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Original Research Article

The digital milestone: exploring the relationship between smartphone use and developmental domains in children aged 1–5 years

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ABSTRACT

Background: In parallel with fast life-wide adoption of smartphones, even young children receive increased access to digital devices. With excessive screen time being a concern as it is, structured smartphone interactions can also bring fine-motor, behaviour-related, and language skills that reflect developmental progress. Objectives were to assess the association of developmental age with performance on smartphones across 12–60-month children, as well as to determine whether smartphone-based interactions can be used as a surrogate marker for developmental screening.
Methods: Descriptive cross-sectional study was carried out on 24 children from 12–60 months of age in a tertiary healthcare facility in India. Developmental age was scored on four parameters fine motor, gross motor, behaviour, and language—based on milestone charts of Ghai essential pediatrics. Smartphone functioning was tested with ten standard interactive tasks. Associations of developmental age with scores on smartphone functioning were studied with Spearman's rank-order correlation test.
Results: There was a highly significant and strong positive correlation with smartphone performance of tasks in all four fields of developmental stages (fine motor: $\rho=0.958$, $p<0.001$; gross motor: $\rho=0.937$, $p<0.001$; behavioral: $\rho=0.949$, $p<0.001$; language: $\rho=0.926$, $p<0.001$). Children with greater developmental maturity demonstrated greater proficiency on smartphones' performance of tasks.
Conclusion: Smartphone interaction performance is significantly associated with young child developmental maturity. Basic smartphone-based tasks can be used as a low-cost adjunctive young child developmental screening tool in under-resourced settings. Multicentric larger trials are needed to confirm these results and create common digital assessment tools.

Keywords: Child development, Smartphone use, Developmental milestones, Fine motor skills, Early screening, Paediatrics

INTRODUCTION

Since the rapid global adoption that began in 2011, smartphones have become an indispensable element of daily life at all levels of socioeconomic status. Their presence is now extended even to early childhood years, where studies reveal that nearly three-quarters of children living in low-income urban communities own or routinely use a smartphone, and most are exposed to one before their first birthday.[1,2] This early and increasing exposure to digital media has generated both interest and concern regarding its developmental implications.

Studies done over decades showed us how screen exposure affects children's physical activity, cognition, social interaction, and sleep patterns.[3-5] While excessive use has been associated with adverse behavioral and cognitive outcomes, structured engagement with touchscreen devices also requires coordinated fine-motor control, visual tracking, and receptive language-all integral components of developmental progress.

Developmental screening is a cornerstone in pediatric practice to enable early detection of delays and thus facilitate early intervention. Developmental surveillance should be a part of every well-child visit, according to the Indian Academy of Pediatrics, with formal screening at 18, 30, and 36 months as critical checkpoints.[6,7] However, these assessments are often time-consuming, subjective, and limited by the availability of trained personnel.

This paper regards a child's ability to perform simple tasks on a smartphone as a potential reflection of neurodevelopmental progress. This research investigates how children from 12 to 60 months of age perform in various tests using a smartphone, in a descriptive cross-sectional study, and how their capabilities correspond to their developmental age regarding fine motor, gross motor, behavioral, and linguistic development.

Aim

The aim is to see whether a child's interaction with a smartphone may provide an accessible, practical tool for early developmental screening, to examine the relationship between developmental age and smartphone function performance in children aged 12–60 months, and to evaluate the potential of smartphone interaction as a proxy tool for early developmental screening.

Objectives

The objectives of the study included to assess developmental age across fine motor, gross motor, behavioural/social, and language domains in children aged 12–60 months, to evaluate smartphone interaction performance through standardized age-appropriate tasks, to analyze the correlation between developmental age and smartphone function performance, and to explore the feasibility of using smartphone-based interaction as a screening proxy for early developmental assessment.

METHODS

Study design and setting

In the Department of Paediatrics at Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, a tertiary care facility in western India, this study was conducted using a descriptive, cross-sectional observational design. The study was completed over a period of one month.

