Associations Between Parenting, Media Use, Cumulative Risk, and Children's Executive Functioning

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ABSTRACT: ***Objective:*** **This study was designed to examine how parenting style, media exposure, and cumulative risk were associated with executive functioning (EF) during early childhood.** ***Methods:*** **A nationally representative group of US parents/caregivers (N = 1156) with 1 child between 2 and 8 years participated in a telephone survey. Parents were asked to report on their child's exposure to television, music, and book reading through a 24-hour time diary. Parents also reported a host of demographic and parenting variables as well as questions on their child's EF.** ***Results:*** **Separate multiple regressions for preschool (2–5 years) and school-aged (6–8 years) children grouped by cumulative risk were conducted. Parenting style moderated the risks of exposure to background television on EF for high-risk preschool-age children. Educational TV exposure served as a buffer for high-risk school-aged children. Cumulative risk, age, and parenting quality interacted with a number of the exposure effects.** ***Conclusions:*** **The study showed a complex pattern of associations between cumulative risk, parenting, and media exposure with EF during early childhood. Consistent with the American Academy of Pediatrics, these findings support the recommendation that background television should be turned off when a child is in the room and suggest that exposure to high-quality content across multiple media platforms may be beneficial.**

*(J Dev Behav Pediatr 35:*367–377, 2014) **Index terms:** media usage, parenting style, cumulative risk, proximal and distal context, executive functioning, early childhood.

A number of academic and social outcomes have been causally and correlationally linked to constellations of factors that either elevate or alleviate children's risk of poor developmental outcomes.[1,2] These factors fall on a continuum of distance to the child from proximal processes linked to parenting and direct exposure to television (TV) content to more distal factors associated with the demographic characteristics of the child and family environments. One essential developmental outcome that undergirds both academic and social success is executive function.[3] Executive function skills are crucial to goal-directed and problem-solving behavior and are comprised of 3 components: working memory, inhibitory control, and attention flexibility.[4] The purpose of this article is to examine whether and how proximal factors, including parenting and media exposure, and distal factors associated with a constellation of demographic factors are associated with the executive function of young children. In addition to these proximal and distal factors, there is also some precedent to expect differing patterns by age; specifically, differences between preschool-age children (i.e., 2–5 years) and school-age children (i.e., 6–8 years). First, executive function undergoes a period of rapid development during the preschool years[5] that sets the foundation for the development of both cognitive and social capacities. By age 5 years, foundational capacities for directing attention, keeping rules in mind, controlling impulses, and enacting plans are in place. The subsequent developmental tasks of refining and learning to efficiently deploy them proceeds into adolescence and early adulthood.[5] There are also marked media usage differences between preschoolers and school agers due to 2 factors: (1) the opportunity to view or use media and (2) the available content for each age group. As children enter formal schooling, their exposure to background TV declines from 3.88 hours in preschool to 2.70 hours, whereas their foreground TV exposure increases slightly from 1.78 hours in preschool to 1.97 hours.[6] Finally, there are also different expectancies and experiences that can shape children's everyday lives in ways that benefit or exacerbate executive functioning. Specifically, in formal schooling, there is more time spent in group settings and greater demands associated with schoolwork. If delays or deficits in executive function exist, these deficits will impede academic development.[4,5]

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Proximal Factors: Parenting Style and Media Content

Differing parenting styles create different emotional climates in the home.[7] These proximal parental processes have been shown to mediate risk during early childhood[8]; however, more distal factors like school environment become stronger predictors of outcomes when children transition into formal schooling.[9] Multiple researchers have linked parenting processes to executive function outcomes[4,10–12] suggesting that the relations among early demographic risks and executive function may be transmitted through the quality of parent-child interactions and parenting style. Elevated levels of risk can reduce a parent's ability to provide high-quality parenting.[10] Two aspects of parenting that are especially influential on development include the degree of consistency in parenting and the level of warmth and responsiveness in a child's life.[13–15] Disorganized and unpredictable family environments with parents who inconsistently apply discipline and may or may not follow through with this disciplinary action disrupt executive function development.[3,4] Conversely, parents who are sensitive and responsive are more likely to create an emotionally interactive context that helps the child feel comfortable and subsequently promotes internalization and self-regulation.[13,14]

