Unpacking Early Digital Addiction and Developmental Challenges in Young Children: A Scoping Review Towards Rethinking Digital Habits

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Abstract

Background: In today's intricate socio-economic landscape, working parents confront challenges in continuously supervising their children's actions, frequently turning to screen devices as a convenient substitute to keep their offspring occupied. Evidence indicates that disproportionate screen time engagement during a very early stage of life (0-3 years) increases substantially with age leading to adverse influence on children's cognitive, linguistic, and academic success over time. In response to this matter, a personalized mHealth solution can appear as a practical proposition to help parents manage potential threats.

Objective: The aim of this qualitative systematic analysis is to underscore the existing blind spots in parental ignorance concerning screen time management, explore the recommended effective strategies for redirecting children under 3 years of age from unwarranted screen contact and lastly, establish a realistic as well as a holistic framework that supports cognitive progression amongst younger children within a context of their domestic setting.

Methods: A systematic search of academic databases including Google Scholar, PubMed, IEEE Xplore, and Elsevier was conducted. Qualitative studies pertaining to the recognition of parental decision-making factors, their repercussions, shortcomings, and proposed conquering strategies to alleviate screen media contact in infants and toddlers (aged 0-3 years) were included. Finally, this review paper will integrate the advocated perspectives and propose an actionable replacement tailored to permit families in promoting mindful digital engagement.

Results: In total, our comprehensive review included 36 articles. Parents' perceptions were grouped into 9 distinct categories. It was found that parents generally consider digital devices beneficial for numerous reasons. On the contrary, negative effects such as cognitive harm, dependence and social isolation were detected, however, parents are bound to depend on digital devices due to their modern lifestyle demands. Various authorities have identified difficulties and have developed countermeasures such as limitations on usage and co-viewing, but their implementation must be refined accounting for the challenges of modern parents. The proposed solution could leverage four pivotal features: (i) Screen time tracking and monitoring mechanism, (ii) A reservoir for parental training, (iii) An alternative activity advocator, finally (iv) an interactive artificial intelligence assistant.

Conclusions: Overall, the majority of parents have a positive perspective towards the recommended intervention strategies and perceive them as an effective solution. However, they also recognize a reasonable gap in these approaches, due to the lack of appropriate tools, guidance, and sufficient time for implementation. The findings of this study could offer future investigators valuable insights into the design of an empathetic and practical mHealth application, aiming to manage their children's screen time more efficiently, improve adherence to healthy screen habits, and foster a digital eco-system where technology itself serves as a promoter for progress and well-being, rather than a liability. Clinical Trial: N/A

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Keywords: infants and toddlers; screen time; cognitive development; parental ignorance; intervention strategies; mHealth

1. Introduction:

The inclination of children towards excessive and unnecessary screen time has become a common problem recently, with the potential to cause severe impacts on several aspects of young children's essential skills development including lower academic achievements, increased anxiety, difficulties in learning languages, and more.[1–4] The American Academy of Pediatrics (AAP), a prominent figure devoted to upholding the welfare of children, strongly discourages exposure to any mode of screen media for children under the age of 2.[5,6] Nevertheless, studies have discovered that approximately 68% of children under this segment frequently surpass the threshold, consuming a standard screen time of 2.05 hours per day, which is deemed to be overwhelming.[7] Also, the occurrence of watching television, one of the most amicable forms of screen media, exceeding 2 hours per day was perceived to be 83% in the US, 78% in Australia, and 82% in Canada amongst toddlers between 2 to 5 years, leading to a noticeably sedentary lifestyle within roughly 34% to 94% of children.[8,9] In today's complex socio-economic landscape, it is also imperative to emphasize the array of obstructions modern parents face in regulating their offspring's activities. With different types of responsibilities and no scope of constant supervision, screen devices have appeared as a convenient alternative, serving as a helping hand for struggling parents leading to nearly 70% of parents disregarding the AAP's recommendations.[10,11] These observations point to a concerning trend of diminishing adherence to screen time guidelines for children, implying a need for a thorough evaluation and update of these guidelines.

Cognitive development remains the foundation stone of a child's holistic advancement. However, accumulating evidence indicates that consuming a disproportionately high rate of screen time has negative implications on children's cognitive and linguistic development which might appear to undesirably affect their academic, social, and psychological outcomes illustrated in Figure 1.[12–15] A psychological study involving Korean children between 24-30 months of age exhibited a

proportionate relationship between screen time and the prospect of undergoing language pause and contracted challenge-solving expertise.[7] Likewise, elevated television coverage at 29 months of age was associated with minimal vocabulary and mathematical aptitude levels at a later period.[16] Conversely, studies have shown that when young toddlers watch high-quality content under adult supervision, they exhibit improvements in attention skills and vocabulary growth compared to their peers who do not watch these programs at all. Such content often employs strategies like labeling objects, encouraging direct interaction between the child and characters, and providing opportunities for the child to respond, contributing to their developmental benefits.[17] Nevertheless, the majority of such positive statements are often presented by media content creators targeting children of 0-2 years age group and are unverified as estimated in the 1999 AAP policy announcements.[18–20] These contradictory findings infer a significant gap in our interpretation and the intent is not to only “solve” this underlying challenge but to acquire a profound understanding of it- so that we can effectively address it.

