ORIGINAL ARTICLE

Parental Education for Limiting Screen Time in Early Childhood: A Randomized Controlled Trial

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ABSTRACT

Objective: To assess the impact of focused parental education on limiting screen time in early childhood.

Methods: An open label randomized controlled trial was conducted in a tertiary care hospital in Delhi wherein 120 healthy children aged 9-10 months of age, born at term gestation and appropriate for gestational age (birth weight ≥ 2500 g), attending the immunization clinic reporting for measles-rubella (MR) vaccination were enrolled. Primary caregivers were randomized to either receive 30 minutes of in-person active counselling with pre-designed content including a printed pamphlet targeted at reduction of screen time (Educational group, n = 60) or to receive routine in-person counseling on general health measures (Control group, n = 60). All caregivers were followed up. Primary caregivers in both groups were reinforced telephonically every month for 6 months. At the end of six months, we assessed the proportion of children with screen-time > 1 hour/day and the median duration of screen-time (minutes / day). We also compared both groups in terms of changes in pre-post intervention developmental and behavioral scores (measured with Ages and Stages questionnaires).

Results: After 6 months of follow-up, 3% (2/60) children in the Educational group had screen time > 1 hour/day as compared to 53% (32/60) (P < 0.001) in the Control group. Median (IQR) for total screen duration in the Educational group was 35 (30,49) minutes/day compared to 75 (50,90) minutes/day in the Control group (P < 0.001). Children in the Educational group were also observed to have a significant change in behavioral score and fine motor and adaptive skills as compared to controls.

Conclusion: Parental education starting in infancy is a promising intervention to reduce screen exposure in children; it may also have a positive impact on their developmental and behavioral skills.

Keywords: *Behavior, Development, Digital Media, Infants, Smartphone, Television*

INTRODUCTION

Children are exposed to screen-based devices from early childhood [1]. In a recent study from urban Delhi, 99.7% children were exposed to screen-based media by 18 months of age; with nearly 90% viewing the screen for more than an hour a day [2]. Excessive screen exposure reportedly leads to delay in gross and fine motor development and impairment in expressive language development [3]; and may also affect attentional capacity, problem solving, and behavioral development. Parental screen habits and attitudes influence a child's screen-time significantly, as children tend to imitate what they see in their surroundings [1].

A multitude of interventions have been found to be effective in reducing screen time in children [4-9]. Early childhood interventions in the form of responsive parenting [9], reducing the number of screens within the home [5], reducing screen access to kids [8], and condi-tioning children to physical activity [4] are reported to be effective interventions. However, there is paucity of specific studies on the impact of parental counseling targeting a reduction in screen-time in the first 2 years of life, especially in the Indian context.

We hypothesized that an intervention starting within the first year of life in the form of parental education and early anticipatory guidance can limit screen-time in the initial two years of life. Screentime reduction may also have a positive impact on the development and behavior of the child. We conducted this study to assess the impact of focused parental education on limiting screen time in early childhood and improvement in behavior and development.

METHODS

We conducted this open label randomized controlled trial (RCT) in a medical college affiliated teaching hospital between January, 2021 and August, 2022. A written

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informed consent was obtained from caregivers of all participants and an ethical clearance was obtained from the Institutional Ethics Committee prior to commencing the study.

Healthy children between 9-10 months of age, born at term gestation and appropriate for gestational age (birth weight > 2500 grams) reporting to the immunization clinic for measles-rubella (MR) vaccination were approached for inclusion. Infants with weight-for-age and weight-for-length < - 2SD (as per WHO growth standards), congenital malformations, developmental delay, chronic or acute systemic illness, cerebral palsy, syndromic disorder, and visual or hearing impairment were excluded. Children and caregivers not having access to screen media (television, smartphone, tablet, laptop, computer, and video game device) were also excluded.