A second set of proximal factors linked to developmental outcomes arises from direct exposure to media. The majority of media exposure by children younger than 8 years is TV-based (i.e., 71%[6]), followed by book reading[16] and music.[17] Early TV studies examined estimates of children's total exposure to TV or availability of books in the household in conjunction with developmental outcomes (e.g., Refs. 16,18). As the field progressed, researchers studied the influence of different types of TV content (e.g., violent and educational).[19,20] This was not necessary for book reading because there were consistently positive associations between parental book reading during early childhood and school-readiness outcomes (e.g., Ref. 21). Associations with music exposure have not been well documented.[17] Researchers have further differentiated TV into foreground or background exposure.[6] Foreground TV is programming that is understandable to children and to which they pay high levels of attention, whereas background TV occurs when the TV is on in the immediate vicinity of the child, but he/she is participating in other activities.[6] Background TV is not typically child-directed, mostly incomprehensible, and garners little attention by children.[22] Foreground exposure directly influences outcomes in ways congruent with program content (e.g., educational predicts positive outcomes, entertainment predicts poorer outcomes[23]), whereas background TV is thought to disrupt cognitive processing indirectly through its creation of an unpredictable, disorganized, and stressful environment where a child's or a parent's attention is constantly recruited away from the task at hand[24]. Continual attention shifting is hypothesized to lead to more systemic difficulties in executive function. For children who reside in low-risk environments, exposure to higher levels of background TV during infancy and preschool was associated with poorer executive functioning, whereas exposure to child-directed educational content was unrelated to executive functioning skills at age 4 years.[25] Similarly, exposure to higher levels of violent content, which contain high levels of perceptually salient formal features, was associated with parental reports of attention problems in 7 year olds.[20]

In addition to these media-related direct effects, it is also probable that exposure is moderated by parenting. One study contrasting infant play and parent-child interactional patterns when a TV was either on or off in the background indicated that infant's play episodes were shorter and less focused,[26] and parent-infant interactions occurred less frequently and were of lower quality[27] when a TV was on. In contrast, studies with preschool-age children have focused on parental coviewing during child-directed programming and found that preschoolers' vocabulary development and comprehension did not increase with parental supervision (e.g., Ref. 28). Although studies have shown that parenting is associated with self-regulation (e.g., Ref. 12) and background TV exposure is associated with poorer executive functioning (e.g., Refs. 18,25), studies have not examined whether the associations among media exposure and child outcomes may be moderated by parenting styles. To address this point, in this study, we test whether exposure to different types of media content is moderated by parenting style.

Distal Factors: Cumulative Risk

Any theory that links proximal processes to outcomes is conceptually incomplete without considering the interrelated role of the more distal context in which children develop.[29] Distal demographic factors shape this contextual environment by exerting their influence along a continuum from factors that elevate the risk of poor outcomes to factors that support and even encourage positive outcomes. For instance, maternal education can be protective when mothers hold college degrees or a risk factor when mothers did not graduate from high school.[4] Although individual demographic characteristics influence development, the accumulation of multiple demographic risk factors has been linked to effects that are above and beyond those effects attributable to any one characteristic.[30] Children living in poverty are also more likely to have poorly educated mothers, live in single parent households, have larger families, have mothers who gave birth when teenagers, and be minorities. Research has established a link between adverse environmental contexts and poorer executive function (e.g., Refs. 31,32). We hypothesize that as the number of demographic risk factors increases, young children's executive function will decrease. In addition, some research suggests that parenting factors are differentially related to executive function depending on demographic factors. In one study of behavioral adjustment for children of low-income African-American

mothers, children whose mothers used a no-nonsense style of parenting with lower levels of warmth and high levels of consistency exhibited better behavioral adjustment.[33] We also hypothesize that parenting factors might differentially predict executive function for children depending on demographic risk factors.

Current Study

Given that the relationships between media usage patterns and parenting on executive function are expected to vary by child age and risk status, we will test associations between these variables separately by both age and risk. Specifically, using cross-sectional data from a representative sample of American families, we will test the following hypotheses in 4 separate models (Fig. 1 for a conceptual model; i.e., low-risk preschool, high-risk preschool, low-risk school age, and high-risk school age): H1a—As the degree of inconsistency in parenting increases, children's executive function will decrease; H1b—As the degree of warmth and responsiveness increases, children's executive function will increase; H2a—As exposure to foreground educational content, reading, and background TV content, executive function will increase; H2b—As exposure to background content or foreground inappropriate content increases, executive function will decrease; H3a—Parenting style will moderate the relation between exposure and executive function such that because children whose parents exhibit increased parental inconsistency are exposed to increasing high-quality content, executive function will be buffered; H3b—A warm and responsive parenting style will moderate the relation between exposure and executive function such that as children whose parents exhibit increased warmth are exposed to increasing high-quality content, executive function will be enhanced; H3c—Parenting style will moderate the relation between exposure and executive function such that as children whose parents exhibit increased parental inconsistency are exposed to increasing poor-quality content, executive function will decrease; and H3d—Parenting style will moderate the relation between exposure and executive function such that the expected negative relationship between negative media exposure and EF will be less pronounced for children whose parents more frequently engage in warm and responsive parenting.

METHODS

Participants

After receiving approval from the institutional review board, a private survey research firm administered the survey in English between January and March 2009. Participants were primary caregivers aged 18 years or older—788 had a child of 2 to 5 year olds (i.e., preschoolers; mean = 3 years, 10.2 months, SD = 14.32 months), 391 had a child of 6 to 8 year olds (i.e., school-aged children; mean = 6 years, 11.9 months, SD = 7.03 months). An additional 298 surveys were not included in the analysis because the target child was younger than 2 years of age, and executive functioning (EF) could not be collected for this age group.