The Institutional Ethics Committee gave its approval prior to the commencement of data collection (Ref. No. [insert IEC number]). Every study activity complied with the Indian Council of Medical Research's (ICMR) guidelines and the Declaration of Helsinki's (2013 revision) ethical standards for human research.

Examining the relationship between smartphone function performance and developmental age in the four major early childhood developmental domains of fine motor, gross motor, behavioral, and language was the main goal.

Participants and sampling method

A total of 24 children aged between 12 and 60 months were enrolled during the study period. Participants were selected using a convenience sampling technique, considering the feasibility and short duration of data collection. Children were recruited from those admitted to the general paediatric ward or accompanying relatives during hospital visits. This diverse recruitment ensured inclusion of children across different socioeconomic and cultural backgrounds, providing a representative sample of the local population.

Before inclusion, the study protocol was clearly explained to the caregivers, and written informed consent was obtained. For children older than two years, verbal assent was also taken in age-appropriate language. Caregivers were assured that participation was voluntary and that refusal would not affect their child’s clinical care.

Inclusion criteria

Children aged between 12 and 60 months, children with prior exposure to a smartphone device, as confirmed by the caregiver, and availability of a parent or guardian capable of providing accurate developmental history and consent were included.

Exclusion criteria

Children with critical or unstable medical conditions that could interfere with participation or observation, no prior smartphone exposure, which could bias task performance, and refusal or withdrawal of consent by caregivers at any stage of the study were excluded.

Study procedure and environment

All assessments were performed in a quiet, well-lit room within the paediatric ward to ensure a child-friendly environment. Each session was scheduled at a time when the child was alert and comfortable, usually during daytime hours after feeding and rest. To build rapport, the investigator engaged the child in short, informal play before the formal assessment. The smartphone used for evaluation was cleaned and reset before each session to ensure uniformity and safety. Depending on caregiver report, the child was assessed using the operating system they were most familiar with (either Android or iOS).

Assessment of developmental age

Each child’s developmental age was evaluated across the four principal developmental domains — fine motor, gross motor, behavioral/social, and language — using a combination of direct observation and caregiver interview. The evaluation followed the developmental milestone framework outlined in Ghai essential pediatrics which is widely used in Indian paediatric practice.[8] Milestones were graded according to the child's ability to perform each task independently and consistently.

Fine motor domain

Assessed tasks included grasping small objects, transferring objects between hands, stacking blocks, scribbling, and using pincer grasp.

Gross motor domain

Activities such as sitting, standing, walking, running, jumping, and stair climbing were observed. Postural control and balance were also noted.

Behavioural/social domain

The child's interaction with the caregiver and examiner, imitation, sharing, response to social cues, and emotional expression were evaluated through direct observation and caregiver input.

Language domain

Language development was assessed through both receptive (comprehension) and expressive (speech) components. The child's ability to understand simple commands, name familiar objects, form sentences, and engage in basic conversation was documented.

Each domain's developmental age was recorded in months and compared against chronological age using standard developmental charts. The mean of the four domain-specific developmental ages was considered the overall developmental age for that child.

The developmental age in each domain was determined using a combination of direct observation and caregiver reporting. During the assessment, children were encouraged to perform age-appropriate tasks in a relaxed and familiar environment to minimize performance anxiety.

Standardized developmental milestone charts commonly used in the Indian population were employed as the reference standard for evaluating developmental age.[8] Each milestone was considered achieved if the child could independently and consistently perform the corresponding skill or behaviour.

For example, in the fine-motor domain, tasks such as stacking blocks or holding small objects were observed, while the language domain included assessing the child's ability to respond to simple commands or name familiar objects. The behavioural domain included evaluating interactive play, social imitation, and attention span, whereas gross-motor milestones were assessed by observing walking, running, jumping, and postural balance.