At enrolment, anthropometry of all children was recorded and interpreted as per standard procedures [10-12]. Details regarding the primary caregiver, their educational qualifications, socioeconomic status as per modified Kuppuswamy scale [13], and primary rearing environment were recorded. Household ownership of television, handheld devices like smartphones, tablets, laptops, and personal computers was also ascertained. Frequency of screen viewing practices of their child (days/week), time (minutes) that their child spent on viewing the screen during the past week (specifying the days) were also recorded. Child's age at first exposure to screen devices was ascertained and the primary caregiver's screen-time (frequency and duration in a week) were also documented. Parental modelling for screen viewing was ascertained at the time of enrolment by asking the primary caregiver about perception of their own and their child's screen viewing habits; and involvement in activities like watching/using screen device during meal time, for entertainment and academic activities. We also assessed the developmental scores using the age-appropriate Ages and Stages Questionnaire (ASQ3) [14] and behavioral scores using the Ages and Stages Questionnaire: Social-Emotional-2 (ASQ:SE2) questionnaire [15] at enrolment. The Hindi versions of these questionnaires have been validated in Indian settings by AIIMS, New Delhi. The ASQ3 questionnaire was used to address competence behaviors, whereas, ASQ:SE2 questionnaire was used to assess both competence and problem behaviour. Low scores using the ASQ:SE2 questionnaire are indicative of normal behavior, and higher scores indicate behavioral problems. High scores on ASQ3 questionnaire are rated better as compared to low scores.

Children were randomized using block randomization of varying blocks into two groups: Educational group and Control group. The random number sequence was generated by a third person not related to the study. Allocation was concealed by the sealed envelope technique. Both participants and investigators were aware of the intervention being done or otherwise.

Parents in the Educational group received 30 minutes of in-person active counseling with pre-designed content targeted at reduction of screen time in a language (English/Hindi) the caregivers could understand. During the session, they were guided to incorporate age-appropriate responsive parenting skills, increase interactive play of the infant, limit screen exposure, and modify parental media habits. The content was delivered as a one-to-one structured talk, and a printed pamphlet with these instructions was also handed over to the primary caregiver at the end of the session. The same was also reinforced telephonically on monthly basis (5 sessions) till the end of the study i.e., for 6 months from enrolment.

Primary caregivers in the Control group received routine counselling regarding nutrition, immunization, and general safety measures. They were informed about the screen use guidelines [16] for infants and young children if asked for. They were also contacted telephonically every month and reminded about general health care and safety measures and about filling the screen time data form for the child. They did not receive any active counselling regarding reducing/modifying screen-time of their children. In both groups, the primary caregivers were instructed to maintain a weekly screen chart in a prescribed format.

Development, behavior scoring, and anthropometry were recorded after 6 months of intervention (conducted at 15-18 months of age during routine immunization visit). The screen-time data sheets filled by the parents were collected. Any significant health related events during follow up duration were noted (illness requiring hospital admissions, family issues impacting development). They were then guided regarding further screen time limitation of their child.

The primary outcome measures included *a*) proportion of children with screen-time >1 hour/day; and *b*) median duration of screen-time (minutes/day). Secondary outcome measures were *a*) change in developmental scores and *b*) proportion of children with problematic behavioral scores.

A previous study reported that 88.7% of children were viewing screen for > 1 h/day by the age of 15-18 months [2]. Aiming for a 25% relative reduction in this proportion, we needed to study 54 intervention and 54 control group participants to be able to reject the null hypothesis with power of 0.8 and Type I error of 0.05. Assuming a 10%

dropout, we included 60 participants in each group.

Statistical analysis: Data were analyzed using IBM SPSS Statistics version 20.0. For normally distributed data, continuous variables between the two groups were compared using Student *t*-test and for data that were not normally distributed, Mann-Whitney *U* test was used. Proportions of young children with screen-time > 1 hour/day, and problematic behavior in the two groups were compared using chi-square test. Changes in developmental and behavioral scores (between baseline and 6 months after intervention) were compared by paired t test. In case of lost to follow up, censoring was done at the last available observation. Intention to treat analysis was used for all primary outcomes. *P* value < 0.05 was considered significant.

RESULTS

Out of 128 children who were approached; 120 children, median (IQR) age 9 (9,10) months; 53% (*n* = 56) boys, were finally enrolled. The flow of participants is depicted in **Fig. 1**. Most of the participants belonged to the urban middle class (90%); mother was identified as the primary caregiver in 95% families. Almost all parents were literate with a third of them being graduates. In most homes, the father was employed (98%) and the mother was a home maker (86%). The mean (SD) weight-for-age (*z*-score) (WFAZ), mean (SD) length/height-for-age (*z*-score) (HFAZ)), and mean (SD) weight-for-length/height (*z*-score) (WFHZ) of enrolled children were -0.8 (0.5), -0.9 (5.2) and -0.9 (0.6), respectively. Baseline socio-demographic characteristics between the two groups were comparable (data not shown).