Design

A rolling cross-sectional survey using a disproportionate stratified random digit dialing procedure was used.

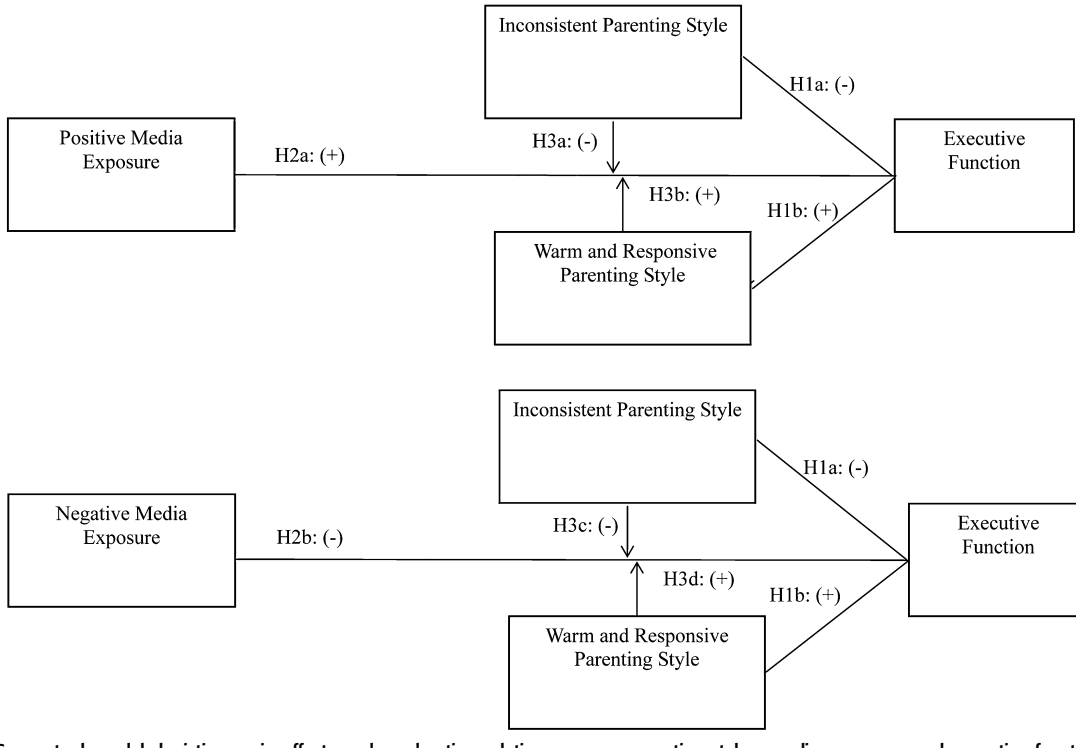

Figure 1. Conceptual model depicting main effects and moderating relations among parenting styles, media exposure, and executive function.

The response rate was similar to other nationally representative surveys that have been conducted with parents of young children—39.1% (e.g., 40%; see Ref. 6 for further details of survey implementation).

Survey data were weighted to adjust for the fact that not all survey respondents were selected with the same probability and to account for gaps in coverage and nonresponse biases in the survey frame. Design weights were used to compensate for the known biases from telephone interviewing in general and the unique sample design of the survey, specifically. The resulting design weights were poststratified along several dimensions obtained from the 2009 national estimates of the Census' American Community Survey.

Procedure

After eligibility screening and informed consent, parents completed the 50-minute survey that included household demographics questions, a 24-hour time use diary and an assessment of the child's EF skills. They were compensated $25 when using a landline (~96%) and $50 when using a cellphone. Cellphone participants received increased compensation because of the increased cost associated with cellphone minutes. There were no demographic differences noted between those contacted through landline and those contacted through cellphone.

Demographic Measures

Parents were asked a series of questions regarding child and family characteristics. See Table 1 for full descriptive statistics on all measures.

Cumulative Risk

After procedures outlined in Ref. 2, a cumulative risk index was created using 6 demographic variables. Risks were dichotomized: 0 indicates no risk present and 1 indicates 2 or more risks present. The following were considered at risk:

- Child's racial/ethnic background: Those who selected Latino/a, African-American, Hispanic, American-Indian, or other were coded as minority status.
- Children in the household: Families with 4 or more children in the home.
- Maternal age: Mothers younger than 18 years at the time of their child's birth.
- Maternal education less than a high school diploma.
- Single parent status as indicated when there was only 1 adult caregiver in the home.
- Socioeconomic status: Income-to-needs ratio was calculated based on 2009 federal poverty guidelines by asking parents their average household income and their family size (US Census Bureau, 2012). Ratios less than 2.0 are considered at risk.

Parenting Style

Based on Baumrind's conceptualization of parenting styles,[33] 3 subscales of the original 62-item questionnaire[34] were administered to all participants. For this article, parenting inconsistency (lack of follow-up), and degree of parental responsiveness subscales were used. Each was measured through 7 items (e.g., how often does parent find it difficult to discipline the child: $\alpha = .73$ inconsistency; $\alpha = .83$ responsiveness) using a 5-point Likert scale: 1 (never) to 5 (always). Higher scores reflect greater inconsistency and greater responsiveness.

