


# What factors are associated with early childhood development in Thailand? A cross-sectional analysis using the 2022 Multiple Indicator Cluster Survey

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## ABSTRACT

**Background** Early childhood development is essential for lifelong health and well-being. This study aims to assess the proportion of children aged 24–59 months in Thailand who are developmentally on track using the Early Childhood Development Index 2030 (ECDI2030) and to explore associations with household socioeconomic characteristics and environments.

**Methods** A cross-sectional analysis was conducted using data from the 2022 Multiple Indicator Cluster Survey by the Thailand National Statistical Office. The developmental progress of 6557 children was evaluated across health, learning and psychosocial domains using ECDI2030 criteria. Multivariable logistic regression was used to assess associations between developmental status and household and participant characteristics.

**Results** The study found that 81.3% of children were developmentally on track. Factors positively associated with being on track included being female (adjusted OR (AOR)=1.49), higher maternal education (AOR=2.02 for above secondary education), more books at home (AOR=1.59 for 3–9 books; AOR=2.40 for 10+ books) and increased screen time (AOR=1.68). Living in the Northern (AOR=0.45) and Northeastern (AOR=0.56) regions decreased the likelihood of being on track.

**Conclusion** Around 20% of children did not meet ECDI2030 milestones, highlighting the need for targeted policy interventions. Gender, region, maternal education, access to books and screen time were significant factors for developmental outcomes. Policies should prioritise support for parents, nurturing care and educational resources, particularly for socioeconomically disadvantaged groups.

## BACKGROUND

During the critical early years of childhood, from birth to age 5, children undergo rapid and essential development across cognitive, motor, language, socioemotional and regulatory domains.<sup>1–3</sup> Adequate development lays the foundation for their future health, well-being and success.<sup>4 5</sup> Aligned with this, indicator 4.2.1 of the Sustainable Development Goals (SDGs) emphasises tracking young

## WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Early childhood development is shaped by socioeconomic factors such as gender, maternal education and home environments. Prior research has demonstrated the importance of these factors in promoting developmental progress in young children.

## WHAT THIS STUDY ADDS

⇒ This study reiterates the crucial role of maternal education and access to developmental resources, such as books, in supporting early childhood development. It also highlights regional disparities, showing that children in certain areas of Thailand are less likely to be developmentally on track. Additionally, the study finds that increased screen time is associated with a higher likelihood of being developmentally on track, which may reflect the context in which screens are used in certain environments.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The findings support policies that ensure equitable access to early learning through parenting interventions and community resources provided by local governments and schools, in order to achieve equitable child development outcomes.

children's developmental progress in health, learning and psychosocial well-being, underscoring the importance of early support and opportunities.<sup>6</sup>

Optimal child development, as outlined in the Nurturing Care Framework by the WHO, UNICEF and the World Bank, highlights the importance of health, responsive caregiving and early learning.<sup>2 7 8</sup> Families who prioritise quality time with their children create nurturing and secure environments where kids feel valued and supported.<sup>1</sup> Access to educational materials like books enriches learning experiences and stimulates curiosity and imagination.<sup>4 9–11</sup> However, excessive

screen time can hinder development by replacing physical activity, overstimulating the brain and affecting attention span and cognitive development, while also reducing face-to-face interactions which are vital for social skill development.<sup>12–16</sup>

Thailand, an upper middle-income country in Southeast Asia, has experienced rapid economic, social and technological changes, impacting the lifestyles and development of families.<sup>17,18</sup> Additionally, the declining total fertility rate from 5.5 per woman in 1970 to 1.3 in 2020<sup>19</sup> results in a significant decline in the number of children under 5 from 6 million in the 1970s to 3 million in the 2020s; reiterating the importance of quality care for children.<sup>20</sup> The Multiple Indicator Cluster Surveys (MICS), conducted by UNICEF periodically (every 3–5 years), is a global survey tool used to gather nationwide, population-based data on key indicators related to the well-being of children and women.<sup>21</sup> MICS surveys in Thailand, conducted from 2006 to 2019, revealed that between 79% and 93% of children were considered developmentally on track.<sup>22–25</sup> With the recent 2022 MICS providing a more comprehensive assessment criterion, it is imperative to analyse the current state using the most updated data and approach.<sup>26</sup>