Smartphone was universally present in all households; in 115 (96%) families, both parents owned a separate smartphone. Television and computer or laptop or tablet were owned by 71 (59%) and 28 (23%) families, respectively. The median (IQR) age at the first exposure to a smartphone was 6 (6,7) months, starting as early as from 3 months of age. The frequency and duration of watching the phone screen were comparable in the two groups. However, the frequency and duration of watching television was significantly higher in children of the Educational Group (**Table I**).

Comparing the screen use practices in the primary caregivers between the groups, the frequency of watching screens of all devices was comparable. However, the duration of use of mobile phones was significantly more in caregivers of the Educational group as compared to the

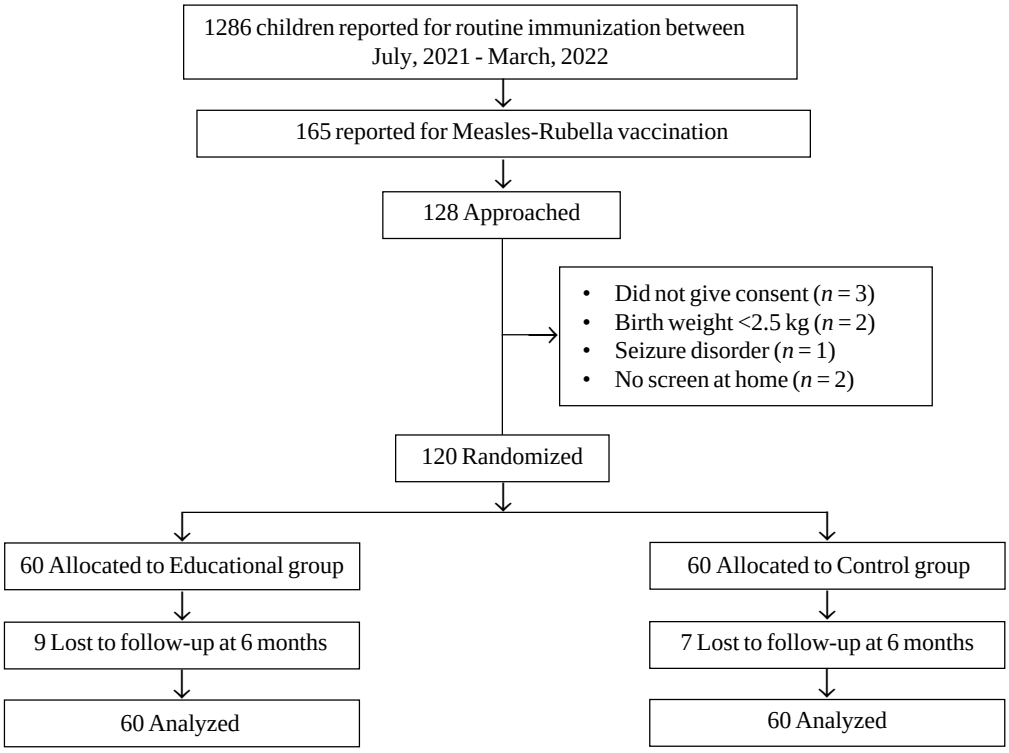

Fig.1 Study flow chart showing enrolment of participants

Table I Baseline Screen Use Practices in Caregivers and Children Enrolled in the Study

Parents	*Educational group (n = 60)*	*Control group (n = 60)*
Mobile device exposure frequency duration (days/week)	7 (7, 7)	7 (7, 7)
Television exposure frequency (days/week)	6 (0, 7)	2 (0, 5)
Duration of mobile devices exposure (minutes/day)[a]	120 (60, 120)	60 (60, 120)
Duration of television exposure (minutes/day)	30 (0, 90)	30 (0, 60)
Children		
Mobile device exposure frequency duration (days/week)	7 (7, 7)	7 (5, 7)
Television exposure frequency (days/week)[b]	2 (0, 7)	0 (0, 6.5)
Duration of mobile devices exposure (minutes/day)	30 (15, 30)	30 (15, 30)
Duration of television exposure (minutes/day)[b]	10 (0, 30)	0 (0, 20)

Values expressed as median (IQR); [a]P = 0.05; [b]P < 0.05.