Child Covariates

Three different covariates were used in all models. Both a child's birth order and participation in child care (for preschoolers) or grade in school (for school-age children) have been linked to differences in the amount and quality of media exposure[19,20,35] as well as to differences in executive function skills.[36] Research also indicates relationships among parenting quality, early language ability, and EF.[10] Consequently, birth order, participation in child care, and vocabulary knowledge were included in our models for preschool-age children, whereas birth order, grade in school, and early literacy skills were included in our models for school-age children.

Birth Order was reported by parents and included as a continuous covariate in all models. Birth order ranged from 0 (only child) to 9.

Child care participation was reported by parents for those children not yet in formal school. Parents were asked whether their child attended and, if yes, what type of setting was the care. Responses were coded into center-based care (37.3%) and in-home care (14.5%; could be care in a family day-care setting or by relatives in the child's home or in the relatives' home). Child's current grade was reported by parents whose children were in formal schooling.

Vocabulary skills for preschool-age children between 24 and 36 months were assessed by means of the MacArthur CDI III short form (MCDI), a 100-item vocabulary production checklist. The raw score was converted to a percentile rank that accounts for sex and age differences. Validity estimates for the CDI III have been calculated with the McCarthy Scales of Children's Ability (0.47–0.56); the Peabody Picture Vocabulary Test (0.41–0.49); and conversational language samples (0.26–0.42[37]). Caregivers of preschoolers between 37 and 71 months answered 10 questions adapted from the Assessment of Literacy and Language (ALL[38]) about their children's vocabulary knowledge, language complexity, and articulation ability. Exploratory factor analysis supported an 1-factor model for these variables, and an internal reliability estimate was adequate (Cronbach's alpha = .77).

Literacy Skills: Literacy skills for school-age children were measured through a series of parent-report questions about the child's phonological and phonemic awareness abilities, as well as, their early reading skills. Items were culled from the ALL[38] and the National Household Education survey.[39] Exploratory factor analysis supported an 1-factor model for these items and an

Table 1. Demographic, Cumulative Risk, Media Exposure, Parenting Style, and Executive Functioning Descriptives

	Preschool-age Children				School-age Children			
Variable	**All**	**Low Risk**	**High Risk**	***t*-Test (χ^2)**	**All**	**Low Risk**	**High Risk**	***t*-Test (χ^2)**
Sample size	788	486	302		391	266	125	
Demographics								
Age, mo	47.22	46.33	48.64	−0.14	83.61	83.89	83.14	1.66†
Gender (% boys)	53.9	51.9	56.9	−2.03	49.0	51.5	45.0	2.70†
Vocabulary (T score)	48.50	50.01	47.29	8.01***	—	—	—	
Literacy	—	—	—		24.46	24.92	23.69	2.60***
In-home child care, %	12.13	10.72	14.24	−2.17	—	—	—	
Center child care, %	40.86	44.78	35.00	20.00***	—	—	—	
Child grade (mean)					2.13	2.19	2.02	0.10
Cumulative risk	1.42	0.42	2.94	−41.87***	1.40	0.38	3.06	−31.09***
Child minority (yes), %	32.21	9.75	66.46	281.09***	25.79	8.81	62.71	123.97***
Mom age at birth (≤18 yr)	2.64%	0.42%	6.03%	23.37***	2.11%	0.77%	5.08%	7.33**
Single parent (yes), %	19.42	2.07	45.89	234.08***	16.05	3.83	43.22	93.36***
Mom's education (<HS), %	8.40	1.45	18.99	76.31***	6.84	1.15	19.49	42.79***
Income-to-needs (<2.00), %	37.84	11.83	77.53	350.31***	27.37	6.90	72.88	177.70***
More than 3 siblings (yes), %	15.41	7.26	27.85	62.04***	18.16	9.96	36.44	38.26***
Media exposure (hrs)								
Background TV	3.92	3.07	5.28	6.87***	2.90	2.51	3.74	−3.05**
Background music	2.76	2.72	2.83	0.46	2.41	2.33	2.59	0.79
Educational TV	0.48	0.59	0.33	0.57	0.20	0.16	0.26	−0.32
Noneducation Foreground	1.39	1.17	1.73	−4.72***	1.77	1.67	1.94	−1.18
Reading	0.38	0.45	0.28	3.63***	0.29	0.34	0.20	2.15*
Parenting style								
Inconsistent parenting	2.07	1.95	2.26	−7.08***	2.00	1.91	2.15	−4.33***
Responsive parenting	4.65	4.63	4.69	−2.11*	4.63	4.60	4.67	−2.07*
Outcome								
Executive function (T score)	50.20	48.88	52.73	5.45***	49.54	47.78	52.44	5.38***

Minority included all minorities (e.g., African-American, American-Indian, and Latino/a) except Asian-American. χ^2 was reported for all 0, 1 variables. *$p < .05$; **$p < .01$; ***$p < .001$; †$p < .10$. TV, television.

internal reliability estimate was adequate (Cronbach's alpha = .91).

