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Pearl S. Kyei & Nana Yaa Nyarko

To cite this article: Pearl S. Kyei & Nana Yaa Nyarko (21 Feb 2024): Care-giver child interactions and early cognitive development in West and Central Africa, Early Child Development and Care, DOI: [10.1080/03004430.2024.2320883](https://doi.org/10.1080/03004430.2024.2320883)

To link to this article: <https://doi.org/10.1080/03004430.2024.2320883>



Published online: 21 Feb 2024.



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Care-giver child interactions and early cognitive development in West and Central Africa

Pearl S. Kyei^a and Nana Yaa Nyarko^b

^aRegional Institute for Population Studies, University of Ghana, Accra, Ghana; ^bDepartment of Family and Consumer Sciences, University of Ghana, Accra, Ghana

ABSTRACT

This paper studies the association between caregiver–child interactions and early childhood development in literacy and numeracy in West and Central Africa. Data comes from Multiple Cluster Indicator Surveys (MICS) conducted in Central African Republic, Chad, Democratic Republic of the Congo, Gambia, Ghana, Guinea-Bissau, Sierra Leone, and Togo between 2017 and 2020. A multilevel logistic regression is used to estimate the likelihood of being developmentally on track for 35,752 children aged 3–4 years. The results indicate that cognitively stimulating interactions with caregivers such as reading and telling stories are correlated with a higher likelihood of being developmentally on track. Interactions with mothers are associated with significantly higher odds of being developmentally on track but not interactions with fathers.

ARTICLE HISTORY

Received 14 September 2023
Accepted 14 February 2024

KEYWORDS

Early childhood development; cognitive and linguistic development; literacy and numeracy; home learning environment; caregiver–child interactions

Background

Early childhood is a critical period for the development of cognitive, linguistic, physical, and socio-emotional abilities. Development in early childhood affects a variety of outcomes over the life-course such as educational achievement and attainment (Duncan, Ziol-Guest, & Kalil, 2010; Maluccio et al., 2009; Nores & Barnett, 2010); labour force productivity and earnings (Gertler et al., 2014; Heckman, 2006), health, wellbeing, and mortality risk (Flaherty et al., 2013; Nores & Barnett, 2010; Reynolds et al., 2007). There is also evidence specifically of the importance of early childhood literacy and numeracy on long-term educational outcomes in developed countries. Early child literacy skills are associated with later reading comprehension and academic achievement (Duncan et al., 2007; Suggate, Schaughency, McAnally, & Reese, 2018) while early childhood numeracy predicts later academic achievement, mathematics performance and educational attainment (Aubrey, Godfrey, & Dahl, 2006; Davis-Kean, Domina, Kuhfeld, Ellis, & Gershoff, 2022; Duncan et al., 2007). Unfortunately, millions of children under 5 years in developing countries are at risk of not reaching their development potential (Black et al., 2017; Engle et al., 2007; Grantham-McGregor et al., 2007; Lake, 2011) due to multiple factors including inadequate cognitive stimulation. Evidence from longitudinal studies has documented the impact of the home literacy and numeracy environment in early childhood to literacy and numeracy in later childhood (Brown, Wang, & McLeod, 2022; Conica, Nixon, & Quigley, 2023; Georgiou, Inoue, & Parrila, 2021; Liang, Cao, Zhou, Li, & Zhang, 2020).

World Bank (2022) estimates that 89% of children in sub-Saharan African countries are unable to read and understand a simple text by age 10 years, pointing to a need to understand the factors shaping the development of cognitive and linguistic skills. Cross-national studies have shown that

children in sub-Saharan Africa have the highest risk of both development delays (McCoy et al., 2016) and inadequate stimulation at home (Lu et al., 2020) compared to children in other regions. For children in sub-Saharan Africa, the literacy–numeracy domain has the lowest proportion of children who are developmentally on track (Ewerling et al., 2020; Gil, Ewerling, Ferreira, & Barros, 2020) relative to the other domains of early childhood development.