Control group. More than half (n = 61) of the caregivers were concerned quite a bit about the time they spend on screen; while only 40% (n = 48) restricted screen exposure of their children. Most of the caregivers were watching screens with their child while eating dinner (108/120,90%).

After 6 months of follow up, only 3% (n = 2) children in the Educational group had screen time > 1 h/day as compared to 53% (n = 32, P < 0.001) in the Control group. Median (IQR) duration of screen time after 6 months reduced significantly in the Educational group to 35 min/day (30, 49), while the reduction in the Control group was 75 (50, 90) min/day (**Table II)**.

After 6 months of intervention, children in the Educational group had a significant change in developmental domains of fine motor and adaptive skills. Change in pre-post intervention behavioral score was also significantly higher in the Educational group (**Table III**). There were no behavioral issues with any of the kids in both groups, either at baseline or at end point. No difference was noted for the anthropometric parameters between the groups at the end of the study (data not shown).

DISCUSSION

In this RCT, we ascertained the efficacy of parental education for reducing screen-time in infancy. The screen-time of children decreased significantly in the Educational group with significant improvement in behavioral and developmental scores after 6 months of intervention.

Indian Academy of Pediatrics (IAP) formulated recommendations for limiting screen-time in Indian infants, children, and adolescents, and recommended that children below 24 months of age should not be exposed to any type of screen and screen should not be used as a measure to calm the child or to feed [17]. Parents should avoid watching screens while with the child and they should be more involved in physical activity and age-appropriate activities. In our study, the median (IQR) age at the first exposure to mobile phones was 6 (6,7) months starting as early as 3 months for smartphones and video-calls which was similar to that reported by Meena et al [2]. Madigan et al [3] in a longitudinal cohort study including 2441 mothers and children, reported that higher levels of screen time at 24 and 36 months were significantly associated with poorer performance on developmental screening tests at 36 months (β - 0.06; 95% CI -0.10 to -0.01) and 60 months (β - 0.08; 95% CI -0.13 to -0.02), respectively. Therefore, we included infants hypothesizing that early childhood intervention with in first year of life would lead to limitation of screen time and positively impact their development.

In a systematic review [18], behavior change tech-

Table II Duration of Screen Exposure in the Two Groups After 6 Months Intervention

Parameters	*Educational group (n = 60)*	*Control group (n = 60)*	*P value*
Total screen duration (minutes/day)	35 (30, 49)	75 (50, 90)	< 0.001
Duration of mobile device exposure (minutes/day)	22 (20, 30)	46 (30, 60)	< 0.001
Duration of television exposure (minutes/day)	13 (0, 30)	30 (0, 30)	< 0.001

Values in median (IQR).

Table III Change in the Behavioral and Developmental Scores Following Intervention (*n*=120)

	Educational group			*Control group*			*Mean Difference*	*P value*
	Baseline	*Follow-up*	*Change*	*Baseline*	*Follow-up*	*Change*	*(95% CI)*	
Behavioural Score ASQ:SE2	32 (8.5)	26 (7.3)	7 (7)	30 (11.5)	28 (9)	2.3 (8)	4.3 (1.4-7.1)	0.004
ASQ3 Language	56.4 (3.3)	56 (2.3)	0.08 (3.2)	56 (3.2)	56 (3)	0.25 (3.6)	-0.167 (-1.4-1.0)	0.777
ASQ3 Gross motor	57 (3.5)	59 (2.1)	1.4 (3.4)	57 (3)	57 (3)	0.08 (3.5)	1.33 (0.07-2.5)	0.061
ASQ3 Fine motor	56.2 (4)	56.4 (3)	0.17 (3)	57 (3)	56 (2)	-1.0 (3)	1.16 (0.06-2.2)	0.041
ASQ3 Personal social	57 (3)	56.8 (2.7)	0.25 (3)	56 (3)	55 3)	-1.08 (3)	1.3 (0.24-2.4)	0.152
ASQ3 Adaptive	56 (2.5)	57 (2.7)	0.5 (3)	56 (3)	56 (3)	-0.33 (3.03)	0.83 (-0.2-1.92)	0.019

Values in mean (SD). ASQ3: Ages and Stages Questionnaire3, ASQ:SE2: Ages and Stages Questionnaire: Socio-emotional, ASQ-SE2 low score indicates normal behaviour and higher score is suggestive of behavioural problem, ASQ3 high score is better as compared to low.