Time Diary

A 24-hour time diary was designed to capture the duration of all of the target child's activities from the previous weekday or weekend day (or most recent typical day if previous day was atypical).[19,39]

Foreground television was operationalized as any TV-like content parents reported their child viewed including on-air television, movies, DVDs, or other TV-recorded content. Using a well-established protocol,[40] all titles were coded as child- and general audience-directed educational content, child-directed entertainment content (any child-directed content not meeting the criteria for an educational designation), or adult-directed content.[38] The kappa for overall interrater agreement equaled 0.75 (% agreement = 87.9%). Two foreground exposure variables were created: total hours spent viewing educational content (educational TV) and total hours spent viewing child-directed entertainment along with adult-directed content (noneducational foreground).

Background television was operationalized as the total number of hours spent in non–media-based activities where parents indicated that a television was on in the background.[6]

Background music was operationalized as the total number of hours spent in non–media-based activities where parents indicated that music was on in the background.

Book reading was operationalized as the total number of hours parents reported that the child read or was read to on a typical day.

Outcome Measure

Executive function was measured through 1 subscale of the widely used parent-report measure Behavior Assessment System for Children (BASC-2[41]), which has sound psychometric properties (internal consistency =

0.90–0.91; test-retest = 0.84), discriminates groups of children with preexisting clinical diagnoses,[42] and is considered an indicator of self-regulation (e.g., Ref. 43). Convergent validity has been established with The Achenbach System of Empirically Based Assessment (0.71–0.83); Conner's Rating Scales (0.51–0.78); and the Behavior Rating Inventory of Executive Function (0.83, global executive function composite). Validity correlations with direct assessments of children's sustained attention and inhibitory control are also adequate (−0.22 to −0.81[44]). Parents were asked questions about a child's ability to regulate behavior and cognition[41,42]; (e.g., how often does your child interrupt conversations) on a 4-point Likert scale 1 (*never*) to 4 (*almost always*). Two separate versions of the BASC-2 Executive Function Content Scale were administered to parents based on the target child's age: <6 years, the 13-item BASC-2 (PRS-P EF Content Scale) and >6 years, the 10-item BASC-2 (PRS-C EF Content Scale). Summed raw scores were converted to T scores (mean = 50, SD = 10) with higher scores indicating poorer EF; a T score of 60 to 69 is considered clinically at-risk for EF problems and ≥70 is associated with clinical symptomology.[44] In this sample, 9.3% of low-risk preschoolers (0.62% with scores ≥70); 20.5% of high-risk preschoolers (8.61% with scores ≥70); 9.5% of low-risk school agers (0.75% with scores ≥70); and 47.1% of high-risk school agers (8.0% with scores ≥70) were considered at risk for or with clinical symptomology for EF problems.

Analytic Approach

Multiple hierarchical linear regression models were computed within the survey module of STATA 12.0 to include the survey weight correction, thereby eliminating problems arising from incorrect standard error estimates (see[6] for details). Conceptual models (Fig. 1) were developed and tested for 4 groups of children based on substantive hypotheses regarding subgroup differences associated with risk status (high- or low-risk) and age (preschool or school age; Table 1).[2] High risk was operationalized as 2 or more cumulative risk factors.[2] Although models were split by low- and high-risk, when each model was run, the original continuous risk variable was used; therefore, in the low-risk models, risk was either 0 or 1, whereas in the high-risk models, risk ranged from 2 to 6. Separating the data by risk and age allowed us to test the 4 models based on a priori assumptions of age-related and risk-related differences in EF outcomes. Within each of these groups, main effect models were used to test hypotheses 1 and 2: the direct effects of parenting styles and exposure to different media content. Models containing interactions between parenting styles and media exposure variables were used to test hypothesis 3: the moderating role of parenting style on the associations between media exposure type and EF outcomes.

The selection of media exposure variables was undertaken in a parsimonious way to more clearly delineate the complex nature of exposure and any relations to parenting and EF. During model development, we used a Wald test to determine if exposure coefficients and interactions were significantly different than zero and examined whether the increase in r^2 associated with the exposure variable and its two 2-way interactions was significant (Table 2). Only significant findings related to exposure and interactions with parenting style are discussed in the results.

RESULTS

Hypothesis 1a: *As the degree of inconsistency in parenting increases, children's executive function will decrease*

As predicted, increasing parental inconsistency (low-risk preschool: B = 5.25, $p < .001$; high-risk preschool: B = 6.26, $p < .001$; low-risk school-age: B = 3.01; $p = .014$) was associated with poorer executive function for all preschoolers (low risk and high risk) and low-risk school agers. The association between inconsistency and executive functioning (EF) for high-risk school-age children was not significant.