The foundations for successful analytical competencies are rooted in early childhood that children typically foster and cultivate within the initial 3 years of life.[21] However, during this critical phase of cerebral development infants and younger toddlers are also extremely susceptible to the detrimental consequences triggered by prolonged screen exposure.[22,23] Most reviews about the prospective risks of screen time for children have mostly targeted the age span of 5-7 years; nonetheless, none have explicitly targeted actions for children between 0-36 months old. Before presenting any solution, Instead of rejecting the ubiquitous presence of smartphones and other screen devices, it is essential to contemplate a realistic strategy personalized precisely to cater to the requirements of parents in the current era. We believe that an mHealth application can appear as a discreet and reachable option, enabling parents to cautiously tackle possible menaces, guard their children, and uphold a steadiness between technological interaction and sensible parenting. Thus, this paper proposes a shift in attention from “filling a research gap” to “acknowledging a research gap”, which can underline the intellectual blind spots and provide actionable insights to expand the design scope. To uncover the intricacies of health, technical, and social branches associated with the utilization of screen media by children aged 0-3years, this paper addresses the following three fundamental research questions:

RQ1**:** How does the lack of knowledge about the potential risks of excessive screen media use on a child’s cognitive development influence parents' decision-making process?

RQ2**:** What alternative interventions have been identified that parents can utilize to successfully distract children from having excessive screen time and support their intellectual capabilities in a home-based setting?

RQ3**:** How can these alternate solutions and actions be effectively incorporated into a holistic approach that alleviates the negative effects of extreme screen time on younger children's cognitive advancement?

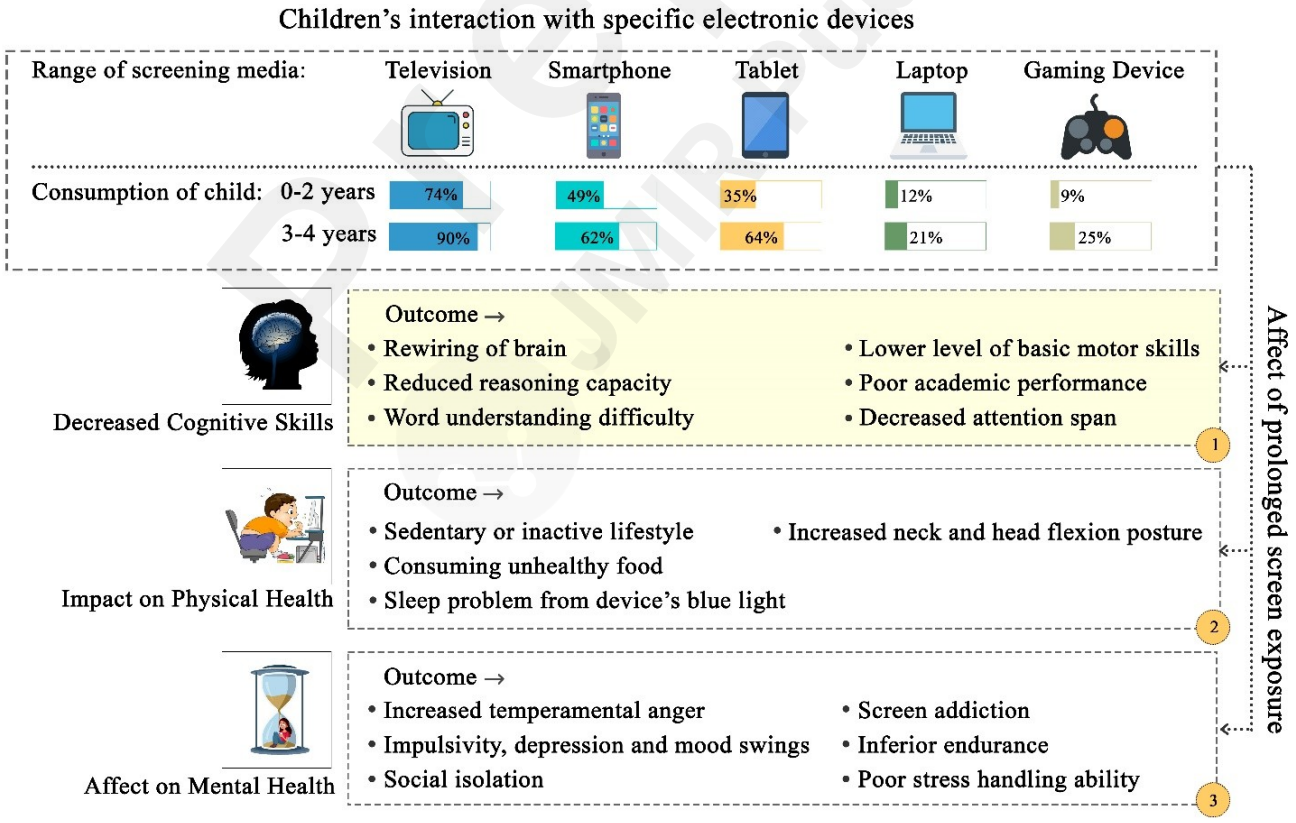

Figure 1: Impact of excessive screen exposure on childhood developmental domains

We initiate by presenting an organized approach to gather relevant literature in the designated field and accumulating their insights. We further delineate the implications that originated due to the existing blind spots in parental understanding, along with proposed recommendations. Lastly, we present some modernistic ideas that can surpass the limitations of children and extended screen time engagement.