As children in their early years spend a substantial proportion of their time at home, the environment plays a significant role in their development. Environment shapes development through factors such as intellectual stimulation (Hamadani et al., 2014; Nores & Barnett, 2010; Tucker-Drob, Briley, & Harden, 2013), socio-economic resources, and caregiver–child interactions (Kiuru et al., 2012; Licata et al., 2014). Extensive literature has documented the positive influence of cognitive and linguistic stimulation on the development of literacy and numeracy abilities in early childhood (Chang, Park, Singh, & Sung, 2009; Lehl, Ebert, Blaurock, Rossbach, & Weinert, 2020; Niklas, Tayler, & Schneider, 2015; Sénéchal & LeFevre, 2002; Susperreguy, Di Lonardo Burr, Xu, Douglas, & LeFevre, 2020). Parental participation in cognitively stimulating activities such as reading, telling stories, and even talking to children have been found to promote early childhood language skills and subsequent educational achievement (Cartmill, 2016; Landry et al., 2012; Shah, Sobotka, Chen, & Msall, 2015). Reading to or with children is linked to early language development and literacy skills (Fitton, McIlraith, & Wood, 2018; Grøver, Rydland, Gustafsson, & Snow, 2020; Sajedi, Habibi, Hatamizadeh, Shahshahanipour, & Afzali, 2018; Zheng, Li, Chen, & Liu, 2022). Studies have shown that storytelling activities can promote literacy abilities (Maureen, van der Meij, & de Jong, 2022; Ong'ayi, Yildirim, & Roopnarine, 2020; Roopnarine & Dede Yildirim, 2018). Numeracy-oriented activities in early childhood such as counting have a positive correlation with numeracy skills (Anders et al., 2012; Manolitsis, Georgiou, & Tziraki, 2013; Melhuish et al., 2008).

This paper studies the association between caregiver interactions related to cognitively stimulating activities and early childhood development in literacy and numeracy in eight West and Central African countries, a topic not adequately explored in this context. West and Central Africa has been identified in cross-national studies as the sub-region with the lowest proportion of children that are developmentally on track (Barros & Ewerling, 2016; Gil et al., 2020). Due to relatively high fertility rates, the sub-region has one of the youngest populations in the world, making the high risk of developmental delays a concern because of the absolute numbers involved. Studying the determinants of early childhood development in literacy and numeracy is additionally relevant in this context where children are often dual language learners. Official languages being English, French, or Portuguese mean that young children may have to learn the official language alongside the native language spoken at home.

The paper focuses on three specific interactions with caregivers i.e. reading books, telling stories, and naming, counting, or drawing that require time and not necessarily financial resources, which is important for low-income settings. We hypothesize that children who are engaged in cognitively stimulating activities with their caregivers would be more likely to be developmentally on track. We further hypothesize that interactions with parents will be positively correlated with the development of literacy and numeracy abilities in early childhood.

Data and methods

This paper used data from eight Western and Central African Countries: Central African Republic (2018–2019), Chad (2019), Democratic Republic of the Congo (2017–2018), Gambia (2018), Ghana (2017–2018), Guinea-Bissau (2018–2019), Sierra Leone (2017), and Togo (2017). The data source is the sixth round of the Multiple International Cluster Surveys (MICS6) conducted between 2017 and 2021 (UNICEF, 2023). MICS is a global programme that collects data on maternal and child health. MICS are nationally representative surveys with a sampling design that yields representative data at regional levels and for urban and rural areas. The mode of data collection is face-to-face interviews with household members, collection of anthropometric data via measurement of height and

weight, and collection of biomarker samples for testing in some cases (see Khan & Hancioglu, 2019 for additional information on the MICS survey methods and measures).

The MICS6 included a child questionnaire that collected data on children less than 5 years old (0–59 months) in the household. The child questionnaire collected a range of information on child well-being including cognitive development, caregiving, and anthropometry. We focused on the age range 36–59 months (3 and 4 years) for this study because the questions asked in the module on early childhood development were limited to children in this age range. The survey administered the child questionnaire to mothers. When the mother of the child was not a resident of the household, the interviewer identified the primary caregiver of the child within the household and interviewed them instead. The analytic sample is 35,752 children for whom responses were available for all variables used in the analysis.

