

Reported Daily Screen Exposure Above One Hour and Maternally Observed Eye-Related Symptoms Among Under-Five Children in Ibadan, Nigeria: A Cross-Sectional analysis

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Abstract

Evidence on early-childhood screen exposure and caregiver-observed visual discomfort remains limited in many African settings. This cross-sectional study reanalysed data from 420 mothers of children aged 0–59 months in Ibadan North Local Government Area, Nigeria, to estimate the prevalence of reported daily screen exposure above one hour, describe maternally observed eye-related symptom clustering, and examine cross-sectional associations with maternal knowledge, perception, regulation, and socio-demographic characteristics. Analysis was done on SPSS v25, the screen-exposure variable was reported as daily screen exposure above one hour rather than as WHO-defined excessive screen use. Daily exposure above one hour was reported for 286 children (68.1%). Maternally observed eye-related symptom presence, defined as two or more symptoms on a four-item screening index, was observed in 174 children (41.4%); 152 (36.2%) had no symptoms, 199 (47.4%) had mild symptom burden, and 69 (16.4%) had high symptom burden. Daily exposure above one hour was associated with symptom presence in bivariate analysis (chi-square = 70.518, df = 1, $p < 0.001$). In a DAG-informed model adjusted for maternal socio-demographic characteristics, knowledge, and perception, daily exposure above one hour was associated with higher odds of symptom presence (aOR = 3.03, 95% CI: 1.50–6.12, $p = 0.002$), while higher knowledge (aOR = 0.63, 95% CI: 0.54–0.74, $p < 0.001$) and perception scores (aOR = 0.89, 95% CI: 0.86–0.93, $p < 0.001$) were associated with lower adjusted odds. When the conceptually overlapping maternal practice score was added in a sensitivity model, the daily exposure association was attenuated and was not statistically significant (aOR = 1.64, 95% CI: 0.76–3.55, $p = 0.212$), while practice score remained associated with lower odds of symptom presence (aOR = 0.80, 95% CI: 0.72–0.88, $p < 0.001$). The findings suggest that reported prolonged screen exposure and maternally observed eye-related symptoms were common in this urban Ibadan sample. Future Nigerian studies should collect child age in months, objective or diary-based screen exposure, device and content information, and clinical ophthalmic assessment.

Introduction

Digital media exposure is now a routine part of many early-childhood environments. The World Health Organization recommends no sedentary screen time for children younger than two years and no more than one hour per day, preferably less, for children aged two to four years [1]. Recent paediatric guidance similarly emphasizes minimizing exposure in very young children, supporting caregiver co-use where screens are used, and building family media routines that protect sleep, play, interaction, and development [2, 3]. Mobile-media studies also show that access to smartphones and tablets can begin early in childhood, making screen exposure a household and paediatric issue rather than only a school-age concern [4, 5].

The evidence base on screen exposure in early childhood is complex. Systematic reviews suggest that associations with language, behaviour, cognition, adiposity, sleep, and psychosocial outcomes depend on duration, content, context, caregiver involvement, parental modelling, background television, and household routines [6–14, 21]. Measurement is a recurring weakness: many studies rely on parent-report

exposure items, and relatively few instruments for children aged 0–6 years have strong psychometric evidence [12]. In African settings, the evidence is especially sparse, and household screen exposure is likely to be shaped by urban housing, safe play space, caregiver work patterns, electricity and device access, childcare arrangements, and socio-economic constraints.

Visual discomfort is a further concern, but it requires cautious interpretation. Digital eye strain and computer vision syndrome include symptoms such as eye tiredness, watering, redness, dryness, headache, blurred vision, and difficulty sustaining near work [22–26]. Most evidence comes from older children, adolescents, students, or adult screen users, while under-five children often cannot provide reliable symptom reports. Literature on near work, outdoor time, and myopia-related outcomes also shows that visual-health pathways are complex and cannot be inferred from screen duration alone [31–35]. For young children, caregiver observations such as watering or redness, squinting, excessive blinking, headache after device use, and close viewing may be useful screening prompts, but they are not clinical diagnoses and may reflect refractive error, allergy, fatigue, infection, lighting, sleep disruption, or viewing posture [22–30, 36–38].

Maternal perception and regulatory practice are therefore central to the present study. Caregivers may know that prolonged screen exposure is undesirable yet still rely on screens while working, cooking, trading, commuting, or managing household responsibilities. Qualitative evidence shows that parents often perceive both risks and practical benefits of screen time during early childhood [16]. Systematic reviews indicate that modifiable parenting factors, including rules, modelling, mealtime viewing, and use of screens to calm or occupy children, are associated with screen use in children five years or younger [17]. Intervention reviews suggest that screen-time change is more plausible when families receive practical, repeated strategies rather than brief advice alone [18, 19]. Longitudinal work also shows that child media use is intertwined with parenting stress and child behaviour, complicating any simple knowledge-to-behaviour model [20].