This study aims to examine the proportion of children aged 24–59 months in Thailand who are developmentally on track using the Early Childhood Development Index 2030 (ECDI2030) and explores associations with household socioeconomic characteristics and household environments. The findings will inform policy initiatives to strengthen early childhood development in Thailand, emphasising the need for targeted interventions tailored

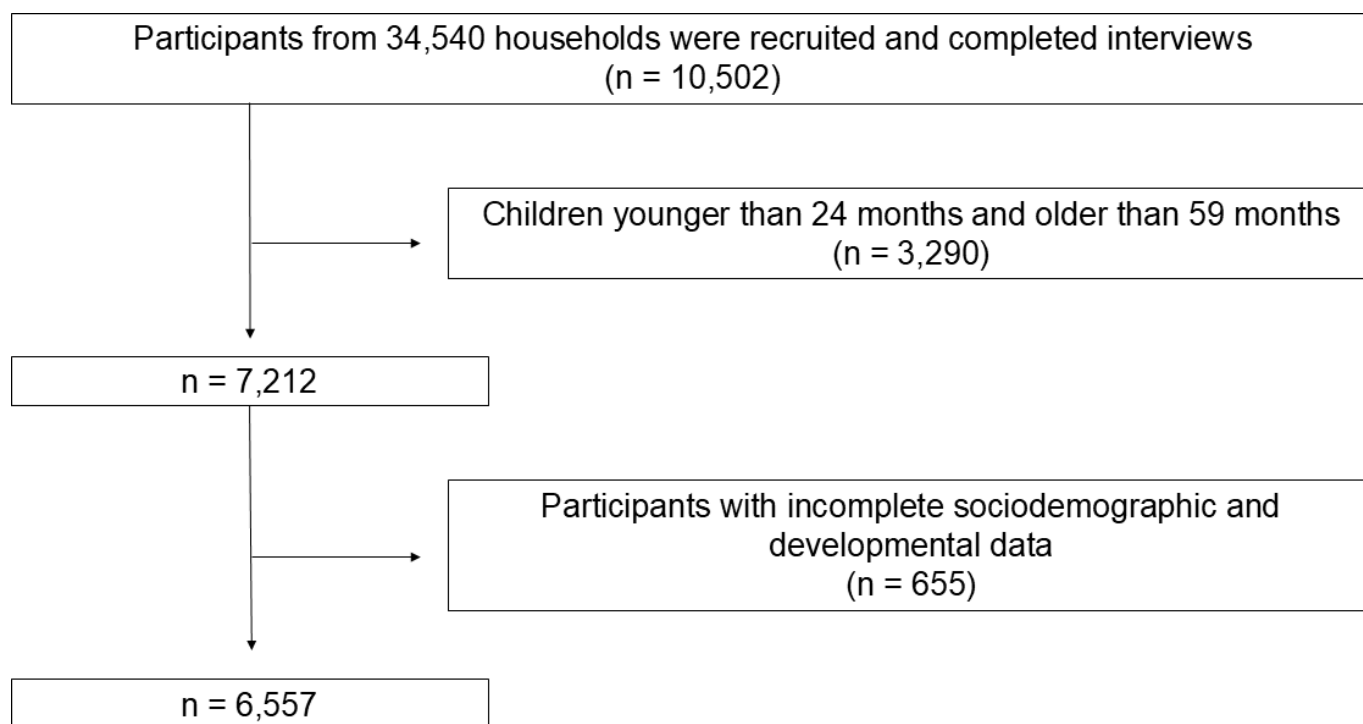
to specific population groups to promote optimal and equitable development outcomes for children in Thailand.