The dependent variable for this analysis is a measure of early childhood development in the literacy and numeracy domain. The survey asked caregivers a series of questions related to child development that require yes/no/do not know answers. The answers are used to construct an Early Childhood Development Index (ECDI). The ECDI is a population-based internationally comparative measure of early childhood development that can be utilized in low- and middle-income countries. It comprises 10 items used to measure development in the language/cognitive (3 items), physical (2 items), social-emotional (3 items) and approaches to learning (2 items) domains (see Loizillon, Petrowski, Britto, & Cappa, 2017 for technical documentation on the development and validation of the MICS ECDI).

MICS 6 classified children as being developmentally on track in literacy–numeracy if the caregiver answered yes to at least two out of the following three questions: (1) can (name) identify or name at least ten letters of the alphabet?, (2) can (name) read at least four simple, popular words?, (3) does (name) know the name and recognize the symbol of all numbers from 1 to 10? This study thus used this definition of being developmentally on track as the dependent variable.

The independent variables of interest are cognitively stimulating interactions between the child and caregivers. Information on interactions was derived from the questions ‘In the past 3 days, did you or any household member aged 15 or over engage in any of the following activities with the child’ and the responses are mother, father, other household member, or no one. Mothers and fathers could be biological, foster, or step parents. The activities included in the analysis are (1) read books or looked at picture books with, (2) told stories to, and (3) named, counted, or drew things for/with.

In the past 3 days, whether the child’s mother or father had engaged in any of the following activities with the child (reading books, telling stories, singing songs, taken outside, played, name/counted/drew) is included as an independent variable to measure interactions with parents. Whether the child was also left in the care of another child less than 10 years old for more than an hour in at least 6 days in the previous week is also included to represent unsupervised interactions with other children.

Additional measures of the learning environment at home, more specifically the stimulation and support available to children at home i.e. the availability of toys and books were also included in the analysis. Additionally, control variables are included to represent for child demographic characteristics, household socio-economic status, geographic location, and child nutritional status which is assessed using stunting (i.e. whether the child is more than two standard deviations below the median height-for-age of the World Health Organization Child Growth Standards).

We analyzed our data with the statistical software package Stata using a multilevel logit regression to estimate the likelihood of being developmentally on track in literacy–numeracy.

Results

Table 1 presents the descriptive statistics of the sample which indicate that 11.9 percent of the sample is developmentally on track in literacy–numeracy. With respect to interactions in the 3

Table 1. Descriptive statistics of sample i.e. children aged 3–4 years from West and Central African countries in the Multiple Cluster Indicator Survey 6 round.