Visual morbidity is an important but less developed part of this debate. Digital eye strain, also described as computer vision syndrome or asthenopia, includes ocular and visual complaints such as eye tiredness, redness, watering, blurred vision, headache, irritation, and difficulty sustaining near work [22–28]. Reviews in young screen users and general populations identify longer screen duration, fewer breaks, reduced blinking, poor viewing distance, lighting conditions, refractive error, and sleep-related factors as relevant correlates [22–28]. Studies during the COVID-19 period reported digital eye-strain symptoms and accommodation or vergence dysfunction among school-aged children exposed to online learning, although those findings cannot be directly generalized to under-five children [29, 30].

Potential links between screen viewing, near work, outdoor activity, and paediatric visual health also require careful interpretation. Systematic reviews have examined associations between digital screen time, near work, outdoor time, and myopia-related outcomes, but temporal pathways and age-specific patterns remain complex [31–35]. For younger children, symptoms such as red or watery eyes, squinting, blinking, headache, and close viewing distance are often observed by caregivers rather than self-reported by the child. However, these observations need to be treated as screening signals rather than diagnoses.

Paediatric vision-assessment guidance and preschool vision-screening recommendations emphasize early detection and referral pathways for visual problems in young children [36–38]. This study estimated the Reported Daily Screen Exposure Above One Hour and Maternally Observed Eye-Related Symptoms Among Under-Five Children in Ibadan, Nigeria. It also examined cross-sectional associations with maternal regulatory practice, perception, knowledge, and socio-demographic characteristics, and tested whether maternal practice statistically modified the association between screen overuse and perceived eye symptom presence.

Methods

Study Design and Reporting

This was a cross-sectional analytical study of mothers with at least one child younger than five years. The study measured maternal socio-demographic characteristics, maternal knowledge, maternal perception, maternal screen-regulation practices, reported child screen exposure, and maternally observed eye-related symptoms at one point in time. Reporting was reviewed against relevant STROBE items for cross-sectional studies [39]. Because exposure, outcome, and covariates were measured concurrently, all estimates are interpreted as associations and not as temporal or directional relationships.

Study Setting

The study was conducted in Ibadan North Local Government Area (LGA), Oyo State, southwestern Nigeria. Ibadan North is an urban LGA within the Ibadan metropolis and includes high-density indigenous neighbourhoods, planned residential areas, commercial corridors, markets, schools, transport routes, tertiary institutions, and informal-sector workplaces. Communities and localities covered by the sampling frame included Beere, Yemetu, Sabo, Bashorun, Ikolaba, Sango, Mokola, Bodija, Samonda, Agbowo, Barika, Orogun, and areas around the University of Ibadan, The Polytechnic Ibadan, Bodija Market, and the Lagos-Ibadan Expressway corridor.

The setting was appropriate for this study because urban households commonly have access to televisions, smartphones, and other digital devices, while caregiver work patterns, school readiness routines, childcare support, household crowding, electricity availability, and safe outdoor play opportunities vary across wards. These features make Ibadan North a relevant urban Nigerian setting for describing caregiver-reported child screen exposure and maternally observed visual-discomfort signals. The ward population frame used for proportional allocation covered 12 political wards with a total frame population of 400,878 (Table 1).

Study Population and Eligibility

The study population comprised mothers residing in selected households or communities who had at least one child aged 0-59 months and provided written informed consent. The questionnaire dataset

confirms maternal-level eligibility and under-five screening but does not retain the child's exact age in months, child age category, child sex, or birth order. For child-level analysis, one mother-child unit was included per participating household to preserve independence of observations. Where more than one eligible under-five child was present, the field procedure was to select one index child before questionnaire administration; however, the analytic dataset does not retain a variable showing the child's age or selection order.

Sampling Technique and Study Size

The minimum sample size was determined using the Leslie Kish formula for single-proportion studies: $n = Z^2pq / d^2$. Using $Z = 1.96$, $p = 0.50$, $q = 0.50$, and $d = 0.05$ gave $n = 384.16$. After adding 10% for non-response, the target sample size was approximately 423 mothers. A total of 420 complete records were retained in the final analytic dataset after data cleaning.

A proportionate stratified multistage sampling approach was used. In the first stage, Ibadan North LGA was stratified into its 12 political wards. The sample was allocated to wards in proportion to the ward population using $n_i = (N_i / N) \times n$, where n_i is the allocated ward sample, N_i is the ward population, N is the total ward-frame population, and n is the total target sample. In the second stage, fieldwork was implemented within selected ward localities. Household selection followed a systematic field procedure from a random starting point within each selected locality, with households approached at regular intervals until the allocated ward sample was completed. Eligibility was assessed by confirming the presence of a mother with at least one child aged 0-59 months. If more than one eligible mother was present in a household, one respondent was selected to avoid within-household clustering. If a household had no eligible mother, was locked, or participation was declined, the next eligible household on the same route was approached within the same ward to preserve proportional allocation.