## METHOD

### Sample and procedure

We analysed data from 2022 MICS, a cross-sectional quantitative survey conducted by the National Statistical Office (NSO) in collaboration with UNICEF.<sup>26</sup> It is a multistage stratified sampling to gather information on children and women at the country and regional levels across urban and rural areas. Sampling involved selecting enumeration areas systematically based on probability proportionate to size, resulting in 1727 sample enumeration areas and 34540 households nationwide (covering all 77 provinces). From these households, interviews were completed with mothers of 10502 children under 60 months old. For this study, we focused on developmentally on-track status assessed in children aged 24–59 months, as this is the age group assessed using the ECDI2030 tool in the MICS.<sup>27,28</sup> Consequently, 7212 children within this age range were included (see the participant flow chart in figure 1).

The survey used computer-assisted personal interviewing via CSPro software V.7.6, with a dedicated data management platform. Training included anthropometric measures and interviewing techniques. Fieldwork by 98 teams used tablet computers, with quality control measures like daily monitoring. Data were managed and edited using SPSS version 24 software. Anonymised data are available on NSO and MICS websites. Face-to-face



**Figure 1** Participant flow chart. ECDI2030, Early Childhood Development Index 2030; MICS, Multiple Indicator Cluster Surveys; NSO, National Statistical Office; SDGs, Sustainable Development Goals.

**Table 1** Developmental domains, subdomains and activity items of Early Childhood Development Index 2030 (ECDI2030)<sup>26</sup>

Domain	Subdomain	Activity item
Health	Gross motor development	<ul style="list-style-type: none"> <li>▶ Can walk on an uneven surface.</li> <li>▶ Can jump up with both feet leaving the ground.</li> </ul>
	Fine motor development	<ul style="list-style-type: none"> <li>▶ Can dress themselves without help.</li> <li>▶ Can fasten and unfasten buttons without help.</li> </ul>
Learning	Expressive language	<ul style="list-style-type: none"> <li>▶ Can say 10 or more words.</li> <li>▶ Can speak using sentences of 3 or more words.</li> <li>▶ Can speak using sentences of 5 or more words.</li> <li>▶ Can correctly use pronouns like 'I', 'you', 'she' or 'he'.</li> </ul>
	Literacy	<ul style="list-style-type: none"> <li>▶ Can consistently name an object.</li> <li>▶ Can recognise at least 5 letters of the alphabet.</li> <li>▶ Can write their name.</li> </ul>
	Numeracy	<ul style="list-style-type: none"> <li>▶ Can recognise all numbers from 1 to 5.</li> <li>▶ Can give 3 objects the correct amount.</li> <li>▶ Can count 10 objects.</li> </ul>
	Executive functioning	<ul style="list-style-type: none"> <li>▶ Can do an activity without repeatedly asking for help or giving up quickly.</li> </ul>
Psychosocial well-being	Emotional skills	<ul style="list-style-type: none"> <li>▶ Asks about familiar people when they are not there.</li> <li>▶ Offers to help someone who seems to need help.</li> </ul>
	Social skills	<ul style="list-style-type: none"> <li>▶ Gets along well with other children.</li> </ul>
	Internalising behaviour	<ul style="list-style-type: none"> <li>▶ How often the child seems very sad or depressed.</li> </ul>
	Externalising behaviour	<ul style="list-style-type: none"> <li>▶ How often the child kicks, bites or hits other children or adults.</li> </ul>

interviews with mothers/guardians lasted approximately 60 min. Fieldwork teams measured the weights and heights of children aged under 5 years. Fieldwork took place between June and October 2022. Failure to obtain household consent to participate was recorded as household non-response, and failure to complete questionnaires after three visits to the household was recorded as individual non-response.<sup>28</sup> Questionnaires were based on the MICS6 questionnaires, translated into Thai and were pretested in Pathum Thani province in April 2022. Based on the pretest results, modifications were made to the wording and translation of the questionnaires.

## Measurement

### Developmentally on track

Developmentally on track was assessed using ECDI2030, a tool designed for integration into MICS to monitor SDG 4.2.1. This instrument relies on caregiver reports rather than direct assessments. Data were collected from mothers or caregivers of children aged 24–59 months to evaluate their developmental progress across 20 activity items spanning health, learning and psychosocial domains<sup>26</sup> (table 1).

