

Research Article**Association Between Screen Time and Expressive Language Delay Among Toddlers in Urban Rourkela, India: A Cross-Sectional Study****Dr Satish Kumar Sethi; Dr Shubhakanta Patel****First author & Corresponding author**

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Abstract:

Background: Toddlerhood represents a sensitive developmental window for acquiring linguistic competence; however, disproportionate digital media consumption threatens to crowd out essential dyadic caregiver interactions alongside linguistic stimulation. Empirical literature addressing these dynamics across Indian contexts remains sparse. Accordingly, this investigation evaluated the frequency of deficits in expressive speech and evaluated how daily duration of device usage correlates with these deficits among young children presenting to an urban clinic located in Rourkela, Odisha. **Methods:** We designed an outpatient-centered, cross-sectional comparative evaluation involving 100 young children divided equally based on documented daily monitor utilization: greater than 2 hours daily (n = 50) and under 2 hours daily (n = 50). Expressive speech milestones were evaluated via the Language Evaluation Scale Trivandrum (LEST 0–3), whereas signs suggestive of autistic spectrum vulnerability were captured using an adapted autism screening tool.

Investigators systematically documented household sociodemographic, device engagement habits, feeding-time screen viewing, and the presence of shared adult viewing. Relationships across discrete metrics were computed using Chi-square or Fisher's exact statistics, generating prevalence ratios paired with 95% confidence intervals. **Results:** Across the entire cohort, 25 toddlers (25.0%) met the threshold for delayed expressive speech. The burden proved markedly elevated among toddlers logging greater than 2 daily screen hours relative to their peers exposed to under 2 hours (36.0% versus 14.0%; prevalence ratio roughly 2.57). Media engagement during feeding occurred in 68.0% of the elevated-usage cohort compared to 36.0% in the comparison cohort, while consistent adult joint engagement proved notably rarer (34.0% versus 58.0%). In total, seven participants (7.0%) yielded positive flags for autism-associated developmental concerns.

Conclusion: Elevated daily screen utilization correlated with an increased rate of expressive communication within this urban clinical cohort. These observations underscore the necessity of incorporating screen usage histories and parent-child interactive quality into pediatric developmental monitoring. Prospective cohort investigations remain essential to delineate causal directions, control for residual covariates, and verify if curbing extreme media consumption can rehabilitate communicative development.

Key words: Expressive language delay; Screen time; Toddlers; Language development; LEST; Autism screening; Digital media exposure; Parent-child interaction; Developmental surveillance.

Introduction:

The formative years of early life mark an essential window for mastering expressive speech, a phase in which rapid gains in vocabulary, vocal imitation, shared attention, and reciprocal dialogue rely heavily on continuous engagement with caregivers and social surroundings. Expressive language delay defined by a child's struggle to produce or employ spoken language appropriate for their age, even when other developmental milestones vary represent a major clinical issue in pediatrics, as unaddressed speech challenges can hinder future social adaptation, academic attainment, and behavioral regulation. Concurrently, the widespread adoption of smartphones, tablets, televisions, and related electronic displays has introduced an alterable environmental influence during this vulnerable maturational timeframe.

Digital media engagement has grown dramatically among toddlers, accentuating the operational differences between instructional, two-way, and largely passive digital content. A comprehensive systematic review and meta-analysis demonstrated that longer duration of monitor usage correlated with inferior linguistic performance, whereas curated educational material and adult co-viewing yielded protective developmental trends [1]. Such outcomes reinforce the displacement theory: the developmental consequences of electronic devices depend not merely on aggregate viewing time, but on the formative daily routines they supplant. Excessive media engagement frequently crowds out vocal exchanges, book sharing, creative pastimes, and other communication-dense routines that naturally foster reciprocal conversational turns [1].