2. Methodology:

This study is organized to provide an in-depth investigation and underline the significance of the cautiously selected research questions, employing a distinct methodology covering detailed scoping criteria, systematic literature search, and data analysis procedure.

2.1 Scoping Criteria

In the context of prospective difficulties, shortcomings, risks, and strain related to the assigning of screen media among young toddlers, the scoping criteria define the precise boundaries and considerations for achieving a home-based solution that permits parents and their children to address and overcome the perceived blind spots, thereby adding significance to the discourse. These challenges include a systematic inquiry of parents' rationale for exposing their infants and toddlers to screen media, its actual impact on their development, a comprehensive and critical evaluation of tailored solutions such as integrating more physical activity, social connectivity, and so forth. In our research, all contributing studies about the research questions achieved preliminary approval. Additionally, the analysis also accounts for parents' misconceptions about the positive impacts of screen media on their children's overall development along with their personal media usage patterns. This was done to encourage their early participation in implementing effective solutions, leading to a comprehensive and distinctive investigation.

2.2 Systematic Literature Search

Leveraging key ideas that address the implicit association of child cerebral development to screen viewing", we examine another crucial component, employing a systematic literature search through a rationalized process that eased identifying relevant literature for our survey paper. The literature review comprised journal papers, peer-reviewed articles, and online reports which were sourced and finalized from academic databases such as Google Scholar, PubMed, IEEE Xplore, and Elsevier. We then articulated a series of specialized key phrases derived from our above-mentioned research questions to categorize papers at the intersection of overextended screen coverage and a child's intellectual growth. Specifically, the terms "infants", "young toddlers", and "early childhood", were methodically searched in aggregation with each of the following phrases-- "cognitive development", "sedentary lifestyle", "screen media", "challenges", "prevalence and factors of screen viewing", "risks related to screen media", "alternative solutions", "mHealth", "software application" to stipulate a basis for demonstrating our discoveries and deductions. The inclusion criteria predicted the following parameters: the identified papers were published in interdisciplinary conferences and respectable journals, or a strategy report constructed by a government organization; and the study deeply engaged in a discussion concerning the detection of impacts, correlations, and solutions for children aged 36 months and younger. The exclusion of irrelevant articles was applied through a selection process of duplicate titles and abstracts. Ultimately, we recognized 36 articles using a PRISMA flowchart satisfying all the criteria, as shown in Figure 2.

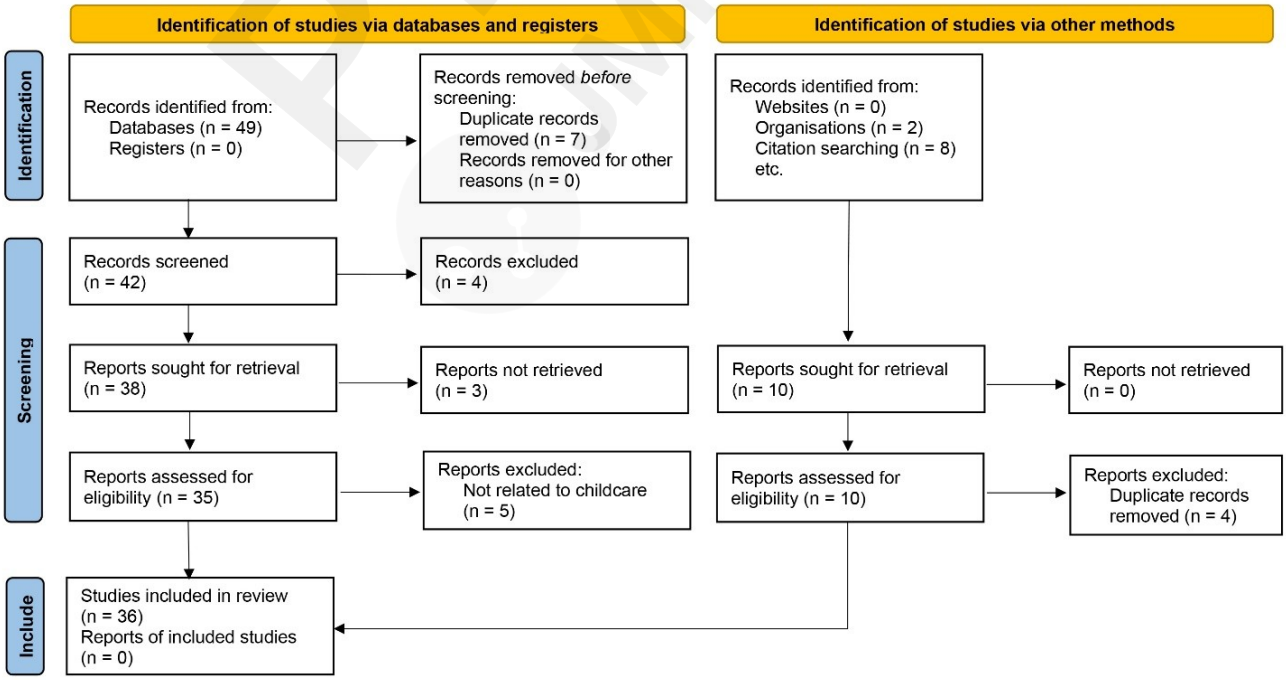

Figure 2: PRISMA flowchart demonstrating the systematic literature search.