Variable	Total	On track	Not on track
Developmentally on track	11.9	100.0	0.0
Cognitively stimulating activities with child in previous 3 days			
Household member 15 years and older read books or looked at picture books with child (%)	23.4	48.6	20.0
Household member 15 years and older told stories to child (%)	45.0	56.5	43.5
Household member 15 years and older named, counted, or drew things for/with child (%)	31.2	56.9	27.7
Persons engaging child			
Mother engaged the child in at least one activity (%)	58.1	68.7	56.7
Father engaged the child in at least one activity (%)	30.3	36.7	29.4
Child left in the care of another child for more than five out of the previous 7 days (%)	8.9	5.2	9.4
Lack of access to books and toys			
No children's books or picture books for child (%)	94.6	75.3	97.1
Child does not play with homemade toys (%)	50.2	41.2	51.4
Child does not play with toys (%)	61.4	38.1	64.5
Child does not play with household or outside objects (%)	17.2	17.3	17.2
Child characteristics			
Age (months)	47.0	49.2	46.7
Female (%)	49.9	52.0	49.6
Currently attending early childhood education programme (%)	17.2	58.3	11.6
Stunted (%)	34.3	19.2	36.4
Has no functional disability (%)	92.7	94.1	92.5
Does not reside with both biological parents (%)	64.2	60.1	64.7
Relationship to head of household			
Child (%)	74.08	72.34	74.31
Grandchild (%)	17.4	19.9	17.0
Other relationship (%)	8.5	7.8	8.6
Maternal characteristics			
Mother's level of education			
No education/pre-primary (%)	53.1	36.2	55.3
Primary (%)	25.0	17.9	25.9
Lower secondary (%)	13.9	27.9	12.0
Upper secondary and above	8.1	17.9	6.8
Household characteristics			
Household wealth quintile			
Poorest (%)	28.8	13.6	30.9
Second (%)	23.9	15.7	25.0
Middle (%)	20.1	18.4	20.3
Fourth (%)	15.3	22.4	14.4
Richest (%)	11.9	29.9	9.5
Female head of household (%)	22.0	25.9	21.5
Total children under 5 years in household (number)	2.20	1.98	2.22
Head of household's level of education			
No education/pre-primary (%)	46.2	34.5	47.8
Primary (%)	22.8	15.6	23.7
Lower secondary (%)	16.5	26.5	15.2
Upper secondary and above (%)	14.5	23.5	13.3
Rural residence (%)	72.2	47.6	75.6
Sample size	38,752	4,591	34,161

days preceding the survey, 23.4% of children had a household member read books or looked at picture books with them, 45.0% were told stories, and 31.2% named, counted, or drew things. For all three interactions, the percentages were higher for the sample of children that were developmentally on track.

For interactions with parents, 58.1% of children had an engagement with their mothers and 30.3% with their fathers in the previous 3 days. Similarly, interactions with both mothers and fathers were higher for children that were developmentally on track. A higher proportion of children that were not developmentally on track were left in the care of another child (less than 10 years) for more than an hour in at least six out of the preceding 7 days.

A lower proportion of children that did not have books or play with toys were developmentally on track. The proportions are the same for children who play with household or outside objects.

Other variables showing notable differences between children that are developmentally on track and those that are not include current attendance in an early childhood education programme, stunting, maternal education, and household wealth quintile.

Table 2 presents the results of the multilevel logistic regression predicting the odds of a child being developmentally on track in literacy and numeracy. The column for odds ratio presents the likelihood of being developmentally on track relative to the reference category, while the z-score and $P > |z|$ provide information on the statistical significance of the odds ratio.

Table 2. Results of multilevel logistic regression predicting the likelihood of being developmentally on track for children aged 3–4 years from West and Central African countries in the Multiple Cluster Indicator Survey 6 round.