Milestone achievement was determined based on parents' perceptions of whether children could perform specific tasks. A 'Yes' response indicated attainment of health and learning milestones, while psychosocial milestones were evaluated through responses indicating appropriate frequencies, such as not experiencing daily sadness or displaying aggression. Benchmarks were defined for a minimum number of milestones expected

by age group to define children as developmentally on track: 7 milestones for ages 24–29 months, 9 for 30–35 months, 11 for 36–41 months, 13 for 42–47 months and 15 for 48–59 months.

### Participants' characteristics and household environments

The independent variables included age, sex, region, residency, maternal education, household wealth, living arrangements, language used at home, number of books at home and screen time. Ages ranged from 24 to 59 months, with sex classified as boy or girl. Regional domains included Bangkok, Central, North, Northeast and South. Domicile was categorised as urban (municipality area) or rural (non-municipality area). Household wealth status was categorised into five wealth quintiles from poorest to richest, using principal component analysis of the ownership of durables, dwelling characteristics, sanitation and other assets. Maternal education was categorised as less than secondary, secondary and post-secondary. Living arrangements were categorised as living with neither, either or both parents. The language used at home was categorised as Thai or non-Thai. The number of books at home was grouped as (a) fewer than 3, (b) 3–9 and (c) 10 or more. Screen time duration was categorised as not using and one or more hours per day according to the WHO's guideline.<sup>16</sup>

### Data management and statistical analysis

Our analysis follows the MICS guide.<sup>26 29</sup> Respondents with missing data on ECDI2030 and independent variables were excluded from the analysis. Descriptive

analysis was performed to determine the frequency and percentage of participants who were developmentally on track. The bivariate association between participants' characteristics and household environments with being developmentally on track was assessed using the  $\chi^2$  test, with statistical significance determined by a *p* value <0.05. Further analysis used multivariable logistic regression to simultaneously examine the associations between participants' characteristics, household environments and ECDI2030. All analyses incorporated survey weights to adjust for respondents in each household, in line with the survey methods. Associations were presented as adjusted ORs (AOR), 95% CIs and *p* values. The analyses were performed using Stata statistical software V.17 (StataCorp, College Station, Texas, USA).

### Ethics approval and consent

As provided by the Statistics Act, BE2550 (2007), NSO has a mandate to conduct population surveys, and ethical review and approval were not required.<sup>30</sup> Verbal consent was obtained from each participant before the interviews.<sup>26 28 30</sup> Participants were informed of the voluntary nature of participation, as well as the confidentiality and anonymity of their information. They were also informed of their right to refuse to answer certain questions or to terminate the interview at any time. The research team was authorised by the NSO to access the survey microdata for this study. Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

### Patient and public involvement

Patients and the public were not involved in this study.

## RESULTS

### Baseline participant characteristics and developmentally on track

Out of 7212 mothers with children aged 24–59 months, 6557 children with complete sociodemographic and developmentally on-track data were included in the study (figure 1). There were more boys than girls (54.3% vs 45.7%) (table 2). The largest proportion of children were from the Northeast region (30.9%), followed by the Central region (26.0%), with most participants living in rural areas (59.9%). The largest proportion of children's mothers had secondary education (41.5%). Most children lived with both parents (56.4%) and spoke Thai at home (90.6%). More than half of the children had fewer than three books at home (54.3%), and 41.2% did not use screen devices for more than 1 hour/day.

### Proportion of developmentally on track by participants' characteristics and their associations

A majority of participants were developmentally on track (81.3%) (table 2). The following characteristics were significantly associated with higher proportions of being developmentally on track: being a girl (84.8%), living

in Bangkok (89.5%), residing in urban areas (83.9%), having mothers with higher education levels (88.5% for post-secondary education), belonging to wealthier households (88.4% for the highest quintile), living with either mother or father (83.3%), having more books at home (91.6% for those with 10 or more books) and using screen devices (84.7% for those with one or more hours per day).