2.3 Data Analysis Procedure

The data analysis approach involves summarizing meaningful conclusions derived from the selected literature that focuses on the existing issues in the domain of screen-based interaction for children under 3 years old. In particular, for RQ1 and RQ2, we conducted a systematized and cohesive qualitative analysis, delving into specific instances such as parental perceptions and correlations influencing their thought-making process. In addition, we investigated how their actions may drive their children to endlessly consume screen-media, while also identifying the countermeasures and alternative intervention strategies suggested by administrative bodies and their efficacy in successfully distracting children from consuming unnecessary screen time. As for RQ3, we will incorporate the promoted perspectives to represent alternative plans of action across home-based childcare environments, ensuring that this survey paper's outcomes accomplish optimum rationality, scalability, and consistency to the targeted audience.

3. Results:

In response to the three research questions, it is evident that the influence of parental attitudes, perspectives, and beliefs along with the parents' own pattern of screen usage shape young toddlers and infants' screen time. This finding aligns with the assumption that parents are generally oblivious to the negative consequences of screen media usage for infants and reveals a substantial gap in the parents' understanding of its effects on cognitive and developmental outcomes. One of the key findings of the research is the parents' unawareness of their personal screen usage habits directly affecting their infants' interactions with screen media, and this lack of awareness is leading to parents making decisions that are inadvertently hindering the cognitive development of their children. Therefore, these findings implore a need for parental education on the implications of screen time usage in infants for parents to make well-informed decisions that can even the odds out of the use of screen media.

3.1 Highlighting the Importance of Awareness in Parental Decision-Making (RQ1)

Amongst the increasing evidence revealing the outcomes related to early childhood screen engagement, it becomes apparent that many parents remain uninformed that their own attitudes, principles, as well as personal screen time ingestion are noted to be directly related to the screen time actions taken by their infants and young toddlers. As principal guardians and decision-makers within the micro-home environment, parents possess significant influence over their infants who are considered exclusively susceptible to the detrimental consequences of screen exposure due to their evolving condition. Infants, However, with a limited understanding of screen time consumption midst children aged from birth to 3 years, it is essential to further explore the parental thought processes considering their ideals and theories in modern settings. To form more realistic standards concerning screen use, it is imperative to discover parents' attitudes toward technology control and how they implement said control toward their children's association with these devices. In Table 1, we describe that the outcomes of screen viewing of children rest crucially on misguided facades of their parents' perspectives surrounding their performance during screen viewing, appropriateness of the content compared to the offspring's age, responsiveness throughout background media usage and so forth which can disrupt cognitive growth and inhibit higher-order intellectual aptitudes, causing infants and toddlers aligning to the screen display persistently whenever the content includes slightly noticeable signals.[21]

Table 01: Parental observations opposed to actual impact.

Parents Perception	**Parent's decision-making factors**	**Impact on child's cognitive development**	**Additional impacts**	**Ref.**
Guarded against outside world	Parents from unsafe vicinities may exploit screen media to avert their toddlers from playing outside.	• More screen media addiction at school age • Less attention span	• Obesity and other health outcomes • Aggression	[2,24]
Media as an educational tool	Belief that programs particularly targeting young toddlers are informative and extremely significant for healthy development.	• Decreased child vocalizations. • No advancement of linguistic skills • Less school-connectedness	• Inverse effect on self-esteem and mental health • Externalizing performance	[7,13,18,25]
Background media	Children subjected to adult-oriented contents termed as background noise while being viewed by their parents or older siblings.	• Intervention with vocabulary growth due to less "talk time". • Concentrated cognitive managing,	• Distraction of child from current activity • Reduced exposure to noticeable human adult	[12,13,20,23,26]

		executive functions, memory and reading conception. • Shorter intervals of focused concentration	conversation • Less parental responsiveness	
Media as a peacekeeper	Child's media time offers a prospect for parents to avoid conflict and focus on other tasks such as preparing food, getting official work done, or doing household duties.	• Lowered focus and attention • Expressive short-term and long-term speech delay	• Decreased parent-child interaction. • Fewer time spent in creative play. • Moderated psychological well-being	[10,26,27]
Bedtime media	Parents comprehending that bedtime media works as a calming sleep aid	• Adverse effect on speech delivery due to less time being read to or reading	• Increased bedtime opposition • Challenges while falling asleep and condensed sleep length	[20]
Infants benefit from using touch screen	Belief that early encounter with touch screen devices often boosts fine motor skill advancement	• Experiencing "video deficit"- difficulties transforming from 2D to 3D objects • Troubled kindergarten motor competences	• Disruption of mental flexibility capabilities • Higher Body Mass Index (BMI)	[10,23,26]
Indication of status	Societal pressure to endlessly retain one's status and purchase latest media related screen gadgets	• Delayed motor skill, cognitive, and verbal advancement	• Limited opportunities for active and outdoor play • Tendency towards sedentary lifestyle	[2]
Underestimation of media consumption	Recognizing that average media viewing is always higher than their own children's viewing length.	• Physical changes to brain • Challenges in information handling	• Agitated behavioral change. • Higher incidence of obesity • Reduced sleep duration	[27]
Unconsciousness on existing recommendations	Minor proportion of parents are alert about existing screen time rules for infants, intensified by a delusion that the guidelines are only concerned about incorporating physical activities, without identifying above-mentioned fundamental aspects supporting the guidance.	• Disproportionate relation with attaining cognitive indicators. • Possibilities of hyper-activeness or inattention	• Health hazards later in life • Disrupted sleep and eating routine	[2,6]