Hypothesis 1b: *As the degree of warmth and responsiveness increases, children's executive function will increase*

As predicted, increasing parental warmth and responsiveness were associated with better executive function for low-risk preschoolers and low-risk school agers (low-risk preschool: B = −3.76, $p = .005$; low-risk school-age: B = −5.17; $p = .004$). The relations between warmth and responsiveness and EF for high-risk preschoolers and high-risk school-age children were not significant.

Hypothesis 2a: *As exposure to foreground educational content, reading, and background music increases, executive function will increase*

As predicted, low-risk preschoolers demonstrated increasing EF with increasing exposure to background music (B = −0.32, $p = .045$), whereas high-risk school agers demonstrated increasing EF with increasing exposure to foreground educational television (B = −5.96, $p < .001$). No other significant relations were noted among media hypothesized to be associated with better EF.

Hypothesis 2b: *As exposure to background TV content or foreground inappropriate tv content increases, executive function will decrease*

As predicted, high-risk preschoolers and low-risk school agers demonstrated decreasing EF with increasing exposure to background TV (high-risk preschool: B = 0.59, $p = .003$; low-risk school-age: B = 0.37, $p = .014$). Contrary to predictions, low-risk preschoolers demonstrated increasing EF with increasing exposure to foreground inappropriate TV (B = −0.79, $p = .021$).

Table 2. Multivariate Regressions Associated with Executive Function Outcome Separated by Risk Profile and Age

	Low-risk Preschool-age Children (n = 486)									
	Main Effects Model					Interactions Model				
				95th Percentile					95th Percentile	
Variable	ΔR^2	B	β	Low	High	ΔR^2	B	β	Low	High
Demographics	.053**									
Birth order		0.22**	.09	0.06	0.37		0.21**	.09	0.07	0.34
In-home care		0.04	.00	−2.88	2.95		0.67	.02	−2.20	3.54
Center care		0.16	.01	−2.10	2.42		−0.08	−.00	−2.43	2.28
Language		−0.13*	−.14	−0.24	−0.02		−0.11	−.12	−0.23	0.01
Risk		−1.30	−.07	−3.58	0.98		−1.19	−.07	−3.51	1.13
Parenting style	.113***									
Responsive (R)		−3.76**	−.19	−6.39	−1.12		−4.81***		−7.24	−2.37
Inconsistent (I)		5.25***	.31	2.88	7.62		5.24***		2.98	7.51
Exposure, hrs	.032**									
Background TV (BTV)		—		—	—		—		—	—
Background music (BM)		−0.32*	−.12	−0.63	−0.01		−0.34*		−0.64	−0.05
Foreground inappropriate (Fin)		−0.79*	−.14	−1.45	−0.12		−0.25		−1.28	0.79
Foreground Educational (Fed)		—		—	—		—		—	—
Reading (READ)		—		—	—		—		—	—
Interactions						.024**				
BM × R		—		—	—		−0.69†	−.11	−1.40	0.02
BM × I		—		—	—		0.03	.01	−0.58	0.64
Fin × R		—		—	—		0.77	.14	−0.19	1.74
Fin × I		—		—	—		0.03	.003	−1.06	1.11
Total r^2	.198***					.222***				

	High-risk Preschool-age Children (n = 302)									
	Main Effects Model					Interactions Model				
				95th Percentile					95th Percentile	
Variable	ΔR^2	B	β	Low	High	ΔR^2	B	β	Low	High
Demographics	.044									
Birth order		−0.03	−.03	−0.29	0.23		−0.03	−.01	−0.29	0.23
In home care		−2.98	−.09	−8.18	2.21		0.32	−.09	−1.30	1.95
Center care		−1.15	−.05	−5.46	3.17		−1.17	−.05	−5.49	3.14
Language		−0.11	−.10	−0.11	0.09		−0.11	−.10	−0.28	0.06
Risk		0.31	.03	0.31	0.79		0.32	.03	−1.30	1.95
Parenting style	.191***									
Responsive (R)		0.65	.02	−3.18	4.47		0.73	.02	−3.07	4.52
Inconsistent (I)		6.26***	.40	4.03	8.48		6.28***	.40	3.79	8.76
Exposure (hrs)	.062**									
Background TV (BTV)		0.59**	.26	0.21	0.97		0.58**	.25	0.21	0.95
Background music (BM)		—		—	—		—		—	—
Foreground inappropriate (Fin)		—		—	—		—		—	—
Foreground educational (Fed)		—		—	—		—		—	—
Reading (READ)		—		—	—		—		—	—
Interactions						.002				

(*Table continues*)

Table 2. Continued

	High-risk Preschool-age Children (n = 302)									
	Main Effects Model					Interactions Model				
				95th Percentile					95th Percentile	
Variable	ΔR^2	B	β	Low	High	ΔR^2	B	β	Low	High
BTV × R		—		—	—		0.08	.01	−0.51	0.67
BTV × I		—		—	—		0.02	.01	−0.56	0.59
Total r^2	.297***					.297***				