Multivariable logistic regression analysis identified gender, regions, maternal education, the presence of books at home and the use of screen devices as statistically significant factors associated with being developmentally on track (table 3). Being a girl (AOR=1.49, 95% CI 1.17, 1.91), having mothers with higher education levels (AOR=2.02, 95% CI 1.23, 3.31 for above secondary education), having more books at home (AOR=1.59, 95% CI 1.17, 2.16 for 3–9 books; AOR=2.40, 95% CI 1.49, 3.86 for at least 10 books) and using screen devices for at least 1 hour/day (AOR=1.68, 95% CI 1.30, 2.18) were all significantly associated with a higher likelihood of being developmentally on track. In contrast, living in the Northern (AOR=0.45, 95% CI 0.27, 0.75) and Northeastern (AOR=0.56, 95% CI 0.34, 0.92) regions was associated with lower odds of being developmentally on track compared with Bangkok.

## DISCUSSION

This study examined the proportion of young children in Thailand who were developmentally on track as measured by ECDI2030. Results showed that 81.1% of children aged 24–59 months were developmentally on track. Girls were more likely than boys to be developmentally on track while residing in Northern and Northeastern regions decreased this likelihood. Higher maternal education and more books at home were positively associated with being developmentally on track, as was increased screen time. These findings highlight the importance of household and parental socioeconomic factors in supporting early childhood development and achieving SDG target 4.2.

This study had both strengths and limitations. A major strength was its large, nationally, regionally and provincially representative sample, providing robust findings critical for monitoring progress towards SDG indicator 4.2.1, which aimed to ensure access to quality early development, care and pre-primary education for all children. It was also the first to use the newly updated ECDI2030, offering fresh insights into child development trends. However, the sampling frame relied on a household registry, potentially excluding marginalised populations such as illegal migrants and the homeless, which may have impacted the prevalence estimates. Additionally, the study relied on parental reporting without direct observation, which may have introduced bias, and the number of books reported at home was not verified. The survey also did not explore the content or patterns of screen time use, limiting our understanding of how screen exposure

**Table 2** Participant characteristics and household environments overall and for children with developmentally on-track data

Participants' characteristics	Total n=6557 (100%)		Developmentally on track n=5328 (81.3%)		P value*
	n	% (column)	n	% (row)	
Age (months)					0.61
24–35	2148	32.7	1739	80.9	
36–47	2191	33.4	1758	80.3	
48–59	2218	33.9	1832	82.6	
Sex					<b>&lt;0.001</b>
Boy	3562	54.3	2788	78.3	
Girl	2995	45.7	2540	84.8	
Region					<b>&lt;0.001</b>
Bangkok	538	8.2	482	89.5	
Central	1706	26.0	1416	83.0	
North	1161	17.7	877	75.5	
Northeast	2029	31.0	1602	79.0	
South	1124	17.1	951	84.7	
Residency					<b>0.03</b>
Urban	2631	40.1	2207	83.9	
Rural	3926	59.9	3122	79.5	
Maternal education					<b>&lt;0.001</b>
Below secondary education	2055	31.3	1538	74.9	
Secondary education	2722	41.5	2214	81.3	
Above secondary education	1780	27.2	1576	88.5	
Household wealth (quintile)					<b>0.002</b>
1	1415	21.6	1104	78.0	
2	1314	20.0	1022	77.7	
3	1323	20.2	1084	82.0	
4	1433	21.8	1171	81.7	
5	1073	16.4	948	88.4	
Living arrangements					0.06
Living with neither mother nor father	1427	21.8	1094	76.7	
Living with either mother or father	1426	21.8	1188	83.3	
Living with both mother and father	3704	56.4	3047	82.3	
Language used at home					0.24
Thai	5942	90.6	4845	81.5	
Non-Thai	615	9.4	483	78.6	
Number of books at home					<b>&lt;0.001</b>
<3	3562	54.3	2729	76.6	
3–9	2197	33.5	1868	85.0	
≥10	798	12.2	731	91.6	
Screen time duration (hour/day)					<b>&lt;0.001</b>
0	2704	41.2	2066	76.4	
≥1	3853	58.8	3262	84.7	

P-value in bold indicates statistical significance.