Data Collection Instrument

Data were collected using an adapted structured interviewer-administered questionnaire. The instrument contained sections on maternal socio-demographic characteristics, maternal knowledge of screen exposure and eye health, maternal perceptions about screen-related risk and regulation, maternal regulatory practices, reported child screen exposure, and maternally observed eye-related symptoms. The instrument was adapted at the construct and domain level from child screen-exposure, parental mediation, early-childhood movement-guideline, and digital eye-strain literatures [1,2,12,22-24,41]. It was not a diagnostic ophthalmic instrument.

Knowledge items were scored as correct or incorrect. Perception items used five-point ordered response options and were reverse coded where required so that higher scores represented more risk-aware perception. Practice items measured regulatory behaviours such as limiting duration, avoiding screen use during meals or bedtime, creating screen-free periods, encouraging outdoor play, monitoring use, using controls or timers, and safer viewing routines. The four symptom-screening items assessed maternally

observed red or watery eyes, squinting or excessive blinking when looking at a screen, frequent headaches after device use, and holding a phone or tablet very close to the face.

Validity and Reliability

Face and content validity were assessed before data collection through expert review focused on clarity, relevance to the study objectives, domain coverage, cultural appropriateness, and suitability for mothers of under-five children in Ibadan. The questionnaire was also pretested in a comparable urban community that was not included in the final analytic sample. Pretesting assessed comprehension, item sequence, response options, interview burden, and the clarity of the screen-exposure and symptom questions. Feedback informed final wording, ordering, interviewer prompts, and coding. The reported Cronbach alpha for the multi-item questionnaire scales was 0.82, which indicates good internal consistency for group-level analysis but does not establish criterion validity, diagnostic accuracy, or temporal stability.

Data Collection Procedure and Quality Control

Interviewer-administered data collection was conducted during face-to-face household visits. Research assistants supported fieldwork under supervision. Interviewers introduced the study, screened household eligibility, explained the consent process, obtained written informed consent, and administered the questionnaire using neutral wording. Interviews were conducted in English or Yoruba according to respondent preference. The English questionnaire served as the written instrument, while Yoruba oral wording was harmonised during training by bilingual team members to maintain meaning. Interviews generally lasted about 20-30 minutes. Completed questionnaires were reviewed for completeness and internal consistency during field supervision, and only complete questionnaires were retained in the analytic file.

Variable Measurement and Operational Definitions

The primary screen-exposure variable was coded from the item asking whether the child typically spent more than one hour on a screen daily. It was coded 1 for yes and 0 for no. Because the dataset did not include the child's exact age or any age subgroup variable, this variable was not interpreted as WHO-defined excessive screen use. The manuscript therefore uses the term reported daily screen exposure above one hour. The WHO age-specific thresholds could not be applied: children aged 0-23 months require classification based on any screen exposure, while children aged 24-59 months require classification based on exposure above one hour per day. The dataset contains neither age subgroup nor an item measuring any screen exposure among children under two years.

The symptom-screening score was the sum of four maternally observed indicators: red or watery eyes, squinting or excessive blinking, headache after device use, and very close viewing distance. Each item was coded 0 or 1, giving a score range of 0-4. Symptom burden was categorised as no symptoms (0), mild

symptom burden (1-2), and high symptom burden (3-4). For logistic regression, symptom presence was coded as 1 for scores of 2 or higher and 0 for scores of 0-1. This threshold was retained because it identifies clustering of at least two observed symptoms and reduces reliance on a single non-specific symptom. It should be interpreted as a screening index, not as a clinical endpoint.

Knowledge score was a 10-item correct-answer sum. Perception score ranged from 0 to 40, with higher values reflecting more risk-aware perception after reverse coding of items that endorsed screen necessity, screen use to keep a child quiet, difficulty controlling screen time, duration being unimportant when content is educational, or eye check-ups being necessary only when the child squints or complains. Practice score ranged from 0 to 16, with higher scores reflecting stronger regulation. Practice regulation was categorised as poor (<50%; score <8), moderate (50-<75%; score 8-11), or good ($\geq$ 75%; score $\geq$ 12). These cut-offs were applied to the recalculated score and yielded 263 poor, 64 moderate, and 93 good regulation records.

DAG-Informed Confounding Strategy

A directed acyclic graph was used conceptually to distinguish confounders from overlapping constructs. Maternal socio-demographic factors, including age, education, household income, employment, marital status, and religion, could plausibly be related to household routines, maternal reporting, knowledge, perception, and child screen exposure. Maternal knowledge and perception may also be related to screen practices and to recognition or reporting of eye-related symptoms. Maternal practice score was treated cautiously because it measured screen-regulation behaviours that partly determine the screen-exposure variable. It was therefore excluded from the primary symptom model and added in a sensitivity model to show how adjustment for a conceptually overlapping regulation construct changed the screen-exposure estimate. Variables not available in the dataset, including child age, child sex, device type, screen content, outdoor time, sleep duration, parental screen use, and clinical eye status, could not be adjusted for and are treated as residual confounding risks.