The detailed developmental milestone framework is presented in Table 1.

Table 1: Developmental milestones across gross motor, fine motor, communication/social, and cognitive/adaptive domains from 2 to 60 months of age. The table outlines the typical age ranges and progressive acquisition of motor, language, social, and cognitive skills observed during early childhood development.

Age (months)	Gross motor	Fine motor	Communication/social	Cognitive/adaptive
2	Lifts head/chest when prone	Eyes track past midline	Alerts to sound; social (reciprocal) smile	Recognizes parent
4	Rolls front to back	Grasps a rattle	Laughs; soothed by parent's voice	Orients head to direction of voice
6	Sits with little or no support	Reaches with one hand; transfers objects	Babbles; developing stranger anxiety	Feeds self
9	Pulls to stand	Developing immature pincer grasp; bangs two objects together	Says "mama/dada" indiscriminately; waves bye-bye	Plays gesture games (e.g., pat-a-cake)
12	Stands/walks alone	Fine pincer grasp	Says one word other than "mama/dada"; follows one-step commands with gesture	Points to desired object
15	Stoops and recovers	Scribbles in imitation	Uses 3–5 words	Uses spoon and cup; turns pages in a book
18	Runs well	Builds a tower of 3 cubes	Points to 1–3 body parts	Helps in the house
24	Throws ball overhead; kicks a ball	Copies drawing a line with crayon	Speaks in 2-word combinations; ≥50-word vocabulary; parallel play	Removes an article of clothing
36	Pedals a tricycle	Copies a circle	Speaks in 3-word sentences; 75%	Brushes teeth with

Continued.

Age (months)	Gross motor	Fine motor	Communication/social	Cognitive/adaptive
			of speech intelligible to stranger	help
48	Hops	Copies a square or cross	100% of speech intelligible; plays cooperatively with a group	Knows 4 colors
60	Skips	Copies a triangle	Defines simple words; uses 5-word sentences	Dresses self

Assessment of smartphone function performance

Each participant was observed performing ten predefined smartphone tasks, selected based on their relevance to age-appropriate motor and cognitive abilities. These tasks included unlocking the screen, tapping icons, scrolling vertically, adjusting volume, playing or pausing media, taking photographs, zooming using pinch gestures, navigating back/home, activating a voice assistant, and identifying familiar images as shown in Table 2.

Table 2: Smartphone functions

S. no.	Smartphone functions
1	Turning the screen on
2	Finding camera application and opening it
3	Taking a photo of a specified object using the back camera
4	Changing the settings on the camera app to front facing
5	Talking a selfie with known family member
6	Answering phone call
7	Turning on flash light
8	Using the phone to play a song
9	Calling someone
10	Sending a text message

The smartphone used was of standard size (5–6 inches), with a sensitive capacitive touchscreen and commonly used interface layout. Caregivers were instructed not to assist the child unless requested by the examiner.

Each correct, independent task performance was awarded one point, while partial or unsuccessful attempts received zero. The total possible score was 10, reflecting the number of successfully executed functions.

Wherever necessary, the examiner demonstrated the function once before asking the child to attempt it. Task performance was observed directly and documented in a structured checklist. The total smartphone score was then correlated with the child's developmental age across each domain.

Data collection and quality control

All observations were conducted by the same trained investigator to maintain inter-observer consistency. Data were entered daily into a predesigned proforma and later cross-verified by a senior paediatrician. Any ambiguous responses were clarified immediately with the caregiver to minimize reporting bias.

To ensure data reliability, random re-assessments were performed in 20% of cases after a brief interval. Discrepancies, if any, were discussed among the study team and resolved by consensus.

Statistical analysis

IBM statistical package for the social sciences (SPSS) statistics (version 26.0) was used to analyse the data after it was entered into Microsoft Excel. The study variables and participant characteristics were compiled using descriptive statistics. The mean±standard deviation (SD) for normally distributed data and the median with interquartile range (IQR) for non-normally distributed data were used to express continuous variables like developmental age across the four domains: fine motor, gross motor, behavioural (including social), and language as well as smartphone function performance scores.