Empirical data focusing directly on toddler cohorts provides critical clarity. A Danish cohort study tracking children aged 2 to 3 years revealed that mobile device usage of 2 or more hours daily correlated with heightened likelihood of expressive communication impairments, an effect that persisted following adjustment for household environments and socioeconomic indices [2]. That investigation proved pivotal by confirming a direct link to expressive performance rather than relying on an undifferentiated, composite developmental index. Paralleling these findings, data from the Indian subcontinent continue to surface. Initial exploratory research among preschool cohorts noted a link between screen consumption and lagging speech milestones [3], while survey research capturing Indian caregiver attitudes highlighted television sets and hand-held devices as ubiquitous household tools, noting rising anxiety regarding their developmental

drawbacks [4]. These regional insights carry immense significance in India, where rapid technological proliferation and widespread handset access intersect with pronounced disparities in early pediatric development resources.

The biological and social pathways driving this relationship are not yet fully delineated. Elevated digital exposure may diminish both the volume and conversational nuance of caregiver-child speech, and running screens during meal routines or household gatherings can disrupt spontaneous verbal exchanges. Alternatively, parents may deploy electronic screens as soothing mechanisms for children who already display behavioral or communicative deficits, introducing the potential for reverse causality. For this reason, screen immersion is best interpreted as an actionable developmental correlate rather than a definitively established primary etiology.

Notwithstanding the growing international literature, critical empirical blind spots persist across urban Indian demographics. Minimal clinical research has paired an operationalized screen-time cutoff with an objective, validated developmental assessment targeting expressive deficits. In addition, communicative impediments frequently overlap with wider neurodevelopmental vulnerabilities, underlining the clinical utility of concurrently screening for autism traits.

To address these gaps, we executed an outpatient cross-sectional protocol among toddlers presenting to an urban medical facility in Rourkela, Odisha. Our objective was to quantify the burden of expressive language delay and contrast toddlers with daily viewing times exceeding 2 hours against those logging under 2 hours daily. Integrating the Language

Evaluation Scale Trivandrum (LEST) alongside the Modified Checklist for Autism, we further examined related environmental and lifestyle determinants of communicative progress. We posited that children logging greater than 2 hours of daily screen time would demonstrate an increased frequency of expressive communication delay compared to those with lower usage. Resolving these associations should bolster clinical developmental screening protocols and supply actionable empirical guidance for caregiver education in everyday pediatric clinics.

Materials & methods:

We implemented a hospital-centered, cross-sectional comparative investigation involving pediatric toddlers presenting to the outpatient clinic of Hi-Tech Medical College and Hospital in Rourkela, Odisha, India. The primary aim was to establish the baseline rate of expressive speech delay and explore its potential relationship with daily digital monitor engagement, contrasting children exceeding 2 hours of daily screen time against those receiving fewer than 2 hours per day.

The final evaluation comprised 100 toddlers evaluated in the outpatient setting throughout the recruitment phase who conformed to all prespecified enrollment parameters. The cohort was partitioned into two distinct exposure tiers according to estimated mean daily display utilization:

- Elevated screen-exposure tier: greater than 2 hours daily (n = 50)
- Reduced screen-exposure tier: less than 2 hours daily (n = 50)

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To prevent misclassification bias and preserve a sharp delineation across categories, pediatric subjects registering a median usage of precisely 2 hours daily were systematically omitted from both comparative arms.

Operationally, screen utilization encompassed all intervals dedicated to television viewing, smartphone interaction, tablet use, or engagement with comparable digital interfaces intended for recreational or non-medical activities.

Selection Parameters

Toddlers falling within the targeted chronological bracket qualified for enrollment if they sought care at the designated outpatient clinic during the study window, provided their primary guardian or biological parent could deliver consistent, credible reports detailing the toddler's routine display engagement and developmental milestones.

Conversely, exclusion was applied to any child with documented major neurological pathologies, verified profound auditory or ocular deficits, confirmed chromosomal or inherited genetic conditions, severe structural congenital anomalies impacting central nervous system maturation, or an established neurodevelopmental diagnosis with previously confirmed communicative impairment. Candidates were likewise excluded whenever parental or guardian accounts regarding digital habits or developmental trajectories were incomplete or unreliable.

Applying these strict screening boundaries curtailed substantial biological and neurological confounding while preserving a representative sample of patients seen in everyday ambulatory pediatric practice.