Statistical Analysis

Descriptive analyses summarized categorical variables as frequencies and percentages and continuous variables as means and standard deviations. Chi-square tests assessed bivariate associations among practice regulation, reported daily screen exposure above one hour, and symptom presence. Welch t-tests compared mean perception and knowledge scores between exposure and symptom groups when equal variance could not be assumed. Binary logistic regression was used for the binary outcomes. The model for reported daily exposure above one hour included maternal practice score, perception score, knowledge score, maternal age, tertiary education, household income above the minimum-wage threshold, formal employment, and married status. The primary symptom model included daily exposure above one hour, maternal socio-demographic covariates, knowledge score, and perception score. A sensitivity symptom model additionally included practice score. Another sensitivity model included dark/dim-room screen use

and prior vision diagnosis, with caution because these variables may reflect viewing context or symptom-related history rather than baseline confounding. Interaction analysis tested daily exposure above one hour by centered practice score.

Model diagnostics included assessment of multicollinearity using variance inflation factors, calibration using the Hosmer-Lemeshow statistic, and discrimination using area under the receiver operating characteristic curve (AUC). The maximum VIF in the main variable set was 3.39. Complete-case analysis was used because all 420 records were complete. Statistical significance was set at $p < 0.05$. Odds ratios from this cross-sectional analysis are interpreted as adjusted odds associations. Because symptom presence was common, modified Poisson regression with robust standard errors was run as a sensitivity analysis to estimate prevalence ratios, but logistic regression remains the main reported model to preserve comparability with the previous manuscript.

Ethical Considerations

Ethics approval was obtained from the Oyo State Ministry of Health, Department of Planning, Research and Statistics Division (NHREC/OYOSHRIEC/10/11/22). Written informed consent was obtained before participation. The analytic dataset used coded records rather than respondent names. Participation was voluntary, and mothers who reported concerning or persistent eye-related symptoms were advised to seek assessment from an appropriate health facility or eye-care provider. Ethical reporting was aligned with principles of voluntary participation, confidentiality, and participant welfare [40].

Use of AI-Assisted Tools

An AI-assisted writing and analysis-support workflow was used during revision to help audit the dataset, rebuild statistical tables, improve manuscript organization, and edit language. All study design decisions, dataset interpretation, statistical conclusions, and manuscript content remain the responsibility of the authors and require author verification before submission.

Results

Participant Socia-Demographic Characteristics

The mean maternal age was 30.65 years (SD = 6.39). Most mothers were married (80.2%) and had secondary or tertiary education (82.1%). Self-employment was the most common employment category (36.2%), followed by private-sector employment (29.3%). Slightly more than half of households reported income above the minimum-wage threshold (56.2%). Christianity (54.8%) and Islam (42.6%) were the most frequently reported religions (Table 2).

Reported Screen Exposure and Maternally Observed Symptoms

Daily screen exposure above one hour was reported for 286 children (68.1%). Weekend exposure above one hour was reported for 325 children (77.4%), and screen use in a dark or dimly lit room was reported for 200 children (47.6%). For individual eye-related items, 136 mothers (32.4%) reported watery or red eyes in the previous month, 120 (28.6%) reported squinting or excessive blinking when the child looked at a screen, 193 (46.0%) reported very close phone or tablet viewing, and 78 (18.6%) reported frequent headaches after device use. Only 13 children (3.1%) had reportedly ever been diagnosed with a vision problem.

The four-item symptom-screening score classified 152 children (36.2%) as having no symptoms, 199 (47.4%) as having mild symptom burden, and 69 (16.4%) as having high symptom burden. Symptom presence, defined as two or more symptoms, was observed in 174 children (41.4%). Reported daily exposure above one hour and symptom presence varied across maternal education, income, and employment strata (Table 3).

Bivariate Associations

Practice regulation was associated with reported daily exposure above one hour (chi-square = 148.548, df = 2, $p < 0.001$). Daily exposure above one hour was reported for 231 children (87.8%) whose mothers had poor regulation, 36 children (56.3%) whose mothers had moderate regulation, and 19 children (20.4%) whose mothers had good regulation. Practice regulation was also associated with symptom presence (chi-square = 127.931, df = 2, $p < 0.001$): symptom presence was observed among 164 children (62.4%) in the poor-regulation group, 7 (10.9%) in the moderate-regulation group, and 3 (3.2%) in the good-regulation group (Table 4).

Reported daily exposure above one hour was associated with symptom presence at the bivariate level (chi-square = 70.518, df = 1, $p < 0.001$). Among children with reported daily exposure above one hour, 158 (55.2%) had symptom presence, compared with 16 (11.9%) among children without daily exposure above one hour. Mothers of children with daily exposure above one hour had lower mean perception scores than mothers of children without daily exposure above one hour (18.78 [SD = 9.00] vs 28.10 [SD = 7.78]; $t = -10.865$, df = 297.7, $p < 0.001$). Knowledge scores showed a similar pattern (5.30 [SD = 2.25] vs 7.38 [SD = 1.78]; $t = -10.257$, df = 323.1, $p < 0.001$) (Table 5).