Normality of data was assessed using the Shapiro–Wilk test and visual inspection of histograms and Q–Q plots. As the data were not normally distributed, Spearman's rank-order correlation (ρ), a non-parametric test, was employed to examine the strength and direction of the association between the developmental age in each domain and the smartphone function performance score.

A positive correlation coefficient (ρ) indicated that higher developmental maturity was associated with a greater ability to perform smartphone functions. The strength of the correlation was interpreted as follows: $\rho=0.00–0.19$ (very weak), 0.20–0.39 (weak), 0.40–0.59 (moderate), 0.60–0.79 (strong), and 0.80–1.00 (very strong). A $p<0.05$ was considered statistically significant. Scatter plots with regression lines were generated to visually depict the relationships between smartphone function performance and each of the four developmental domains (fine motor, gross motor, behavioural, and language).

Ethical considerations

All caregivers were informed that participation was completely voluntary, and they were free to withdraw at any time without it affecting their child's care. The study involved no invasive procedures. Before analysis, all personal details were removed to ensure anonymity. Data was handled with confidentiality and used only for our study and academic purposes.

RESULTS

A total of 24 children were assessed for developmental maturity across four key domains: fine motor, gross motor, behavioural, and language and their respective smartphone function performance scores were recorded. Each child's developmental age (in months) was compared with their smartphone performance score (out of 10), which showcased their ability to complete age-appropriate smartphone tasks.

Spearman's rank-order correlation analysis was used to examine the relationship between developmental age and smartphone function in each domain. A positive correlation coefficient (ρ) indicated that greater developmental maturity was associated with better smartphone task performance.

The strength of the correlation was interpreted as follows: ρ=0.00–0.19 (very weak), 0.20–0.39 (weak), 0.40–0.59 (moderate), 0.60–0.79 (strong), and 0.80–1.00 (very strong). A $p<0.05$ was considered statistically significant.

The analysis showed that correlations between developmental age and smartphone performance were very strong and statistically significant in all four domains. Children with higher developmental age showed higher scores of smartphone functioning, reflecting the fact that greater maturity in motor, behavioural, and language skills enabled better performance in interactive digital tasks. The study showed a very strong association between fine motor skills and performance on the smartphone: ρ=0.958, $p<0.001$.

In other words, children with better hand and finger coordination can touch more accurately on touchscreens. There was also a strong connection to the overall motor development: ρ=0.937, $p<0.001$, which suggests that broader physical coordination is supportive of effective smartphone use. Equally, behavioural age had a very strong positive correlation: ρ=0.949, $p<0.001$, suggesting that behavioural maturity and attention control are some of the most vital preconditions for successfully navigating a smartphone. The same was largely true of the language domain: ρ=0.926, $p<0.001$, indicating that children with more developed receptive and expressive language skills did better in communication-based tasks on the smartphone. Overall, all the developmental domains showed very strong and statistically significant positive correlations with the performance of smartphone functions ($p<0.001$). From these findings, it appears that performance of a smartphone task is a good and reliable reflection of children's developmental progress across their motor, behavioral, and language skills. Table 3 shows the correlation coefficients and p values for each of the developmental domains.

Figures 1-4 illustrate the positive linear relationship between developmental ages and smartphone performance: a visual presentation of strong correlation patterns observed in this study analysis revealed very strong, statistically significant positive correlations between developmental age and smartphone performance across all four domains.