Sample size and sampling

The investigation enrolled 100 toddlers, allocating 50 participants to each device-exposure tier. Recruitment proceeded via non-probabilistic sequential sampling among eligible children presenting to the ambulatory clinic during the data-gathering timeframe. This sample quota was selected based on clinical throughput feasibility and established study parameters.

Given the cross-sectional comparative architecture, the primary analytical strategy centered on quantifying the proportion of expressive language impairment within both cohorts and contrasting these distinct proportions.

Assessment of expressive language development

Linguistic milestones were appraised utilizing the Language Evaluation Scale Trivandrum for ages 0 to 3 years (LEST 0–3), a standardized clinical instrument normed on Indian pediatric populations to detect communication deficits during the first three years of life. Initial standardization data on 643 subjects confirmed its robust sensitivity, clinical specificity, repeat reliability, and high inter-examiner concordance.

A trained assessor executed the LEST battery in strict compliance with the established testing manual. Age-appropriate communicative milestones were determined via a synthesis of targeted behavioral observations and structured caregiver input. Children meeting the established scoring threshold for delayed speech were identified as presenting with language lag.

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The primary clinical endpoint was expressive language delay, operationalized through the expressive domain items of the LEST scale. To minimize ascertainment bias, LEST scoring was executed and tabulated without knowledge of the child's reported electronic display metrics.

Screening for Autism-Associated Vulnerabilities

An adapted autism screening checklist was implemented to flag toddlers showing signs suggestive of social-communicative or behavioral vulnerability. This step served strictly as a risk-stratification mechanism rather than a definitive diagnostic assessment for autism spectrum conditions.

Performance was stratified dichotomously as either screen-negative or screen-positive following the instrument's validation cutoff scores. Toddlers yielding a positive screen were documented as carrying elevated neurodevelopmental risk and were referred for formal multidisciplinary follow-up.

When utilizing the Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R/F) validated for subjects aged 16 to 30 months the protocol consists of a parent-administered checklist complemented by targeted clarification items when indicated. Final reporting should confirm the translation dialect and specific iteration used to support external replication.

Measurement of Screen Exposure

Data capturing digital device utilization was collected from parents or primary guardians via an itemized questionnaire. Respondents reported their child's typical aggregate daily time spent engaging with

television sets, mobile phones, tablet monitors, and related electronic displays.

Additional information was obtained regarding:

- predominant type of screen device;
- exposure during meals;
- whether an adult regularly co-viewed screen content with the child; and
- other relevant characteristics of the child's daily environment.

Mean daily media consumption was quantified in units of hours per day. Applying the study's priori stratification criteria, subjects were sorted into either the greater than 2 hours daily tier or the under 2 hours daily tier.

Given that guardian-estimated device metrics are vulnerable to retrospective recall inaccuracies, participants were instructed to detail the child's habitual engagement across a standard seven-day period instead of citing atypical or isolated single-day estimates.

Sociodemographic and clinical variables

A standardized case report form was employed to capture child age, gender, birth rank, institutional preschool or creche enrollment, maternal literacy attainment, and pertinent neurodevelopmental milestones. Maternal educational background was stratified based on the highest formal credential confirmed by the respondent.

To prevent confirmation bias, all relevant pediatric clinical history and developmental indices were cataloged prior to analyzing the screening outcomes.

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Evaluators completed prior calibration on the diagnostic batteries to ensure strict adherence to standardized administration protocols.

Outcome measures

The primary clinical endpoint was the rate of expressive language delay observed across both screen-usage tiers.

The primary independent factor was daily monitor duration, categorized as:

- greater than 2 hours per day; and
- less than 2 hours per day.

Secondary exploratory parameters comprised biological sex, birth order, screen use during meal sessions, consistent adult co-viewing, and positive screening on the autism-risk assessment.