	Low-Risk School-Age Children (n = 266)									
	Main Effects Model					Interactions Model				
				95th Percentile					95th Percentile	
Variable	ΔR^2	B	β	Low	High	ΔR^2	B	β	Low	High
Demographics	.088**									
Birth order		−1.01*	−.14	−1.81	−0.20		−1.14**	−.16	−1.96	−0.33
Grade		−0.34	−.04	−1.59	0.91		−0.19	−.02	−1.70	2.24
Literacy		−0.14	−.07	−0.41	0.14		−0.08	−.04	−0.36	0.19
Risk		0.17	.01	−1.81	2.16		0.27	.02	−1.70	2.24
Parenting style	.122***									
Responsive (R)		−5.17**	−.27	−8.70	−1.64		−5.23**	−.27	−8.51	−1.95
Inconsistent (I)		3.01**	.21	0.78	5.24		3.58***	.25	1.51	5.64
Exposure, hrs	.039**									
Background TV (BTV)		0.37*	.19	0.07	0.67		0.16	.09	−0.10	0.42
Background Music (BM)		—		—	—		—		—	—
Foreground inappropriate (Fin)		—		—	—		—		—	—
Foreground educational (Fed)		1.47†	.09	−0.28	3.21		1.08	.06	−0.58	2.74
Reading (READ)		—		—	—		—		—	—
Interactions						.032**				
BTV × R		—		—	—		−0.11	−.02	−0.87	0.66
BTV × I		—		—	—		0.83**	.21	0.26	1.40
Fed × R		—		—	—		−2.87	−.04	−10.47	4.73
Fed × I		—		—	—		−0.65	−.02	−3.87	2.58
Total r^2	.249***					.281***				

	High-risk School-age Children (n = 125)									
	Main Effects Model					Interactions Model				
				95th %					95th %	
Variable	ΔR^2	B	β	Low	High	ΔR^2	B	β	Low	High
Demographics	.161*									
Birth order		−0.69	−.11	−1.78	0.40		−0.68	−.10	−1.77	0.41
Grade		−1.92	−.12	−4.81	0.98		−1.99	−.12	−4.86	0.88
Literacy		−0.69*	−.24	−1.34	−0.03		−0.65†	−.22	−1.30	0.01
Risk		3.84***	.38	1.51	6.17		3.94***	.39	1.59	6.29
Parenting style	.072*									
Responsive (R)		−2.26	−.06	−9.92	5.39		−3.05	−.09	−10.62	4.51
Inconsistent (I)		3.04†	.20	−0.38	6.45		2.90	.19	−0.57	6.36

(*Table continues*)

Table 2. Continued

	High-risk School-age Children (n = 125)									
	Main Effects Model					Interactions Model				
				95th %					95th %	
Variable	ΔR^2	B	β	Low	High	ΔR^2	B	β	Low	High
Exposure, hrs	.114*									
Background TV (BTV)		—			—	—	—		—	—
Background music (BM)		—			—	—	—		—	—
Foreground inappropriate (Fin)		—			—	—	—		—	—
Foreground educational (Fed)		−5.96***	−.38	−9.07	−2.86		−2.86	−.18	−6.33	0.62
Reading (READ)		—			—	—	—		—	—
Interactions						.019				
Fed × R		—		—	—		−10.97**	−.21	−18.68	−3.27
Fed × I		—		—	—		−2.93	−.11	−7.20	1.34
Total r^2	.347***					.366***				

Rules of thumb for interpreting standardized (beta) regression coefficients by Cohen[52] are .10 = small; .30 = medium; and ≥.50 = large.

Hypothesis 3a: *Parenting style will moderate the relation between exposure and executive function such that the negative association between inconsistent parenting and poorer EF will be less pronounced for children who watch more high-quality media*

This hypothesis was rejected.

Hypothesis 3b: *A warm and responsive parenting style will moderate the relation between exposure and executive function such that as children whose parents exhibit increased warmth are exposed to increasing high-quality content, executive function will be enhanced*

This hypothesis was supported only for high-risk school-age children. As their educational TV exposure increased and their parents exhibited more responsiveness, these high-risk school-age children's EF increased (B = −10.97, p = .005).

Hypothesis 3c: *An inconsistent parenting style will moderate the relation between exposure and executive function such that as children whose parents exhibit increased parental inconsistency are exposed to increasing poor-quality content, executive function will be decreased*

This hypothesis was confirmed with low-risk school-aged children only. As low-risk school-age children's background TV exposure increased and their parents exhibited lower parental consistency, these low-risk school-age children's EF decreased (B = 0.83, p = .001).

Hypothesis 3d: *Parenting style will moderate the relation between exposure and executive function such that as children whose parents exhibit increased warmth are exposed to increasing poor-quality content, executive function will be buffered*

This hypothesis was rejected.

DISCUSSION

This study represents a departure from more monolithic approaches to media effects research by considering the ecological context of media exposure, including parenting styles and a constellation of demographic risk factors on executive functioning (EF). As predicted, parenting style was associated with EF, but differed as a function of risk profile. For children from low-risk homes, responsiveness was associated with increased EF and inconsistency with decreased EF but for children living in high-risk families, only inconsistency was strongly associated with EF. Overall, increasing levels of demographic risk were also associated with poorer EF for high-risk school-aged children but as predicted by cumulative risk models of development,[2,4] models separated by age and risk profile revealed a more nuanced view of the myriad relations among content, media platform, parenting styles, and demographic risk, as well as, different patterns of resource utilization.