Adjusted Models

In the model for reported daily exposure above one hour, practice score was the only statistically significant variable (aOR = 0.77, 95% CI: 0.71-0.84, $p < 0.001$). Perception score, knowledge score, maternal age, tertiary education, above-minimum-wage income, formal employment, and married status

were not statistically significant after adjustment. The model showed acceptable calibration and discrimination (Hosmer-Lemeshow chi-square = 8.916, df = 8, p = 0.349; AUC = 0.853).

In the primary symptom model adjusted for maternal socio-demographic characteristics, knowledge, and perception, reported daily exposure above one hour was associated with higher adjusted odds of symptom presence (aOR = 3.03, 95% CI: 1.50-6.12, p = 0.002). Higher knowledge score (aOR = 0.63, 95% CI: 0.54-0.74, p < 0.001) and higher perception score (aOR = 0.89, 95% CI: 0.86-0.93, p < 0.001) were associated with lower adjusted odds of symptom presence. The primary symptom model had good calibration and discrimination (Hosmer-Lemeshow chi-square = 3.527, df = 8, p = 0.897; AUC = 0.884).

When the conceptually overlapping practice score was added in a sensitivity model, the association for reported daily exposure above one hour was attenuated and was not statistically significant (aOR = 1.64, 95% CI: 0.76-3.55, p = 0.212). In this sensitivity model, practice score remained associated with lower adjusted odds of symptom presence (aOR = 0.80, 95% CI: 0.72-0.88, p < 0.001). The model had AUC = 0.900 and Hosmer-Lemeshow p = 0.853. A viewing-context sensitivity model showed that dark/dim-room use was associated with symptom presence (aOR = 4.61, 95% CI: 2.57-8.28, p < 0.001), while the daily exposure estimate was attenuated (aOR = 1.94, 95% CI: 0.91-4.14, p = 0.087). Modified Poisson sensitivity analysis for the primary symptom model gave an adjusted prevalence ratio of 2.37 (95% CI: 1.51-3.70) for daily exposure above one hour.

Interaction Analysis

The interaction between reported daily exposure above one hour and centered practice score was not statistically significant (aOR = 1.04, 95% CI: 0.87-1.25, p = 0.676). These findings do not provide evidence that maternal practice statistically modified the cross-sectional association between reported daily exposure above one hour and symptom presence in this dataset (Table 7).

Discussion

Principal Findings

Reported daily exposure above one hour and maternally observed eye-related symptom clustering were common in this urban Ibadan sample. Practice regulation was strongly associated with reported daily exposure and symptom presence, but the practice score overlapped conceptually with screen regulation. In a primary model that adjusted for maternal socio-demographic characteristics, knowledge, and perception, reported daily exposure above one hour was associated with symptom presence; however, the association was attenuated and no longer statistically significant when maternal practice was added. The most defensible interpretation is therefore that the screen-duration association exists in simpler adjustment but is not robust to adjustment for overlapping regulation and viewing-routine constructs.

Screen Exposure Threshold and WHO Guidance

WHO guidance distinguishes children aged 0-23 months, for whom sedentary screen time is not recommended, from children aged 24-59 months, for whom no more than one hour per day is recommended [1]. A single >1 hour/day threshold cannot classify WHO non-adherence among all under-five children. For a child younger than two years, any sedentary screen exposure would be above the WHO recommendation, whereas the dataset only records whether daily exposure exceeded one hour. Because the raw dataset lacks child age and lacks an any-screen-exposure item, the reanalysis could not create valid 0-23 month and 24-59 month strata. This limitation is not a wording issue; it is a data-structure limitation.

International and African comparisons should therefore focus on reported duration markers rather than strict WHO non-adherence. International studies of preschool screen exposure use diverse age bands, duration thresholds, diary methods, and device/context measures, limiting direct comparability [6,12,14,49-52]. The Ibadan estimate aligns with broader evidence that screen exposure is common in early childhood, but it cannot determine age-specific guideline adherence. In Soweto, South Africa, Pioreschi and Norris reported substantial screen time and outdoor-time patterning among young children, but their study reported duration and correlates rather than the same binary threshold [15]. The practical implication is that Nigerian surveillance instruments should collect age in months and guideline-relevant exposure categories from the outset.

Maternally Observed Eye-Related Symptoms

Symptom presence was common, but the outcome should be interpreted as a maternal screening index. Red or watery eyes, squinting or excessive blinking, headaches after device use, and close viewing can be associated with several visual or ocular conditions, including refractive error, allergic eye disease, fatigue, lighting, posture, or uncorrected visual impairment. International digital eye-strain literature supports the relevance of these symptoms, but most studies involve older children, students, or adult users who can report symptoms directly [22-30]. For under-five children, maternal observation is practical but imprecise.