Ethical considerations: Prior to enrolling participants, the formal research protocol received clearance and ethical endorsement from the Institutional Ethics Committee of our institution. Every child's legal guardian or biological parent provided formal written informed consent following a detailed explanation of the investigation. Enrollment remained entirely elective; guardians received explicit assurances that declining to participate or withdrawing at any juncture would carry no negative repercussions for their child's routine healthcare. All analytical records were thoroughly anonymized by removing personal identifiers, with developmental data stored under strict confidentiality safeguards. Whenever screening

revealed substantial communicative impairment or flagged an elevated autism risk, guardians were counseled immediately and directed to appropriate pediatric, developmental, audiological, or speech-language specialists for comprehensive diagnostic appraisal based on clinical indication.

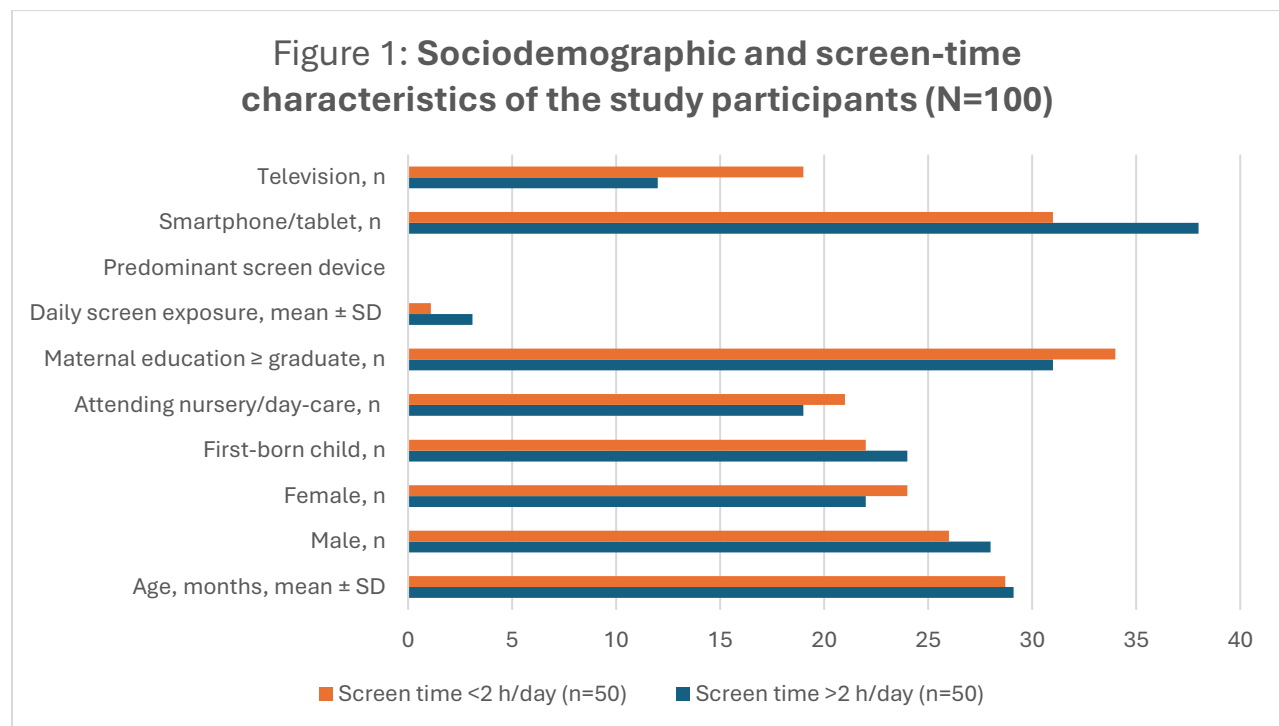
Data quality and confidentiality

Assessing staff underwent calibrated instructional training to master the delivery and scoring conventions of the developmental screening tools. Before digital transcription, completed record sheets were cross-checked to verify procedural completeness. All study records were housed within an encrypted, credential-secured repository restricted exclusively to designated research investigators. Given that these evaluations functioned as preliminary developmental screens rather than formal clinical workups, findings derived from both the LEST inventory and the autism screening checklist were categorized strictly as preliminary risk markers rather than confirmed clinical diagnoses.