niques, like "behavior substitution", "information about social and environmental consequences", "demonstration of the behavior", "behavioral practice/rehearsal" and "goal setting (behavior)" are reported to be most promising in reducing screen exposure. Parental education intervention is one such effective intervention [19]. A parental education intervention in our study led to a significant reduction in the proportion of infants with daily screen time > 1 hour and duration of screen-time after 6 months of follow up. Lin et al [20] conducted a cluster randomized controlled trial with the aim to investigate the effect of a parental educational program on screen use among preschoolers and reported a significant reduction in screen time (effect size: 0.83, $P < 0.001$), improved sleep quality (effect size: 0.57, $P = 0.01$) and attention score (effect size: 0.77, $P = 0.02$) for psychosocial adaptation in children in the experimental group. Similar results were reported by Dennison et al [21] and Fitzgibbon et al [22].

Intervention Nurses Start Infants Growing on Healthy Trajectories (INSIGHT) trial [9], conducted an RCT in 2018 where primiparous mother-newborn dyads ($n = 279$) were randomized and responsive parenting was trained to the Educational group by nurses at 3, 16, 28, and 40 weeks to minimize screen exposure. They concluded that from infancy to early childhood, responsive parenting reduced screen time and television exposure, but did not increase the frequency or amount of interactive play. A recent systematic review specifically targeting children aged under six years found that interventions lasting greater than six months and conducted in a community, home, or pre-school setting were most effective at reducing screen time [23]. Similar observations were seen in our study, re-emphasizing the positive impact of parental education intervention on reducing screen exposure starting as early as neonates to less than 1 year of age.

Excessive screen exposure is found to be significantly associated with delayed motor skills, cognitive and language development [24,25]. Screen exposure in infancy is found to be positively associated with self-regulatory problems later [26]. In our study, development scores for fine motor and adaptive skills were better in the Educational group as compared to the Control group, while there was no difference in gross motor, personal social, and language skills. Also, behavioral scores were found to be better in the Educational group as compared to the Control group. Xie et al [27] observed that preschoolers with screen time of more than 60 minutes tend to have significantly more behavioral problems (total problem: 35.84 vs 32.76, $P = 0.024$; externalizing: 11.54 vs 9.08, $P = 0.016$). Similarly, Christakis et al [28] reported that an increase in the number of hours that a child watched television at the age of 1 year predicted a 28% increase in attention problems when the child reaches age seven. In our study, children enrolled were less than 1 year of age, as maximum brain development occurs in the first 2 years of life. Therefore, promoting age-appropriate responsive parenting, with parental education and early anticipatory guidance within the first year of life can prevent behavioral and developmental problems due to early screen exposure.

An RCT conducted in the past reported greater reductions in targeted sedentary behavior ($P < 0.001$), children's BMI ($P < 0.05$), and energy intake ($P < 0.05$) in the Intervention group compared to the Control group [29]. In our study, no difference in the anthropometric parameters were seen between the Educational group and the Control group. This difference could be attributed to the shorter period of follow-up in our study as compared to the above study where monitoring was done for 2 years.

The study had some limitations. This was an open labelled study where blinding could not be done and only one face to face interactive session was conducted with the primary caregivers. Since data collection relied on parental reports, there was a risk of recall and social desirability biases which also could be a limitation of the study. Children were followed only for 6 months, which might be

WHAT THIS STUDY ADDS?

- Early childhood intervention in the form of parental counseling is an effective intervention in reducing screen-time duration in children aged below 18 months.

too short a period to assess development and behaviour, therefore studies with longer follow-ups must be conducted in the future. The screen-time duration and frequency was noted as provided by the caregiver and was not supervised due to logistic constraints involved in collecting such data. The content of media use was not assessed which also is an essential factor. The Hawthorne effect in the Control group could also be a confounding factor.

We conclude that early childhood intervention starting within the first year of life in the form of parental education and early anticipatory guidance can limit screen time in the initial 2 years. Reduction of screen time may have a positive impact on the behavioral and developmental scores of the child. Guidelines regarding screen time must be inculcated by the pediatricians in their daily practice on every well baby visit. Primary caregivers can also be counseled at Anganwadi centers regarding reducing screen exposure and their harmful effects. Educational interventions must be started at an early age to promote the reduction of screen exposure and more age-appropriate activities to enhance the holistic development of children.

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