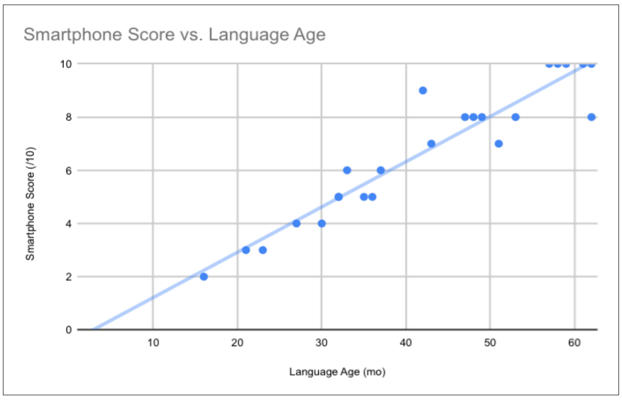

Figure 1: Co-relation between smartphone score and language age.

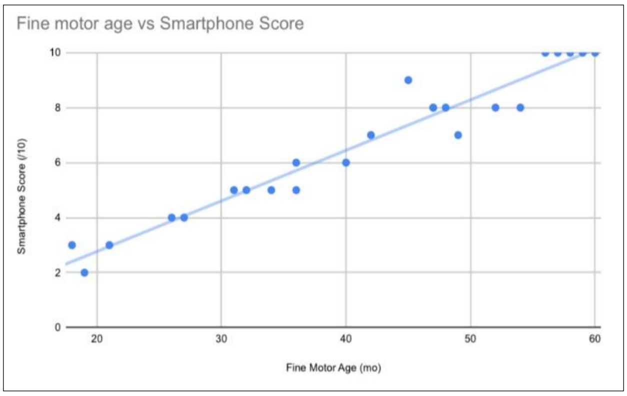

Figure 2: Co-relation between smartphone score and fine motor age.

Children with higher developmental ages consistently achieved higher smartphone function scores, indicating that increased maturity in motor, behavioural, and language skills facilitated better performance in interactive digital tasks.

Table 3: Analysis of the study.

Developmental domain	Spearman's ρ	P value	Interpretation
Fine motor	0.958	<0.001	Very strong positive correlation
Gross motor	0.937	<0.001	Very strong positive correlation
Behavioural	0.949	<0.001	Very strong positive correlation
Language	0.926	<0.001	Very strong positive correlation

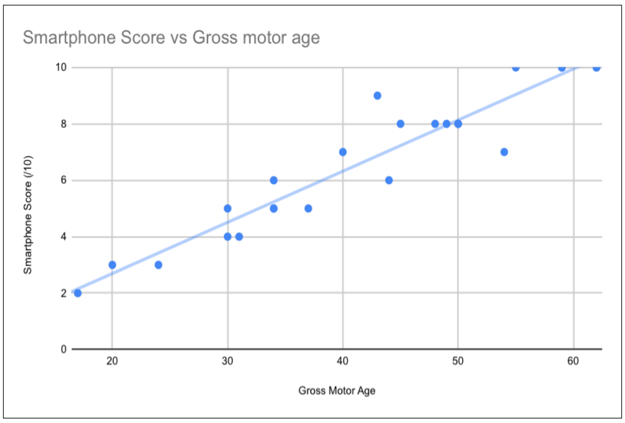

Figure 3: Co-relation between smartphone score and gross motor age.

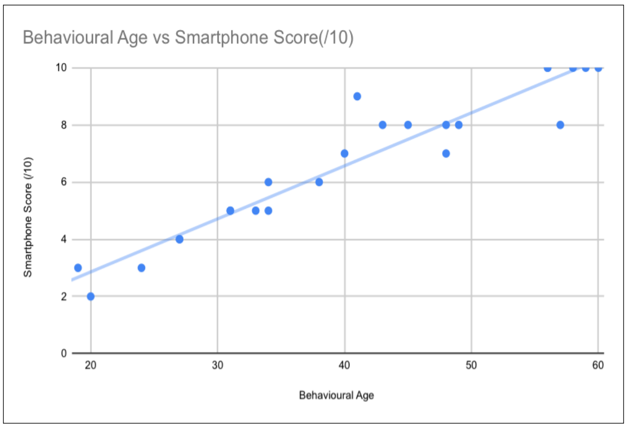

Figure 4: Co-relation between smartphone score and behavioural age.