Statistical analysis:

Digital records were compiled into an electronic database and processed through a dedicated statistical package. For continuous metrics, values were tabulated as mean $\pm$ standard deviation (SD), whereas categorical parameters were summarized via absolute frequencies and percentage distributions. All hypothesis evaluations were two-tailed, setting the threshold for statistical significance at $p < 0.05$

Results:



The two groups were broadly comparable in age and sex distribution. Children with >2 hours of daily screen exposure had a higher frequency of screen use during meals and lower reported rates of regular adult co-viewing (Figure 1).

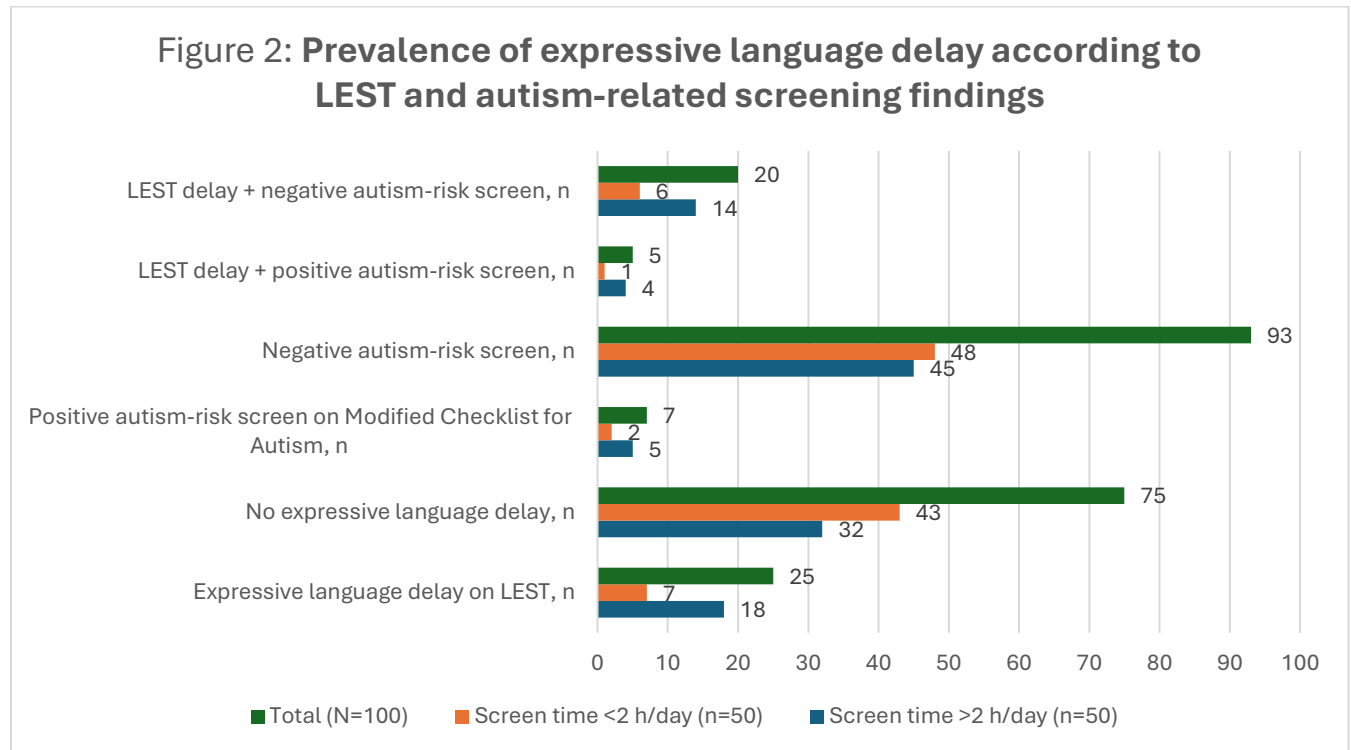
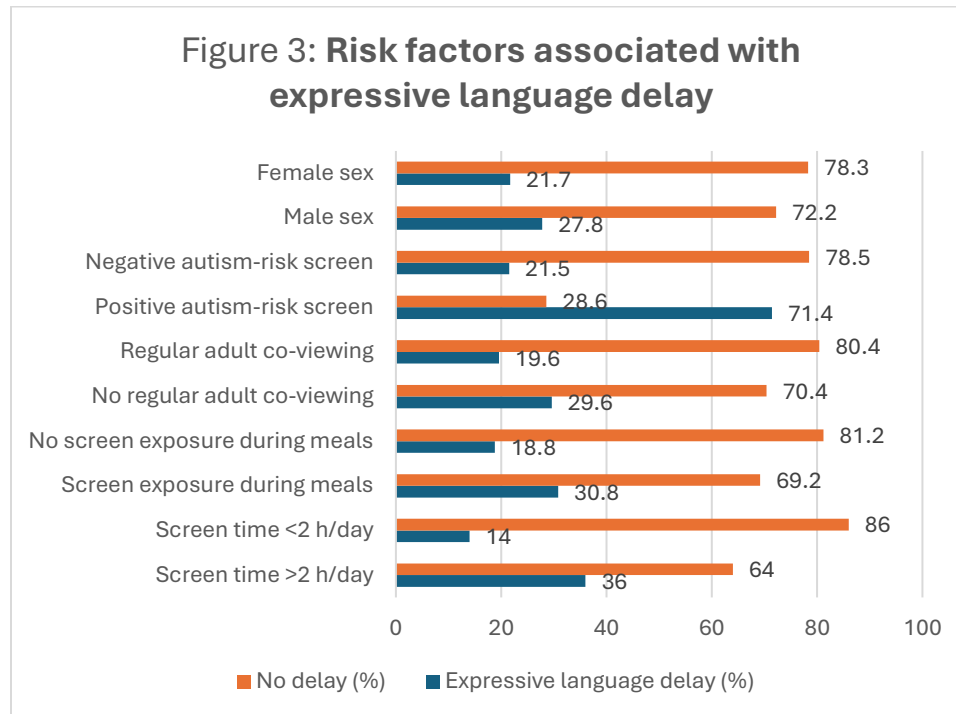