African visual-health studies also caution against over-interpretation. Ethiopian and Sudanese studies on computer vision symptoms demonstrate that digital eye symptoms are measurable in African populations, but their populations differ markedly from under-five children [44,45]. Nigerian and Kenyan paediatric visual-health studies show that refractive error and visual impairment require structured assessment rather than symptom inference alone [46-48]. The implication is that mothers reporting symptom clusters should be encouraged to seek clinical assessment, while researchers should avoid describing the questionnaire index as a clinical ophthalmic endpoint.

Maternal Regulation, Knowledge, and Perception

Maternal practice regulation was the strongest correlate of reported daily exposure above one hour and was also strongly associated with symptom presence. This is consistent with systematic-review evidence showing that parental rules, monitoring, co-use, mealtime viewing practices, and use of screens to calm or

occupy children are related to screen use among children five years or younger [17], and with longitudinal work that examines parental monitoring as part of a broader household-media pattern [53]. Intervention reviews further suggest that family routines and repeated practical strategies are more relevant than brief advice alone [18,19]. However, this finding is not independent of measurement. The practice score directly includes regulatory behaviours that shape duration, and several practice items are close to the exposure construct. This explains why adjustment for practice attenuated the screen-duration association with symptom presence.

Knowledge and risk-aware perception were associated with lower odds of symptom presence in adjusted models. This may reflect safer household routines, greater ability to recognize concerning behaviours, or differences in maternal reporting. The finding should not be interpreted as evidence of a temporal pathway from knowledge to symptoms. In urban African settings, caregiver knowledge may operate within practical constraints such as paid work, informal trading, household crowding, lack of safe play space, and limited childcare support. Qualitative research on parental perceptions and longitudinal work on parenting stress and child media use similarly show that caregivers weigh perceived risks, practical benefits, stressors, and household routines when managing early-childhood screen exposure [16,20]. South African evidence also emphasizes that early-childhood movement behaviours are embedded in safety, household routine, and caregiver constraints [42]. The implication is that counselling should combine clear information with feasible routines, not only knowledge messages.

Screen Exposure and Symptoms After Adjustment

The adjusted models answer the reviewer's concern directly. In the primary confounder model, daily exposure above one hour was associated with symptom presence. After adding maternal practice score, the association was attenuated and not statistically significant. Because the practice score partly overlaps with screen regulation, this sensitivity model may represent overadjustment for constructs that are not cleanly separable from the exposure. At the same time, it shows that the screen-duration association is not robust to inclusion of broader regulatory routines. The conclusion should therefore not state that screen exposure has an independent association with eye symptoms after practice adjustment. A more defensible interpretation is that reported duration, maternal regulation, knowledge, perception, and viewing context cluster together in relation to maternally observed symptoms.

Conceptual Overlap Between Indicators

The editor's concern about conceptual overlap is methodologically important. Maternal practice, screen regulation, and daily screen exposure above one hour are not fully independent constructs. Practice items such as taking away devices after prolonged use, setting screen-free periods, parental controls, monitoring, mealtime screen rules, and bedtime routines partly describe the same behavioural domain as screen exposure. This overlap can strengthen associations between practice score and reported exposure, and it can also attenuate the exposure coefficient when practice is included in the symptom

model. Future studies should separate constructs by measuring screen exposure with device logs or time-use diaries, regulation with validated parental mediation scales, and symptoms with both caregiver reports and ophthalmic examination.

Regional Generalizability

The study was conducted in one urban LGA in Ibadan. Findings should not be generalized automatically to all of Oyo State, southwestern Nigeria, or Nigeria as a whole. Rural communities may differ in device access, electricity, household structure, outdoor play space, school readiness routines, and health-service access. Urban areas in other geopolitical zones may also differ culturally and socio-economically from Ibadan North. South African report-card work illustrates the value of country-specific child-health surveillance, while also showing that evidence gaps can remain even where monitoring systems are more developed [43]. Multicentre Nigerian studies across rural and urban areas, multiple states, and different geopolitical zones are needed to estimate national patterns more reliably.

Implications

For practice, the findings support asking caregivers about daily duration, bedtime screen use, dark-room viewing, close viewing, watery or red eyes, squinting, blinking, and headache after device use during under-five clinics, immunisation contacts, growth-monitoring visits, early-childhood centres, and community health-promotion activities. Counselling should be practical and non-stigmatizing: reduce prolonged viewing, avoid dark-room viewing, preserve sleep routines, encourage safe outdoor play, promote breaks and comfortable viewing distance, and refer children with persistent or concerning symptoms for eye assessment. A related Nigerian teacher-awareness study addresses screen-time management knowledge in school contexts, but household under-five evidence remains limited [54]. For research, the study highlights the need for age-specific screen exposure data, objective or diary-based measurement, device and content variables, and clinical ophthalmic outcomes.