DISCUSSION

The present study indicates that smartphone functionalities may serve as effective substitutes for assessing developmental milestones. They present benefits compared to existing methods by being rapid and easily accessible for healthcare professionals and caregivers alike. With the help of specifically designed applications, caregivers can maintain a real-time log of their child's development. This data can also be shared remotely with pediatricians, which is especially beneficial since evaluating development in clinical environments can be difficult due to patient anxiety or non-cooperation. Digital developmental screening tools might also be connected to a child's electronic health record (EHR), facilitating long-term tracking and notifications for any delayed milestones.[9] Furthermore, using smartphones incorporates the simultaneous application of fine motor skills, visual tracking, and language comprehension, thereby offering a more thorough insight into the child's development.[10]

These results indicate that smartphone functionalities may serve as alternative indicators of developmental milestones. They present several advantages over conventional assessment methods, being swift, easily accessible, and convenient for both healthcare professionals and caregivers. Through purpose-built applications, caregivers can maintain up-to-date records of their child's development, which can also be transmitted remotely to pediatricians.[11] This approach is particularly useful when in-person evaluations are difficult due to patient anxiety or limited cooperation. Digital developmental screening tools could also be integrated with a child's electronic health record (EHR), allowing ongoing monitoring and automated notifications for delayed milestones. Moreover, smartphone use simultaneously engages fine motor coordination, visual tracking, and language comprehension, offering a more comprehensive picture of the child's developmental progress.[10] Compared to traditional assessments, smartphone-based evaluations can be more easily standardized and may reduce observer-related bias.[13]

Nonetheless, certain limitations should be acknowledged. The small sample size may restrict the applicability of the findings. The study did not assess prior exposure to smartphones, which could affect familiarity and performance. Unlike clinical observation, smartphone-based assessments may not fully capture behaviors such as peer interactions, emotional responses, or parent-child bonding—all essential elements of thorough developmental evaluation.[13]

Ethical considerations also arise when children with no previous technology experience are introduced to smartphones in a clinical context, potentially promoting early overuse or inappropriate use, which has been linked to adverse cognitive and developmental outcomes.

Additionally, these assessments may not be suitable for children with certain disabilities, such as visual impairments or musculoskeletal conditions, where interacting with digital interfaces is challenging.[14] Smartphone tasks also offer limited insight into gross motor development, as they generally do not engage large muscle groups or postural control.[15]

Overall, the study underscores the potential of accessible technology for monitoring child development14. Smartphone-based tasks can serve as practical, readily available alternatives or supplements to traditional milestone assessments, offering insight across multiple developmental domains.[16]

Future directions

Larger, multicenter investigations are necessary to validate and refine this approach for broader clinical use. Future research should focus on developing standardized checklists of simple technological tasks on smartphones or tablets, possibly through dedicated applications, to monitor developmental progress. Additionally, studies could explore adaptations of smartphone-based assessments for children with specific developmental disorders (e.g., autism spectrum disorder, cerebral palsy) to determine their suitability for inclusive screening. Establishing ethical guidelines to prevent excessive screen time and ensure responsible use of technology during early childhood will be critical.