Figure 2 describes the prevalence of expressive language delay according to LEST and autism-related screening findings. Expressive language impairment presented at a noticeably higher frequency among toddlers viewing displays for greater than 2 hours daily compared to those engaging with media under 2 hours daily (36.0% versus 14.0%). This disparity reflects an estimated risk ratio near 2.57, pointing toward an elevated burden within the prolonged-viewing cohort. Confirmatory testing via Chi-square or Fisher's exact evaluation across the primary dataset is recommended to establish formal statistical significance.

Of the 100 enrolled young children, 25 subjects (25.0%) were flagged for delayed expressive speech based on the Language Evaluation Scale Trivandrum (LEST) (Figure 3). Delays were documented with greater frequency among subjects logging more than 2 hours of daily monitor viewing compared to those receiving fewer than 2 hours (36.0% versus 14.0%). In addition, device usage during feeding sessions and the lack of consistent adult co-engagement occurred at higher rates among children exhibiting delayed communication milestones. A minor subset of participants demonstrated positive indicators on the autism risk inventory, which trended alongside expressive delay. Taken together, these patterns point to an association linking elevated monitor exposure and diminished conversational engagement to expressive speech deficits; nevertheless, the cross-sectional architecture precludes drawing any definitive causal inferences.



Discussion:

This observational cross-sectional investigation evaluated how routine daily monitor use relates to expressive communication deficits among a clinical cohort of 100 toddlers evaluated at an ambulatory pediatric center in Rourkela, Odisha. Based on the Language Evaluation Scale Trivandrum (LEST), an expressive deficit was identified in 25% of the total sample, presenting with a marked elevation among children logging more than 2 hours of daily screen time relative to their peers exposed to under 2 hours daily (36.0% versus 14.0%). The resulting prevalence ratio reached roughly 2.57, demonstrating that children within the extended-exposure group experienced more than a twofold frequency of expressive language impairment. While the cross-sectional framework precludes establishing a causal link, the strength and orientation of this link parallel a growing volume of global and Indian reports indicating that prolonged or unguided digital media

immersion corresponds with compromised communicative progression in early childhood.