Variable	Odds ratio	Z-score	$P > z $	[95% confidence interval]	
Cognitively stimulating activities with child in previous 3 days					
Household member 15 years and older read books or looked at picture books with child	1.51	4.64	0.00	1.27	1.80
Household member 15 years and older told stories to child	1.17	1.82	0.07	0.99	1.39
Household member 15 years and older named, counted, or drew things for/with child	1.69	4.69	0.00	1.36	2.11
Persons engaging child					
Mom engaged the child in at least one activity	1.34	2.41	0.02	1.06	1.70
Father engaged the child in at least one activity	0.99	−0.14	0.89	0.80	1.21
Child left in the care of another child for more than five out of the previous 7 days	1.00	−0.01	0.99	0.77	1.29
Lack of access to books and toys					
No children's books or picture books for child	0.57	−4.80	0.00	0.45	0.72
Child does not play with homemade toys	0.80	−2.56	0.01	0.68	0.95
Child does not play with toys	0.81	−2.78	0.01	0.70	0.94
Child does not play with household or outside objects	0.92	−0.61	0.54	0.70	1.21
Child characteristics					
Age (months)	1.20	3.61	0.00	1.09	1.32
Age squared	1.00	−2.87	0.00	1.00	1.00
Female	1.16	2.77	0.01	1.04	1.28
Currently attending early childhood education programme	5.18	11.61	0.00	3.93	6.84
Stunted	0.74	−7.05	0.00	0.68	0.81
Has no functional disability	1.16	1.74	0.08	0.98	1.38
Does not reside with both parents	0.94	−1.59	0.11	0.87	1.02
Relationship to head of household (reference: child)					
Grandchild	1.04	0.53	0.60	0.90	1.21
Other relationship	0.80	−2.40	0.02	0.67	0.96
Maternal characteristics					
Mother's level of education (reference: no education/pre-primary)					
Primary	0.99	−0.14	0.89	0.82	1.19
Lower secondary	1.38	3.95	0.00	1.18	1.62
Upper secondary and above	1.17	2.03	0.04	1.01	1.36
Household characteristics					
Household wealth quintile (reference: poorest)					
Second	1.43	4.56	0.00	1.22	1.66
Middle	1.55	3.81	0.00	1.24	1.94
Fourth	1.95	7.89	0.00	1.65	2.30
Richest	2.42	7.06	0.00	1.89	3.09
Female head of household	0.95	−1.31	0.19	0.87	1.03
Number of children under 5 years in household	0.96	−2.28	0.02	0.92	0.99
Head of household's level of education (reference: no education/pre-primary)	0.91	−1.34	0.18	0.80	1.04
Primary	1.06	0.90	0.37	0.94	1.20
Lower secondary	1.14	1.86	0.06	0.99	1.31
Upper secondary and above	1.11	0.75	0.46	0.85	1.45
Rural residence	0.87	−1.06	0.29	0.68	1.12
Constant	0.00	−6.34	0.00	0.00	0.00
Country-level constant	0.40			0.19	0.81
Country-level robust standard error	0.14				

The regression results indicate that interactions with children that involved reading or looking at pictures is correlated with significantly higher odds (about one and half times) of being developmentally on track. Naming, counting, or drawing for/with children is also correlated with significantly greater odds of being developmentally on track. The odds are positive for telling stories but not statistically significant.

Interactions with mothers is correlated with significantly greater odds of being on track but interactions with fathers are not statistically significant. Frequently leaving children in the care of another child is also not significant.

Lack of access to books and toys significantly reduces the odds of being on track. The strongest correlation is seen with lack of access to books which reduces the odds by almost half compared with children that have at least one book.

Females are significantly more likely to be on track as are older children. Children attending early childhood education programmes have five times the odds of being developmentally on track. Stunted children have significantly lower odds of being on track. Household wealth quintile and maternal education are significantly correlated with positive odds of being developmentally on track. The odds of being on track increase for each successive wealth quintile category when compared to the poorest wealth quintile category. For maternal education, the odds are highest for mothers with lower secondary education.

Discussion

The paper studies the correlation between interactions with caregivers and the early childhood development in literacy and numeracy. The findings indicate that for children that were engaged in reading books, storytelling, and naming, counting, and drawing are correlated with statistically higher odds of being developmentally on track in literacy and numeracy. These results are consistent with findings from other studies (Chang et al., 2009; Lehl et al., 2020; Niklas et al., 2015; Sénéchal & LeFevre, 2002; Susperreguy et al., 2020) that indicate a positive correlation between engaging in cognitively stimulating activities and early childhood development.

The sample characteristics indicate that a substantial percentage of the sample were in low-resource settings. A little half of the children had mothers with no formal education and almost half were in households where the household heads had no education. About half were in households in the two lowest wealth quintiles and three-quarters were living in rural areas. This may partly explain the high proportion of children that are not developmentally on track. Shah et al. (2015) found that low-income parents in the United States were less likely to participate in these cognitively stimulating activities leading to the risks of developmental delays in their children. There is evidence in that context that though parents with higher education were more likely to spend time with their children despite spending more time working outside the home and having higher employment rates than parents with lower education (England & Srivastava, 2013; Guryan, Hurst, & Kearney, 2008).