CONCLUSION

This study demonstrates a strong and consistent association between smartphone task performance and developmental age across fine motor, gross motor, behavioural, and language domains among children aged 12–60 months, suggesting that simple smartphone interactions may reflect underlying neurodevelopment maturity. By showing that structured, age-appropriate smartphone tasks correlate closely with traditional milestone assessments, our findings highlight the potential of smartphone-based tools as economical, convenient adjuncts to early developmental screening, particularly in resource-limited settings where trained personnel and standardized tools may be scarce. Although the small sample size and variations in prior device exposure limit generalisability, this work contributes new evidence supporting the integration of digital interaction metrics into paediatric developmental surveillance and provides a foundation for future multi-centre studies to refine, validate, and ethically implement digital screening approaches without encouraging excessive screen use.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Sohn SY, Rees P, Wildridge B, Kalk NJ, Carter B. Prevalence of problematic smartphone usage and associated mental health outcomes amongst children and young people: a systematic review, meta-analysis and GRADE of the evidence. BMC Psychiatry. 2019;19(1):356.
2. Kabali HK, Irigoyen MM, Nunez-Davis R, Budacki JG, Mohanty SH, Leister KP, et al. Exposure and Use of Mobile Media Devices by Young Children. Pediatrics. 2015;136(6):1044-50.
3. Chaibal S, Chaiyakul S. The association between smartphone and tablet usage and children development. Acta Psychol (Amst). 2022;228:103646.
4. Sina E, Buck C, Ahrens W, Coumans JMJ, Eiben G, Formisano A, et al. Family consortium. Digital media exposure and cognitive functioning in European children and adolescents of the I. Family study. Sci Rep. 2023;13(1):18855.
5. Nakshine VS, Thute P, Khatib MN, Sarkar B. Increased Screen Time as a Cause of Declining Physical, Psychological Health, and Sleep Patterns: A Literary Review. Cureus. 2022;14(10):e30051.
6. Glascoe, FP, Marks KP. Detecting children with developmental-behavioral problems: The value of collaborating with parents. Psychol Test Assess Model. 2011;53(2):258-79.
7. Bharadva K, Shastri D, Gaonkar N, Thakre R, Mondkar J, Nanavati R, et al. Consensus Statement of Indian Academy of Pediatrics on Early Childhood Development. Indian Pediatr. 2020;57(9):834-41.
8. The Children's Hospital of Philadelphia. "Developmental Milestones | Children's Hospital of Philadelphia." 2014. Available at: www.chop.edu/primary-care/developmental-milestones. Accessed on 03 November 2025.
9. Weiskopf NG, Hripcsak G, Swaminathan S, Weng C. Defining and measuring completeness of electronic health records for secondary use. J Biomed Inform. 2013;46(5):830-6.
10. Moon JH, Cho SY, Lim SM, Roh JH, Koh MS, Kim YJ, et al. Smart device usage in early childhood is differentially associated with fine motor and language development. Acta Paediatr. 2019;108(5):903-10.
11. Kitsao-Wekulo P, Kipkoech Langat N, Nampijja M, Mwaniki E, Okelo K, Kimani-Murage E. Development and feasibility testing of a mobile phone application to track children's developmental progression. PLoS One. 2021;16(7):e0254621.
12. Operto FF, Viggiano A, Perfetto A, Citro G, Olivieri M, Simone V, et al. Digital Devices Use and Fine Motor Skills in Children between 3-6 Years. Children (Basel). 2023;10(6):960.
13. Daum MM, Bleiker M, Wermelinger S, Kurthen I, Maffongelli L, Antognini K, et al. The kleineWeltentdecker App - A smartphone-based developmental diary. Behav Res. 2022;54:2522-44.
14. Souhir Chamam, Forcella A, Musio N, Quinodoz F, Dimitrova N. "Effects of Digital and Non-Digital Parental Distraction on Parent-Child Interaction and Communication." Front Child Adolesc Psychiatr. 2024;3:21.
15. Langlais M, Veras V, Davidson F, Rhyner A. Swipes vs. Strides: How Mobile Media Use Shapes Children's Gross and Fine Motor Skills. Children. 2025;12(10):1337.
16. Hsu CF, Chien TW, Chow JC, Yeh YT, Chou W. An App for Identifying Children at Risk for Developmental Problems Using Multidimensional Computerized Adaptive Testing: Development and Usability Study. JMIR Pediatr Parent. 2020;3(1):e14632.

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