Research indicates that a significant number of parents use digital devices alongside their children due to a plethora of reasons, including their personal screen addiction or out of fear that their offspring might fall behind academically. Parents' perspective on these devices, resulting from various environmental, societal, and familial factors, contrast extensively: some parents are overprotective against the outside world and would prefer their children spend time indoors and be safe, some think of it as a tool of education and progress in life and believe without enough screen media literacy, children might fall behind other children. Some parents just use it as a method of distraction, a medium to avoid conflict or to induce sleep in children. Some of them even provide their children with the newest and latest devices as a means of preserving social standing due to the notion of these devices as status symbols. However, some parents underestimate their children's screen time altogether, while some are ignorant of the standards or recommendations and do not recognize the problem at all. Nevertheless, the adverse consequences of these parental strategies can be severe, leading to mood changes, sleep problems, mental and physical changes, and even health problems. Such reliance on screen devices

has standardized its presence in regular life, suggesting parents that screen usage is a harmless and an obligated aspect of progressive upbringing. This belief, paired with convincing marketing campaigns staging educational values, often serves to further conceal the potential cognitive challenges associated with device usage.[25] It is hence crucial to figure out how parents comprehend the exploitation of screen technologies for their children's education, as their observations may significantly distress both the quantity and quality of screen devices available to their young ones.

3.2 Positive Strategies for Reducing Excessive Screen Time in Children (RQ2)

The ubiquitous existence of screen media within home environments has become an ingrained element in the lives of infants and toddlers [28]. Among this significant demographic, almost 72% of children between 0-8 years of age and 38% of children under two years old have admittance to some form of modern devices such as smartphone, video iPod, iPad, or tablet device.[29,30] Even though there exists a plethora of studies highlighting the possible short-term complications during infancy and persistent long-term ramifications in the following developmental phases, such devices remain unavoidable in the modern world due to their proficiency in captivating the minds of offsprings . [21] After comprehensively acknowledging all the repercussions, respective policy-formulating authorities, such as American Academy of Pediatrics (AAP), the US Department of Health and Human Services, the Australian Department of Health and Ageing as well as the Canadian Pediatric Society now advise reducing screen time as one of the key urgencies by completely discouraging media use on infants and toddlers below the age of 2 years old, and implementing rigorous restrictions for children and adolescents aged 2 to 18 years.[20] Figure 3 illustrates the advised duration of screen time and other supporting endeavors for children defined by AAP to facilitate constructive media exercise while cultivating healthy behaviors, such as adequate sleep, outside play, and consistent physical activity.

GUIDELINES BY AAP ON SCREEN DEVICE USAGE, SLEEP DURATION AND FUNDAMENTAL PHYSICAL ACTIVITY DURATION BASED ON CHILDREN'S RESPECTIVE AGE GROUP TO:

- address what type of media and how much screen time is appropriate for each child.
- promote a child's cognitive, physical and mental health
- cultivate healthy lifestyle

AGE GROUP	RECOMMENDED SCREEN TIME	DURATION FOR OUTDOOR ACTIVITY	TOTAL AMOUNT OF SLEEP
0-12 Months	No Screen Media	Not Satisfactory	12-16 h/day
12-24 Months	Minimum screen participation in the presence of a parent	Not Satisfactory	11-15 h/day
2-5 years	At most 1h/day, only for consumption of high-quality content	0.5-1 h/day	10-14 h/day
6-12 years	No more than 1h/day closely supervised at all times	1h/day	9-12 h/day
13-18 years	Maximum 2h/day with limitations on content	1h/day	8-10 h/day

Figure 3: The advised total amount of screen time, physical/outside activity, and sleep for discrete age groups of children[15,22]

Parent and child's screen observing levels are greatly interrelated. Children under the age of 2 years old have very limited power over their adjacent surroundings and their actions are merely a replication of what their parents do around them. There is ample amount of evidence representing that the occurrence of extreme screen media viewing in a family is associated with toddler's own screen viewing practices.[22] Findings reveal that if parents engage in more than 4 hours a day TV watching, their toddlers will be three times more likely to exceed the same duration too.[31] Thus, parents of infants of this specific age bracket need to limit their own usage of digital devices as this is the chief contributor to infants' interest in the usage of screen media. Along with parents, childcare providers, precisely pediatricians play a fundamental role in reassuring a well-adjusted approach and educate parents on healthy media habits by persistently supervising parental obedience to the established guidelines during scheduled appointments, guaranteeing their proper enactment in households, and efficiently moderating undesirable outcomes allied with inapt screen utilization. Therefore, intervention strategies for the long-term betterment of young toddlers are imperative. As evident, such intervention strategies largely entail actions taken by parents, childcare providers, as well as pediatricians due to each of them having their unique role in the infant's well-being. Given the incursion of modernization in home environments, the following intervention strategies demonstrated in table 2 provide directions that are ideal from a family perspective, and it is imperative to inaugurate such principles as a reference point for forthcoming actions.