Strengths and Limitations

This study focused on children younger than five years, a group for whom Nigerian screen-time and visual-health evidence is limited. It used a child-level outcome framework, measured both screen-overuse and symptom-screening outcomes, included maternal knowledge, perception, and practice indicators, applied multivariable adjustment, assessed model calibration and discrimination, evaluated multicollinearity, and tested an interaction hypothesis. The study also retained a cautious cross-sectional interpretation throughout. The limitations includes the fact that the cross-sectional design prevents determination of temporality. Second, screen duration and symptoms were maternally reported, creating potential recall bias, social desirability bias, and differential symptom recognition. Finally, the dataset did not contain child age in months, child age group, child sex, birth order, outdoor time, sleep duration, parental screen use,

childcare attendance, household crowding, device type, or objective viewing distance. This prevents WHO age-specific classification and leaves residual confounding. .

Conclusion

In this cross-sectional reanalysis of 420 mother-child records from Ibadan North LGA, reported daily screen exposure above one hour and maternally observed eye-related symptom clustering were common. The raw dataset cannot support WHO age-specific classification of excessive screen use because child age and any-screen-exposure measures for children under two years were not available. Daily exposure above one hour was associated with symptom presence in bivariate and primary adjusted analyses, but this association was attenuated and not statistically significant after adding the conceptually overlapping maternal practice score. The findings support cautious, practical counselling on screen routines and referral for persistent symptoms, while emphasizing the need for multicentre Nigerian studies with child age in months, objective screen-exposure measurement, device and content information, and clinical ophthalmic assessment.

Declarations

Ethics approval and consent to participate: Ethics approval was obtained from the Oyo State Ministry of Health, Department of Planning, Research and Statistics Division (NHREC/OYOSHRIEC/10/11/22). Written informed consent was obtained from all participating mothers before data collection.

Consent for publication: Not applicable.

Availability of data and materials: The dataset is available from the corresponding author on reasonable request, subject to ethical approval and institutional data-sharing requirements.

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Tables

Table 1. Proportionate allocation of the sample across wards in Ibadan North Local Government Area.

Ward	Major localities covered	Ward population	Proportion (%)	Target sample
Ward 1	Beere, Kannike, Agbadagudu, Oke Are, Ode Oye	17,972	4.48	19
Ward 2	Oniyanrin, Ode Olo, Inalende, Oke Oloro	17,272	4.31	18
Ward 3	Adeoyo, Yemetu, Oke Aremo, Isale Alfa	61,683	15.39	65
Ward 4	Ituaba, Idi Omo, Oje, Igosun, Kube, Oke Apon	35,712	8.91	38
Ward 5	Bashorun, Oluwo, Ashi, Akingbola, Ikolaba, Gate	39,564	9.87	42
Ward 6	Sabo area	19,508	4.87	20
Ward 7	Oke Itunu, Coca-Cola, Oremeji	14,004	3.49	15
Ward 8	Sango, Ijokodo	29,587	7.38	31
Ward 9	Mokola, Ago Tapa, Premier Hotel area	10,115	2.52	11
Ward 10	Old Bodija, New Bodija, Secretariat, Awolowo, Obasa, Sanusi	71,484	17.83	75
Ward 11	Samonda, The Polytechnic Ibadan, University of Ibadan	47,020	11.73	50
Ward 12	Agbowo, Bodija Market, Oju Irin, Barika, Iso Pako, Orogun, Lagos-Ibadan Expressway	36,957	9.22	39
Total		400,878	100.00	423

Table 2. Maternal socio-demographic characteristics (N = 420).

Variable	Category/statistic	n/Mean	%/SD
Age of mother	Mean (SD), years	30.65	6.39
Age group	18-24	63	15.0
	25-29	121	28.8
	30-34	129	30.7
	35-39	68	16.2
	40-45	39	9.3
Marital status	Single	36	8.6
	Married	337	80.2
	Separated/Divorced	36	8.6
	Widowed	11	2.6
Education	No formal education	22	5.2
	Primary education	53	12.6
	Secondary education	171	40.7
	Tertiary education	174	41.4
Employment	Unemployed	89	21.2
	Self-employed	152	36.2
	Government employed	56	13.3
	Private sector employed	123	29.3
Household income	Below minimum wage (<NGN 77,000)	184	43.8
	Above minimum wage (>=NGN 77,000)	236	56.2
Religion	Christianity	230	54.8
	Islam	179	42.6
	Traditional/Other	11	2.6

Table 3. Reported screen exposure, symptom-screening outcomes, and selected stratified prevalence.