\*Bivariate association between categorical variables and developmentally on track was examined via  $\chi^2$  analyses ( $p < 0.05$  = statistical significance).

might be associated with developmental outcomes. Lastly, the cross-sectional design limited the ability to establish causality.

In this study, 81% of children aged 24–59 months in Thailand were developmentally on track, surpassing the

global average of 75.3% observed across 85 countries between 2014 and 2022.<sup>31</sup> Many of these countries, being low- and middle-income, generally reported lower rates of children being developmentally on track. However, the prevalence in this study was lower than in previous

**Table 3** Multivariable logistic regression analyses of developmentally on track and participants' correlates (n=6557)

Participants' characteristics	Developmentally on track			P value
	Adjusted OR	95% CI		
		Lower	Upper	
Age (month)				
24–35 (ref)				
36–47	0.88	0.65	1.21	0.44
48–59	0.98	0.71	1.36	0.90
Sex				
Boy (ref)				
Girl	<b>1.49</b>	1.17	1.91	<b>&lt;0.001</b>
Region				
Bangkok (ref)				
Central	0.67	0.38	1.18	0.16
North	<b>0.45</b>	0.27	0.75	<b>&lt;0.001</b>
Northeast	<b>0.56</b>	0.34	0.92	<b>0.02</b>
South	0.8	0.48	1.32	0.38
Residency				
Urban (ref)				
Rural	0.93	0.70	1.24	0.65
Maternal education				
Below secondary education (ref)				
Secondary education	1.38	0.93	2.06	0.11
Above secondary education	<b>2.02</b>	1.23	3.31	<b>0.01</b>
Household wealth (quintile)				
1 (ref)				
2	0.82	0.57	1.18	0.29
3	0.96	0.65	1.42	0.85
4	0.73	0.45	1.16	0.18
5	1.01	0.61	1.66	0.97
Living arrangements				
Living with neither mother nor father (ref)				
Living with either mother or father	1.02	0.67	1.54	0.94
Living with both mother and father	0.84	0.56	1.27	0.41
Language used at home				
Thai (ref)				
Non-Thai	1.09	0.76	1.56	0.63
Number of books at home				
<3 (ref)				
3–9	<b>1.59</b>	1.17	2.16	<b>&lt;0.001</b>
≥10	<b>2.40</b>	1.49	3.86	<b>&lt;0.001</b>
Screen time duration (hour/day)				
0 (ref)				
≥1	<b>1.68</b>	1.30	2.18	<b>&lt;0.001</b>

Model adjusted for age, sex, region, residency, maternal education, household wealth, living arrangements, language used at home, number of books at home and screen time duration.  
P-value in bold indicates statistical significance.

surveys conducted in Thailand, which reported 79% in 2006 and 93% in 2012, 2015 and 2019.<sup>22–25</sup> It is important to note that previous surveys used different criteria (Early Childhood Development and ECDI2030), making direct comparisons difficult. With both Early Childhood Development and ECDI2030 using different methodologies, this makes their results not entirely comparable.<sup>29</sup> Despite this, the lower prevalence in the current study underscores the need for increased support for children, particularly in the wake of the COVID-19 pandemic, when the closure of early childhood education centres may have contributed to developmental delays, especially for marginalised families.<sup>32</sup>

Sex and maternal education were significantly associated with early childhood development. Girls were more likely to be developmentally on track than boys, a trend observed globally, possibly due to earlier language and social skill development.<sup>33</sup> Boys often faced communication challenges, with gender differences in early childhood education affecting engagement—girls tended to interact more with teachers, while boys displayed more spontaneous behaviours.<sup>33</sup> Our findings aligned with UNICEF's assessment across 84 countries, where girls had higher developmental on-track rates than boys.<sup>31</sup> Similarly, higher maternal education was associated with the better developmental outcomes, as educated mothers were more aware of early childhood development and provided enriched learning environments.<sup>34 35</sup> In contrast, parents with lower education levels, particularly from disadvantaged families, often struggled to support their children's development.<sup>36</sup> Enhancing parental knowledge and skills during antenatal care and well-child visits could help less educated parents contribute positively to their children's development.