Table 02: Summary of the intervention approaches and their anticipated outcome

Target contributor	Recommended intervention strategies	Clarification	Expected Outcome	Ref
Parents	Restriction over child consumption	Consistently control screen time length through the day, avert using any screen device during meals or sleep time and turn off any device while not in use.	• Promote healthy eating behaviors. • Improved language acquisition • Better value and quality of life	[13,21]
	Limiting parental usage	Formulate home-based regulations regarding screen media turn off time for parents themselves.	• Beneficial to significantly reduce screen time of their children. • Increased scope for practicing parent-child connectivity	[5,15,32]
	Co-viewing	Co-viewing with a parent to encourage viewing high quality media content, supervise what their children see and hear, enhance the educational experience.	• Enhance cognitive development advantages. • Parent-child interaction • Ampler vocabulary possession during infancy	[7,15,21,27]
	Quality over quantity	Promote particularly made educational media content which uses schemes to assist language training, contains naive story structures and allows scopes for child to reply.	• Higher communication skills • Increase in prosocial behavior. • Expand visual concentration abilities. • Positive racial outlook	[7,13,21,23,26]
	Child-directed and age-appropriate media content	Shows that mainly aid infants to better grip ideas containing longer displays to target stimuli, using typical characters, providing narration hints, labelling, and leading infant mind to more valuable information	• Facilitate infants understanding. • Overcome “video deficit”. • Learn during screen media engagement. • Higher school readiness	[10,15,19,26]
	Promote healthy lifestyle.	Include outdoor or physical activity, imaginative play, accurate sleep cycle, and a nutritious diet	• Can promote locomotive skills, address childhood obesity, and improve metabolic health. • Influence in collective adaptive skills	[33]
Pediatricians	Encourage parents to set age-appropriate “media limits”	Screen media restrictions for children under 2 years old should be reviewed at scheduled visits.	• Foster balance at an initial stage	[20]
	Encourage supervised independent play	Inform parents about independent play during hours when they cannot participate in playing with the child.	• Build perseverance and problem-solving expertise while remaining under surveillance	[20,34]
	Explain magnitude of “unplugged play”	Encourage parents to engage children in performing activities that interest them	• Allows a child’s mind to expand, solve problems, think productively, and widen analyzing abilities.	[5]

3.3 Constructing a holistic strategy: A passageway to augment young children’s cognitive acceleration (RQ3)

Parents of the 21st century are facing an unprecedented number of challenges. In the fast-paced world of today, every individual is accountable for multifaceted responsibilities, which is why parents have to juggle between work, household chores, parenting, and social obligations, among other things. As parenting can no longer be the sole duty of any single individual parent, they have to resort to available options to keep their toddlers and infants occupied. By far the most convenient solution in this regard is screen media due to their effectiveness in establishing the aim and their ubiquitous presence. Parenting activities and patterns play an essential role in screen media engagement among infants due to the infants’ reliance on their parents for engagement with screen media in contrast to older children who can independently make their own choice about their regular activities.[12] Therefore, exercising composed, understanding, collaborative, and engaging parental behaviors can successfully reverse the prospective detrimental impact of excessive screen time on

infants' and younger toddlers' complete development.[35] For instance, many studies have confirmed that from the stage of 6 months of age, the presence of a parent who actively participates and delivers statements on the viewed content has an affirmative influence on the infant's attention span.[26] However, due to the challenges of today's world quality communications with their offspring has become inadequate, and thus causing damaging outcomes on their developmental curve. Even though studies have presented policies to prompt a more participating home environment, these time-restrained parents face tight spots to implement those policies. In light of the perceptions gathered from our investigation into RQ1 and RQ2, we propose the advancement of a mHealth tool as a credible solution. The justification is unpretentious- Digital devices have become integrated with our daily lives irrespective of our perspective of this. Therefore, it is a wise decision to capitalize on the problem to create the solution. Such a tool would be befitting to address the challenges fortified by unwarranted technology consumption, as high-tech devices are a prevalent aspect that is already accessible to every parent. We believe that a mHealth app will retain the intelligence to supervise the micro-digital ecosystem accurately and carefully within a household. The solution is simple, efficient, cost-effective, inclusive, and accessible. In outlining the direction for the evolution of this application, we believe four pivotal elements along with their salient features, illustrated in Table 3, as unconditionally principal: (i) Infants and toddlers screen time tracking and monitoring: so that parents can receive feedback and adjust their strategy to regulate the child's screen time, (ii) Provision of parental training and guidelines: a wealth of resource for the parents to teach their child and also learn helpful information to manage their infants screen time, (iii) Alternative activity advocator: a feature to recommend non-screen activity suggestions unique to each child's preference, finally (iv) interactive artificial intelligence: platform for parents to receive immediate assistance (Figure 4).

Figure 4: Prototype of an mHealth application, with its monitoring functionalities

Overview of the key features:

Screen Time Tracking and Monitoring: A feature with the ability to demonstrate detailed insights into daily data usage across multiple devices. The tracking mechanism is crucial as it provides feedback as well as important insights about usage patterns which can be achieved by utilizing parental control APIs that monitor and record screen time along with Xamarin or React Native that can be used for shared codebases. The screen time goals and alerts feature can advise parents with notifications or warnings when screen time limits come nearer or are surpassed. The Screen Time API and the UsageStatsManager API both can be utilized for iOS and Android respectively. Furthermore, the Digital Reward System will motivate the user to adhere to screen time limits and rules by the use of a tangible reward system which can be implemented through a gamification framework and can be tied to databases to track the progress. The features can be synced across devices using cloud services like Firebase or AWS.