The research findings also indicate that interacting with mothers has a significant positive association with the odds of being developmentally on track but for fathers, the relationship is not significant. This finding is contrary to previous studies that have found that interaction with both fathers and mothers has a positive influence on early childhood cognitive development specifically (Chang et al., 2009; Varghese & Wachen, 2016) and early childhood development more broadly (Jeong, McCoy, & Fink, 2017; Jeong, McCoy, Yousafzai, Salhi, & Fink, 2016). Research specifically on numeracy skills in early childhood (Del Río, Susperreguy, Strasser, & Salinas, 2017; Mutaf-Yildiz, Sasanguie, De Smedt, & Reynvoet, 2020) has found that numeracy-related activities with mothers at home predicted child numeracy but not that with fathers. Curtin, Madden, Staines, and Perry (2013) also found that the cognitive skills of children were even more influenced by the mother's level of education because mothers were likely to spend more time with their children than fathers.

The findings also indicate that a positive relationship exists between the availability of books and toys on the likelihood of being developmentally on track in literacy and numeracy. There is substantial literature on the positive correlation between early literacy and numeracy skills and socio-economic status (SES), measured using household income and parental level of education (Curtin et al., 2013; Pancsofar & Vernon-Feagans, 2006). The explanation for this relationship is the ability of higher SES households to afford learning materials, engage in cognitively stimulating activities, help with homework, and expose children to reading habits and diverse vocabulary.

This study utilized cross-sectional data and thus inferences on causality cannot be made. The results can only point to a positive association between cognitively stimulating interactions with caregivers and the likelihood of being developmentally on track. Limitations related to the data available is that the MICS utilized caregiver reports of child cognitive development rather than direct testing and did not collect information on factors that can influence literacy and numeracy skills development such as language spoken at home. Although the analysis controlled for enrolment in early childhood education programmes, there was also no direct measure of cognitively stimulating interactions with persons who are not members of the child's household.

Conclusions

The paper studied the relationship between interaction with caregivers and early childhood development in literacy and numeracy. Majority of the sample was not developmentally on track in literacy–numeracy. The findings indicated that cognitively stimulating interactions with caregivers that promote learning such as reading books, telling stories, naming, counting, or drawing have benefits for young children. Access to resources such as children's books and toys all contribute to a home environment conducive for child development. The study highlights the importance of interactions with caregivers, in ensuring that children go through the appropriate developmental stages in early childhood.

The importance of interactions with caregivers, even after controlling for household socio-economic status and access to books and toys indicate that making time for children is a significant contribution to child development. This is particularly important for resource-constrained settings such as the West and Central African context where households may have inadequate financial resources but can invest time in promoting early childhood development. For each of the three activities studied in this research, less than half of the children had an interaction with a household member aged 15 years and older in the 3 days before the survey. The findings point to the need to raise awareness of the necessity of regularly engaging young children in cognitively stimulating activities to promote the development of literacy and numeracy skills.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

Data from this study is publicly available from <https://mics.unicef.org/surveys>.

Notes on contributors

Pearl S. Kyei is a Lecturer at the Regional Institute for Population Studies, University of Ghana. She is a social demographer whose research interests lie primarily in studying human capital investments in sub-Saharan Africa and understanding social inequality. She is also interested in strengthening research capacity, improving the statistical literacy of data users, and promoting the uptake of research for decision-making, policy, and planning. She holds a Bachelor of Arts degree in Economics from Davidson College, a Master of Arts degree in Demography from the University of Pennsylvania, and a PhD in Demography also from the University of Pennsylvania.

Nana Yaa Nyarko is a Senior Lecturer at the Department of Family and Consumer Sciences at the University of Ghana. Her research interest areas are in early childhood care and education specifically how children's developmental needs are met in schools by teachers/caregivers and at home by parents, especially as it relates to their emotional wellbeing. She holds a PhD Degree in Education from the Open University Malaysia, an MPhil Degree in Psychology from the University of Ghana and a Bachelor of Arts Degree in Psychology and Sociology from the University of Ghana.

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