These outcomes align closely with pooled results from a meta-analytic synthesis of 42 investigations incorporating 18,905 pediatric subjects, which identified an inverse relationship between overall device viewing and language proficiency (pooled correlation coefficient near -0.14) [1]. Crucially, that systematic appraisal drew a clear line between media duration and content quality: curated educational broadcasts and caregiver co-engagement exhibited constructive associations with verbal competence, whereas cumulative screen time and passive ambient television tracking tracked with adverse developmental outcomes [1]. Our investigation adds specificity to this body of work by isolating toddlers and contrasting an operationally actionable cut point of greater than 2 hours per day against less than 2 hours per day. Consequently, the distinct divergence in LEST-verified communicative delay offers practical

utility. This excerpt functions effectively as the opening of a discussion section for a pediatric or developmental medicine manuscript. It integrates our study cohort findings with global meta-analytic evidence and Indian literature.

The link between digital display exposure and linguistic acquisition cannot be attributed solely to raw duration. Within this cohort, 68% of toddlers in the greater than 2-hour bracket engaged with monitors during feeding times, whereas only 36% did so in the comparison group. This contextual distinction holds clinical weight, as device use during feeding displaces conversational turn-taking, shared ocular engagement, and opportunities to rehearse novel words. In parallel, data from the EDEN mother-child investigation revealed that running television broadcasts during family dining correlated with depressed linguistic scores irrespective of aggregate screen time [5]. Consequently, the domestic setting of media exposure exerts an influence equal to, or exceeding, sheer temporal consumption.

This explanatory pathway aligns with the displacement model. Young children master expressive communication through contingent social responsiveness, verbal modeling, reciprocal dialogue, coordinated attention, and iterative communicative exchanges. Hours dedicated to passive viewing supplant verbal exchanges, shared literacy activities, symbolic play, and sensitive adult responsiveness. Evaluating preschool-aged cohorts, researchers identified that extended screen engagement tracked with compromised verbal production and reception, with drops in joint reading and parent-child relational quality serving as mediating mechanisms [6]. Furthermore, unassisted media consumption correlated with depressed lexical diversity and general expressive skills, whereas guided viewing with parents

yielded beneficial trends [7]. These mechanisms provide a coherent explanation for the heightened rate of expressive lag identified in our greater than 2-hour cohort.

Disparities in caregiver co-viewing further substantiate this perspective. Merely 34% of subjects in the prolonged-usage cohort experienced consistent adult joint engagement, contrasted with 58% among children with lower exposure. While these cross-sectional observations cannot establish whether scarce adult co-viewing directly prompts speech deficits or merely co-occurs with elevated media usage, they confirm that digital exposure is not a uniform risk variable. Karani et al. accentuated this multifactorial complexity, highlighting that caregiver supervision, direct engagement, media programming, and physical surroundings alter the developmental impact of screen viewing [8]. An ensuing scoping synthesis corroborated that variation across daily duration, material quality, and adult mediation accounts for discordant empirical outcomes [9].

Broad-scale empirical data from Denmark offer compelling validation, drawing on 31,125 children assessed across two to three years of age. That investigation demonstrated that handheld device usage of 2 or more hours daily elevated the likelihood of expressive communication deficits (adjusted odds ratio 1.46), with exposure between 1 to 2 hours conferring a modest risk increment [10]. Accordingly, our observed prevalence ratio of approximately 2.57 aligns directionally with the Danish cohort data; however, direct equivalence across effect sizes must be interpreted cautiously, as our preliminary estimate reflects an unadjusted association based on categorical LEST evaluations, whereas the Danish cohort deployed multivariable regression against survey-based language metrics.

Existing literature is not entirely homogeneous, a reality critical for an objective discussion. Prior research observed that cumulative daily monitor use lacked a reliable link to linguistic ratings, whereas background television during household dining exhibited a much more robust negative relationship [5]. A synthesized review collated 16 separate investigations, noting that nine highlighted unfavorable developmental consequences, five registered null findings, and two documented beneficial associations [9]. Recent epidemiological work likewise indicates that household socioeconomic resources, nocturnal sleep routines, and broader familial environments may account for maturational gaps more substantially than raw media duration [11]. Hence, our data must not be construed as definitive proof that digital screen immersion functions as an isolated driver of expressive communication delay.