Parental Training and Guidelines: An educational reservoir can assist the parents to gain knowledge, so that they don't feel clueless, especially the young and first-time parents. The function can impart feasible resources such as articles, videos, or infographics to enlighten parents about the potential influences of extreme screen time and policies for controlling it. The feature of the educational reservoir can be achieved using a headless content management system that manages and serves the content dynamically, even real-time updates can be obtained using services like Contentful or Strapi. The platform can be made to integrate the feature of Linking parents with authorized child psychology or pediatrics experts through audio/video calls for personalized guidance on screen time management, this feature can be realized by a booking system and using a secure calling feature using Twilio API. It is also possible to create interactive tutorials using libraries like Intro.js and tie it to the device setting API to configure a Night mode that offers stepwise

directions on applying tools such as flux that can lower blue light revelation during nighttime gadget usage. Lastly, the creation of a community forum, Virtual platform, can aid parents to exchange tips, share experiences, and obtain advice from other parents on controlling their child's screen time. The front end and backend of this aspect can be developed using React.js and Node.js, ensuring proper authentication and moderation features, essential for this service to operate.

Alternative Activity Advocator: This feature can actively support to lessen the dependence on screen media for children. The relevant sub-sections falling within this section can include shared family activities: which proposes productive and tailor-made ideas for involving family activities to promote parent-child bonding and encourage non-screen interaction., and provision of digital and audiobooks which delivers an assorted library of digital and audiobooks appropriate for a child's relevance, age, and reading intensity. Decision tree algorithm or machine learning model could be utilized, powered through data collected via in-app surveys and stored in a NoSQL database like MongoDB for flexibility to achieve such unique offerings. Recommendation algorithms can be implemented using Python's scikit-learn or similar libraries.

Interactive AI: An advanced attribute attainable by harnessing the power of AI (Artificial Intelligence). The AI assistant tool can be developed by leveraging NLP libraries like NLTK or spaCy in Python and integrating with a chatbot framework such as Rasa or Microsoft Bot Framework. The assistant should ideally be competent in considering multifaceted parental anxieties and propose tailored counsel accordingly on administering screen time and minimizing its impact on children's intellectual development. The non-screen activity plan (indoor and outdoor activities, crafts, exercises, etc.) can also be accomplished by employing advanced data and probabilistic programming to construct the most fitted and personalized activities based on a child's inclinations and habits by implementing machine learning with TensorFlow or PyTorch that can analyze user data and finally, use A/B testing to refine the algorithms based on user feedback. This feature will provide an advanced, understandable, and available means for parents to receive instantaneous assistance.

Table 03: Outline and assessment of distinctive attributes

Key Feature	**Salient offerings**	**Expected outcome**
Screen Time Tracking and Monitoring	Screen Time Tracker	Promote a sensible digital lifestyle and grant parents to make informed choices.
	Screen Time Goals and Alerts	Empower parents to establish a controlled setting by setting and enforcing screen time limits and lowering excessive usage.
	Digital Reward System	Practice self-control and time management expertise in children from an earlier phase.
Parental Training and Guidelines	Educational Reservoir	Cultivate a well-informed and inspired child-raising approach.
	Expert Consultation	Boost parental proficiency in managing screen time for their children.
	Night Mode Awareness	Inform parents about the repercussions of blue light on a child's sleep cycle and overall welfare.
	Community Forum	Stimulate a perception of cohesion and united development amid concerned parents.
Alternative Activity Advocator	Shared family activities	Foster stronger parent-child relationships.
	Provision of Digital and Audiobooks	Elate children's vocabulary, cognitive capacities and vision while developing a fondness for reading, urging them to opt for an instructive option over needless screen usage.
	Feedback and Ratings	Constant modification of activity references that augments user commitment and matches distinctive requirements.
Interactive AI	Parental Advisory AI Assistant	Provide an advanced, understandable, and available means for parents to receive instantaneous assistance.
	Personalized Suggestions	Cultivate holistic child development through engaging activities, diminishing screen time dependence.

All in all, the mHealth solution is poised to becoming a one stop solution for all the problems that parents face regarding excessive screen time of children, by leveraging the cutting-edge technology of Information Technology, Machine

Learning and Artificial Intelligence. The comprehensive framework, easy-to-understand UI, screen time monitoring, an exclusive knowledge hub on parenting instructions, and the interactive AI assistant are some of the outstanding and exclusive features that may be embedded during the initial development phase of this platform.