Based on traditional media research, we predicted that positive media content like educational TV[19] and book reading[16] would be associated with positive child outcomes, whereas negative media content like adult-directed TV or child-inappropriate foreground TV[6,22] would be associated with poorer outcomes. For low-risk preschoolers, background music was associated with stronger EF, and for high-risk school-aged children, increased educational television exposure was associated with stronger EF. Conversely, increased background television was associated with weaker EF in both high-risk preschoolers and low-risk school-aged children. The relationship between child-inappropriate foreground TV and stronger EF for low-risk preschoolers is puzzling. For younger children, child-inappropriate content consisted mainly of narrative-based programs, like Sponge Bob. Although not coded as educational content in this study, research has linked viewing narrative-based content with

stronger literacy skills.[45] However, experimental research has linked short-term viewing of such programs to poorer EF.[46] Much research remains to be conducted to better understand this unexpected finding.

Educational TV exposure was positively associated with EF for high-risk school-age children who have substantially fewer resources in the home likely because this type of TV represents an unduplicated educational opportunity.[47] Parents of low-income school-age children describe their TV viewing habits with their children in ways remarkably similar to the book-reading routines of middle-income parents.[45] A high level of exposure to background TV for high-risk preschoolers is also consistent with a resource model. It is likely that the sheer exposure to a near constant state of noise in the home overwhelmed high-risk preschoolers' abilities to self-regulate and subsequently modulate responses to the constant presence of a TV. For older children, the volume of background TV exposure declined by 30%, perhaps allowing the buffering effect of educational TV found in this study to emerge.

We also extend previous studies and provide evidence in support of the hypothesis that media exposure associations with EF would be moderated by parenting style.[4,8,12,14] As described, greater levels of parental inconsistency were associated with poorer executive function. When inconsistency was coupled with high levels of exposure to background TV for school-age children in low-risk homes, inconsistency seemed to exacerbate the negative effects of background TV. Inconsistency is associated with weaker self-regulation more broadly.[48] In addition, these children are being constantly bombarded by the auditory stimuli generated by background TV while they are also simultaneously interacting less frequently with their parents[27,49] and, when they do, the interactions are of poorer quality.[27,49] This combination of poor parenting and poor-quality background noise may overwhelm their ability to develop strong self-regulation skills as suggested by their poorer EF scores. This is despite the fact that these children who live in low-risk homes are characterized by better educated parents, more economic resources, and more cognitively stimulating interactions and materials and have resources available to them.

However, viewing educational TV was associated with better EF scores for high-risk school-age children. The beta was larger when these parents also engaged in more responsive parenting. There is a large body of literature that demonstrates numerous educational and social benefits associated with viewing educational TV (for example, Ref. 35) and with children whose parents engage in more responsive parenting.[7] It is, therefore, not surprising that combining a positive and warm parenting climate with high-quality educational TV can further boost EF children in this population.

There are however limitations in the research design. Specifically, although measures used in this study were chosen based on their predictive value and robust associations with observational outcomes,[37,42,44] a significant limitation of our design was that there were no direct observations of parent-child interactions and measures of parenting, media exposure, cumulative risk, and EF outcome were based on 1 source of data, namely parent report collected by phone survey. In addition, measures used were screening measures that consisted of fewer items and lower validity estimates that likely introduce error into the results and underestimate the overall relations among key variables. In particular, the use of the Behavior Assessment System for Children (BASC-2) EF content subscale could affect interpretations of the findings. Based on the fact that a 10- to 13-item screening measure of EF was used, it is not possible to delineate associations between each of the 3 components of EF, namely working memory, inhibitory control, and attention flexibility, with cumulative risk, media exposure, and parenting factors. There are limitations of cross-sectional studies based on possible cohort effects, and longitudinal studies should also be conducted to test the predictive validity of the findings; but based on prior research,[50] we predict our cross-sectional model results will hold. Furthermore, although there are limitations of this correlational survey and additional experimental studies with stronger outcome measures including direct assessments are required to determine causality, the associations identified here warrant further scrutiny, particularly the positive association between educational television exposure and improved EF for high-risk schoolchildren given the easy access to this media type. This is clearly a direction for future research.

Overall, these results suggest that media exposure should be considered within the ecological context of the child. These findings are consistent with those that suggest very high levels of exposure to background TV are negatively associated with EF and exacerbated by conditions of cumulative risk and parenting style.[51] Consistent with the AAP,[1] these findings support the recommendation that background television should be turned off when a child is in the room. Exposure to high-quality TV content can be especially helpful for high-risk children, whereas traditional high-quality content found in music can be beneficial for low-risk children. Finally, parenting style plays a pivotal role in moderating the associated benefits of media exposure.

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