Having books at home was important for early childhood development, as it helped foster language skills, cognitive growth and stronger parent–child bonds.<sup>9–11</sup> Reading to children improved their vocabulary, critical thinking and imagination, while also strengthening emotional connections.<sup>9–11</sup> Interestingly, this study found that screen use was also positively associated with developmental outcomes. This differed from MICS 2019 in Thailand, which found no significant association between screen time and childhood development.<sup>37</sup> While many studies, particularly in high-income countries,<sup>13 15</sup> suggested that screen use could be harmful, our findings suggested the need for further research. One possible explanation for this positive association is the role of screen devices during the COVID-19 pandemic. With early childhood education centres closed, children with access to screens likely used them for online learning, allowing them to continue their education. Meanwhile, children without access to screen devices may have missed important educational opportunities.<sup>38 39</sup>

Regional disparities played a crucial role in early childhood development. Our findings indicated that children living in the Northern and Northeastern regions were significantly less likely to be developmentally on track

compared with other parts of the country. These regions have historically struggled with economic growth, infrastructure and access to education.<sup>19</sup> Both the Northern and Northeastern regions lagged in educational infrastructure and access to quality schools, limiting children's exposure to stimulating learning environments.<sup>19 40</sup> Limited access to healthcare and early childhood development programmes, along with geographical and financial barriers, further restricted families' ability to support early development.<sup>40</sup>

As part of our analysis, we considered the potential impact of missing data. In this study, about 9% of participants were excluded due to incomplete data. To assess the potential impact of these missing data, we performed sensitivity analyses using both best-case and worst-case scenarios. In the best-case scenario, where missing participants were assumed to be developmentally on track, the results were consistent with the original analysis. However, in the worst-case scenario, assuming all missing participants were developmentally off track, the variable 'books at home' lost its statistical significance. This suggests that while missing data may influence the significance of certain variables, the overall findings of the study remain largely unchanged.

The findings of this study have important implications for policy and practice. Effective policy should support parents and caregivers as they have a critical role in fostering responsive relationships and supporting early learning, which are essential for promoting early child development. Ensuring equitable access to health services, nutrition, protection and early learning from birth to school entry through nurturing care and positive parenting practices is imperative.<sup>2 7 8</sup> Policies that promote evidence-based parenting interventions during antenatal and postnatal care, as well as throughout early childhood, are essential for achieving equitable outcomes for all children. Furthermore, local governments and schools should enrich community resources by offering access to children's books through libraries. Supporting young mothers to continue their education can also contribute to their children's development and well-being.

## CONCLUSION

This study examined the progress towards SDG target 4.2.1 and the factors influencing developmental outcomes in children aged 24–59 months in Thailand. Nearly 20% were found to be developmentally off track as measured by ECDI2030, emphasising the need for public health interventions and policy attention to address these gaps and support improvements in early childhood development. Factors positively associated with being developmentally on track included sex, maternal education, availability of books at home and screen time, while residing in Northern and Northeastern regions decreased this likelihood. These findings underscore the crucial role of household and parental socioeconomic factors in

shaping early childhood development. Effective policies should support parents as primary caregivers, ensure optimal nurturing care, positive parenting practices, and provide additional support for children, particularly those in socioeconomically disadvantaged groups.

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**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not applicable.

**Ethics approval** This study involves human participants and was approved by the Thailand Department of Health Institutional Review Board (approval number: 757/2024). Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data are available in a public, open access repository. The data used in this study are publicly available from the 2022 Multiple Indicator Cluster Survey (MICS), accessible online at: <https://mics.unicef.org/surveys>.

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