4. Discussion

Principal Findings

The findings of the study are in agreement with the hypothesis that screen media has been adversely affecting the development of young toddlers and infants and the effects have been identified to put things into perspective. Irrespective of the parents' reasoning behind exposing their children to screen media, the results of excessive usage are severe, even grim. The myriad of effects include lack of attention to current activity, aggression, tendency towards a sedentary lifestyle leading to higher BMI and obesity, opposition to bedtime, reduced quality of sleep, disrupted mental capabilities and flexibility, reduced social exposure, so on. The effects can result in social anxiety and ineptness, limited cognitive and psychological development and many health hazards manifesting later in life. Therefore, the consequences are far more serious than we would like to believe. The dire consequences of excessive screen time usage are beyond doubt, so we moved on to find the root of the problem. We found out that parents' own patterns of screen media use, their attitudes towards technology, whether it is a means of protection against the outside world or is a peacekeeper, or generally wanting to get their children apt in the latest technology, and societal factors like being a status symbol, or just to have the image of being a good parent- all these aspects play a vital role for a parent in handing their child a piece of screen media. These, along with unawareness of the dangers of digital devices on infants, lead to the children having unhealthy screen media habits. It is undeniable that this integration will be further strengthened with time, fortifying the necessity for a proper strategy to manage these devices especially in the case of infants and toddlers. It is important that time spent on digital devices is not abused, in fact used for the mental and physical well-being of children. Hence, intervention from parents to tackle this seemingly innocuous habit must be undertaken.

Consequently, some major intervention strategies have been identified in this paper including restriction over child consumption, limiting parenting usage, and co-viewing as they promote the development of healthy personal and social behaviors,[13,21] and increase the connectivity between parent and child .[15,32] Simultaneously, these home-based interference activities ensure improved language acquisition, communication skills, and cognitive development.[7,15,21,27] More hands-on strategies like quality regulation of content for the delivery of age-appropriate and child-directed content are also necessary, as children lack the decision-making abilities of what content to watch and are influenced the most via the content they consume, therefore, these strategies are imperative for a positive viewing and learning experience for our younger generation.[10,15,19,23,26] Pediatricians must also play their role as part of their duty to suggest parents the best course of action for their children. In this regard, they should encourage parents to set age-appropriate media limits and also suggest supervised independent playing corresponding to their interest, helping the children develop a sense of perseverance, build up their problem-solving skills, allow their minds to expand, widen their analyzing abilities, and make them excited for the outside world .[5,20,34]

As stated before, technology has become entrenched in our lives and it is only going to become a firmer aspect in the future, therefore, the challenges related to technology must be solved by leveraging technology itself. Therefore, we proposed a mHealth tool to address the screen time problem amongst children and will make the job of supervising screen media expenditure easier for the busy parents of today's world. We take the path of minimum resistance by considering parents' worries, child's liking and affinities, and propose customized solutions for the problems, which is practical and empathetic. Vital features that are proposed for the tool are firstly, screen time tracking and monitoring, which provides insights about the duration a child is on screen and provides digital rewards or screen time alerts and goals, leading to making informed choices about their children's screen time and promoting a sensible digital lifestyle. Another empathetic aspect of this app is the proposed parental guidance and training, which will not only teach the parents about the harmful ramifications of unnecessary screen time, but also explain how to prevent them. The reservoir will come in handy for the parents as they will feel much more confident in their ability to manage their children's use of digital devices. Furthermore, the activity advocator will suggest non-screen real-life activities tailored to the preferences of children, eventually strengthening the bond between child and parent. Finally, the personalized AI assistant would serve as a vigilant associate to parents, helping them to figure out unique solutions and diminishing screen dependence.

Limitations

The digital landscape is complex and continuously evolving, making it difficult for anyone to keep track of. Hence everyone should have a resource of guidance to be able to navigate this complex world of technology. The proposed tool can be the guardian angel in the context of parenting. For a continuously evolving problem, the solution should be one that can adapt to any new challenge presented to it, so the proposed tool should be in the process of updating continuously. With the help of established Information Technology along with technology of the new era such as AI and Machine Learning, it is possible to overcome any shortcomings. Therefore, the application can, for example, provide parents with more nuanced control over content and usage time. There is a necessity for longitudinal research into this to recognize the long-term effects of screen media usage on children's physical, mental, and social well-being, and how the

tool is beneficial in shaping a healthier digital lifestyle. These studies can help identify patterns and outcomes that may be ambiguous in short-term studies, providing profound insights into how screen time affects holistic development over time and how well it can be managed. In the long run, we believe this tool could become a reliable and valuable means for parents to create healthier habits for their beloved children.

5. Conclusion

This paper highlights the challenges faced by the stressed-out parents of the 21st century, who have to deal with the constant pressure of the rapidly evolving digital landscape and contemporary parenting. It emphasizes the lack of awareness of the detrimental consequences of screen media among parents on their infants and further demonstrates that this issue is becoming increasingly complicated, underscoring a significant research gap on how to efficiently manage children's device consumption. The paper highlights the urgent need to address and regulate screen time for infants and calls for a holistic approach that considers parental education, technological intervention and societal factors in promoting healthy screen habits. Subsequently, the paper proposes a straightforward mHealth application that leverages the same technologies it seeks to control, creating an overarching platform where parents can learn more about methods to manage screen time, track and monitor screen media use, advocate for offline activities. The tool has the potential to become an alert associate in helping parents tackle the aforementioned problems, offering immense assistance. The ultimate beneficiaries of this solution are, however, the children who stand to gain a massive enhancement in their cognitive and psychological development through the use of this tool. Finally, the paper highlights the importance of ongoing research and development to acknowledge the longitudinal effects of the proposed solution. In conclusion, an mHealth application could be a groundbreaking method that ensures children can harness technology for their own growth and well-being in the digital age.

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