The intersection between digital display viewing and autism-associated behavioral markers requires similarly cautious appraisal. Across this sample, 7% of children flagged positive during Modified Checklist for Autism administration, and 5% demonstrated concurrent autism vulnerability alongside LEST-confirmed expressive speech delay. This diagnostic convergence accentuates the clinical utility of neurodevelopmental profiling whenever caregivers raise expressive concerns. Nonetheless, a positive risk screen does not constitute a formal clinical diagnosis of autism spectrum condition. A comprehensive meta-analytic synthesis identified a crude correlation between screen usage and autism-like features; however, this correlation lost statistical significance after correcting for selective publication bias, illustrating the inherent vulnerabilities of observational designs [12]. Consequently, these observations substantiate structured developmental

monitoring rather than implying an etiologic relationship between digital media and autism emergence.

Subsequent published scholarship provides further backing for a measured, clinically grounded perspective. Regional survey data indicated that handheld smartphones and conventional televisions formed the predominant hardware utilized across Indian homes, reinforcing the urgent need for structured guardian guidance concerning digital media habits and child communication [13]. In a comparative evaluation of Indian preschool cohorts, children diagnosed with developmental language disorder exhibited significantly higher daily monitor engagement than typically developing peers, with prolonged usage correlating negatively with receptive abilities, expressive indices, and pragmatic social communication [14]. Furthermore, an inquiry into joint household digital routines revealed that toddlers with speech-language impairment logged extended screen intervals alongside dramatically lower exposure to bedtime storytelling and dynamic parental dialogue [15]. These insights align directly with our study by reframing the debate away from an isolated "screen hours" metric toward an ecological family-interaction framework.

Several methodological constraints should temper our conclusions. Young children presenting with unrecognized baseline communication deficits might be offered electronic devices by parents for behavioral regulation, introducing the likelihood of reverse causality. A cohort of 100 participants limits statistical sensitivity and parameter precision. Device exposure parameters relied on retrospective maternal recall and are susceptible to reporting misclassification. In addition, our analytical framework neither separated passive amusement programming from structured

pedagogical tools nor enumerated protective activities like shared book reading. Unmeasured variables including socioeconomic strata, maternal schooling level, sleep hygiene, daycare attendance, innate developmental traits, and parental emotional well-being warrant rigorous multivariable control within larger cohorts. Finally, LEST screening classifications and autism checklist scores detect developmental vulnerability but cannot replace full-scale speech pathology, audio, or neuropsychological evaluations. Notwithstanding these constraints, our findings carry direct ambulatory relevance. The uniform trajectory documented across Indian and global literature suggests that outpatient pediatric clinics must routinely audit viewing duration, environmental context, feeding-time media habits, programming quality, and adult co-engagement whenever assessing toddlers with communicative concerns. Rather than advancing rigid prohibitions, clinical guidance should prioritize displacing passive viewing with contingent verbal responsiveness, joint reading, interactive play, and reciprocal household communication. Prospective cohort investigations in India featuring expanded cohorts, passive digital sensing, and granular tracking of content and co-viewing are imperative to determine if targeted reductions in screen exposure alter long-term expressive trajectories. Such prospective work is especially urgent within accelerating digital hubs like Rourkela.

Conclusion:

In summary, these data points to a clinically relevant correlation between exceeding 2 hours of daily monitor viewing and expressive speech delay among toddlers. The roughly 2.6-fold rise in prevalence identified within the prolonged-viewing cohort parallels extensive evidence that heavy, non-interactive digital engagement often crowds out the

reciprocal social exchanges necessary for mastering early communication. Nonetheless, aggregate screen time represents merely a single facet of a wider developmental ecosystem, rather than an isolated, standalone driver of linguistic impairment.

Conflict of Interest:

There is no conflict of interest among the present study authors.

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