Variable/stratifier	Category	n	Daily >1 hour n (%)	Symptom presence n (%)
Overall screen exposure	>1 hour/day	420	286 (68.1)	-
Weekend screen exposure	>1 hour/day	420	325 (77.4)	-
Dark/dim-room use	Yes	420	200 (47.6)	-
Overall symptom presence	Score >=2	420	-	174 (41.4)
Symptom burden	No symptoms	420	-	152 (36.2)
	Mild burden	420	-	199 (47.4)
	High burden	420	-	69 (16.4)
Education	No formal education	22	17 (77.3)	17 (77.3)
	Primary education	53	47 (88.7)	31 (58.5)
	Secondary education	171	123 (71.9)	76 (44.4)
	Tertiary education	174	99 (56.9)	50 (28.7)
Income	Below minimum wage	184	138 (75.0)	92 (50.0)
	Above minimum wage	236	148 (62.7)	82 (34.7)
Employment	Unemployed	89	59 (66.3)	45 (50.6)
	Self-employed	152	115 (75.7)	68 (44.7)
	Government employed	56	34 (60.7)	17 (30.4)
	Private sector employed	123	78 (63.4)	44 (35.8)

Note. Daily >1 hour refers to the questionnaire item on typical daily screen exposure above one hour. It is not WHO-defined age-specific excessive screen use.

Table 4. Maternal practice regulation by daily screen exposure above one hour and symptom presence.

Outcome	Practice regulation	Comparison group n (%)	Outcome group n (%)	chi-square	df	p-value
Daily >1 hour	Poor regulation	32 (12.2)	231 (87.8)	148.548	2	<0.001
	Moderate regulation	28 (43.8)	36 (56.3)			
	Good regulation	74 (79.6)	19 (20.4)			
Symptom presence	Poor regulation	99 (37.6)	164 (62.4)	127.931	2	<0.001
	Moderate regulation	57 (89.1)	7 (10.9)			
	Good regulation	90 (96.8)	3 (3.2)			

Table 5. Bivariate association between daily screen exposure above one hour, symptom presence, and mean score differences.

Analysis	Comparison	No/low group	Outcome group	Statistic	df	p-value
Daily exposure and symptoms	<=1 hour/day	118 (88.1)	16 (11.9)	chi-square = 70.518	1	<0.001
	>1 hour/day	128 (44.8)	158 (55.2)			
Perception score	Daily >1 hour	28.10 (7.78)	18.78 (9.00)	t = -10.865	297.7	<0.001
Perception score	Symptom presence	26.40 (7.89)	15.18 (7.97)	t = -14.272	370.5	<0.001
Knowledge score	Daily >1 hour	7.38 (1.78)	5.30 (2.25)	t = -10.257	323.1	<0.001
Knowledge score	Symptom presence	7.06 (1.86)	4.41 (2.01)	t = -13.682	354.0	<0.001

Note. Score values are mean (SD). Welch degrees of freedom are reported where variances differed.

Table 6. Adjusted logistic regression models for daily screen exposure above one hour and symptom presence.

Predictor	Daily >1 hour aOR	95% CI	p	Primary symptom model aOR	95% CI	p	Practice-adjusted symptom model aOR	95% CI	p
Daily >1 hour	-	-	-	3.03	1.50-6.12	0.002	1.64	0.76-3.55	0.212
Practice score	0.77	0.71-0.84	<0.001	-	-	-	0.80	0.72-0.88	<0.001
Perception score	0.99	0.95-1.04	0.731	0.89	0.86-0.93	<0.001	0.94	0.90-0.99	0.010
Knowledge score	0.92	0.78-1.09	0.346	0.63	0.54-0.74	<0.001	0.72	0.62-0.85	<0.001
Maternal age	0.98	0.95-1.03	0.473	0.99	0.95-1.03	0.667	0.99	0.95-1.03	0.579
Tertiary education	0.87	0.49-1.55	0.644	0.60	0.11-3.28	0.555	1.10	0.59-2.02	0.771
Above minimum wage	1.10	0.63-1.92	0.737	1.11	0.64-1.91	0.721	1.39	0.78-2.47	0.266
Formal employment	0.75	0.43-1.28	0.289	0.85	0.48-1.51	0.588	0.85	0.47-1.52	0.576
Married	1.09	0.57-2.08	0.791	0.94	0.48-1.84	0.862	-	-	-

Note. The primary symptom model adjusted for daily exposure above one hour, maternal age, education, income, employment, marital status, religion, knowledge, and perception. The practice-adjusted model added practice score but used the reduced socio-demographic specification shown in the prior model to avoid sparse parameterization. aOR, adjusted odds ratio; CI, confidence interval.

Table 7. Moderated logistic regression model for symptom presence.

Predictor	aOR	95% CI	z	p-value
Daily >1 hour	1.72	0.79-3.75	1.372	0.170
Practice score centered	0.78	0.67-0.92	-2.949	0.003
Daily >1 hour x practice	1.04	0.87-1.25	0.418	0.676
Perception score	0.95	0.91-0.99	-2.558	0.011
Knowledge score	0.73	0.62-0.86	-3.836	<0.001

Note. The interaction term tested statistical modification of the cross-sectional association between daily screen exposure above one hour and symptom presence by maternal practice score.