence of an association between child development and exposure to stimulating early-learning activities, such as reading of stories or books and interactive play. In seven of the countries with available data, children who had participated in the greatest number of early-learning activities were least likely to screen positive to the Ten Questions. This result is consistent with previous findings that children who have greatest parental interaction or most stimulating home environments have the best developmental (especially cognitive) outcomes.^{24–30} A possible alternative explanation is that children who are at risk of disability are excluded from early-learning activities more often than are their non-disabled peers. The finding in two countries (Ghana and Sao Tome and Principe) that children screening positive for disability were significantly more likely to have taken part in early-learning activities is counter to our expectation and draws attention to a need for further research.

Notably, children not attending school were more likely to screen positive for disability than were those attending school in many countries. An implication of this finding is that programmes monitoring the frequency of child disability in countries with low and middle incomes will be incomplete if they rely on ascertainment exclusively through schools. These results also emphasise the possibility that children with disabilities might not have the same opportunities to attend school as do other children in their communities, and the need to lend support to and promote policies of inclusive education.

In addition to limitations posed by the cross-sectional nature of the MICS3 data and the absence of diagnostic information, our analyses were limited by computation of confidence intervals and tests for significance that were possible only for results within countries, and not for the combined dataset, which included information about nearly 200 000 children. This limitation, which was due to the use of different sample weighting procedures across countries, precluded pooling of the data to allow multilevel and multivariate analyses to assess causal hypotheses. As a result, the summary statistics cannot be interpreted as representative of a defined population, such as all countries with low and middle incomes. Despite the limitations of MICS3 disability data, their collection has been an important step towards obtainment of internationally comparable information about the frequency and status of children with disabilities in countries with low and middle incomes, where overall nearly 90% of the world's children reside.^{31,32}

Incorporation of the Ten Questions child disability module into MICS provides countries and international organisations with a low-cost strategy for monitoring of child disability in culturally and linguistically diverse settings and locations that do not have infrastructures for providing assessment and support services for

children with disabilities and their families. However, administration of the surveys and dissemination of the results is not sufficient. Effective monitoring of disability needs follow-up and confirmation of screening results, and application of the information to increase capacity for service provision and to lend support to policies to improve outcomes for children with disabilities.

MICS3 applied the same measure for risk of disability to participants from many countries with low and middle incomes.⁶ The internationally comparable results substantially extend what is known about children at risk of disability in these countries. The significant associations that we report between positive screens for disability and access to nutrition and early-learning opportunities call for further investigation. With the growth of interest in child health and development, we hope to see continued improvements in global health research and policy to both reduce risk of disability and improve opportunities and outcomes for children with disabilities in countries with low and middle incomes.

Contributors

CAG was responsible for study design and project coordination, report writing and revision, data analysis and interpretation, and design, creation, and revision of tables and figures. MJM was responsible for study design, data analysis and interpretation, report writing and revision, and design and creation of tables and figures. CC provided expertise about MICS data collection methods, report editing and revision, and data interpretation. MSD was responsible for supervision of the project, study design, expert knowledge about the Ten Questions and global childhood disability, data interpretation, report writing and revision, and revision of tables and figures.

Conflicts of interest

We declare that we have no conflicts of interest.

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