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The influence of television and video game use on attention and school problems: A multivariate analysis with other risk factors controlled

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ABSTRACT

Background: Research on youth mental health has increasingly indicated the importance of multivariate analyses of multiple risk factors for negative outcomes. Television and video game use have often been posited as potential contributors to attention problems, but previous studies have not always been well-controlled or used well-validated outcome measures. The current study examines the multivariate nature of risk factors for attention problems symptomatic of attention deficit hyperactivity disorder and poor school performance.

Method: A predominantly Hispanic population of 603 children (ages 10–14) and their parents/guardians responded to multiple behavioral measures. Outcome measures included parent and child reported attention problem behaviors on the Child Behavior Checklist (CBCL) as well as poor school performance as measured by grade point average (GPA).

Results: Results found that internal factors such as male gender, antisocial traits, family environment and anxiety best predicted attention problems. School performance was best predicted by family income. Television and video game use, whether total time spent using, or exposure to violent content specifically, did not predict attention problems or GPA.

Interpretation: Television and video game use do not appear to be significant predictors of childhood attention problems. Intervention and prevention efforts may be better spent on other risk factors.

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Attention problems are an issue of concern to medical professionals, psychologists and families, given the potential impact of such symptoms on school performance in children. A considerable consensus (Barkley et al., 2002) has been reached that clinically significant attention problems have a strong biological and genetic basis. Nonetheless, many researchers have sought to find social risk factors for attention problems, given the possibility that such risk factors may be particularly amenable to prevention and intervention efforts.

Recent research has focused on the potential impact of viewing television or playing video games on attention. Researchers have hypothesized that either the excitement of television, or the rapidly shifting focus of television may make children less tolerant of the comparatively laborious process of education in schools (Christakis et al., 2004; Anderson et al., 1977). However, this point has proved to be controversial as studies have found that television exposure does not predict attention problems (Anderson et al., 1977; Stevens and Mulsow, 2006; Obel et al., 2004), where as others have found

some evidence for this relationship (Swing et al., 2010; Mistry et al., 2007; Johnson et al., 2007). Evidence for video game effects has been perhaps even more inconsistent although some scholars have extended the “excitement” hypothesis of television effects to video games (Swing et al., 2010). Considerable evidence has emerged that playing action video games in particular may enhance cognition and attention (Spence and Feng, 2010; Dye et al., 2009) and that video games may present a potential intervention platform for children with cognitive disabilities (Durkin, 2010). Other research has suggested that the relationship between video game use and attention problems may be curvilinear (Tahiroglu et al., 2010) or weakly associated with decreased attention (Swing et al., 2010).

Several methodological issues have limited the validity of research on television and video game influences on attention problems. These issues include a reliance on poorly validated outcome measures related to attention problems, studies which do not adequately control for confounding variables, and inappropriate generalizations from one population to another (for instance college students to young children). For example in one recent study (Swing et al., 2010) attention symptoms were not measured by a well-validated clinical instrument such as the Child Behavior Checklist (CBCL; 13), but rather by an ad-hoc 3-item measure with

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no known validity. This study also failed to control for relevant family, social and intrapersonal factors that may explain any small but spurious media/attention link. Problems such as this are not limited to a single study. Issues related to measurement validity and use of proper statistical controls are of paramount importance to this research field. So too is consideration of the developmental stages of particular cohorts of children. Research which examines media influences in college students and other adults may have limited impact regarding potential influences on children. This is particularly true for studies which employ adult participants in contrived laboratory settings and use poorly validated measures as indicators of attention problems.

The current study examines the relationship between television and video game use on attention problems and school GPA, uses a well-validated clinical measure of attention problems. Furthermore, it controls for other relevant risk factors for attention problems, including gender (Rucklidge, 2010), family income (Nobile et al., 2010), neighborhood and peers (Kalyva, 2007; Beaver et al., 2008), family environment (Schroeder and Kelley, 2009; Biederman et al., 1995) and mental health problems including depression, anxiety and antisocial personality traits (Alqahtani, 2010; Mayes et al., 2009; Biederman et al., 2008). Data from the current study are drawn from the Laredo Youth Outcome Project, a study of risk factors for negative youth outcomes in a Hispanic majority sample (Ferguson et al., 2009). This study was primarily designed to examine the relative impact of social factors, including family, peers and media as well as mental health on youth violence. Results indicated that peers, as well as depression and antisocial traits were the best correlates of youth violence. The current examination of attention problems using this dataset has not been previously published.

1. Methods

1.1. Participants

Participants include 603 youth from a small city in South Texas (see Ferguson et al., 2009). Youth included in the present study ranged in age from 10–14, with a mean age of 12.35 ($SD = 1.34$). The majority of youth in the present study were Hispanic in ethnicity (96.8%). This sample was approximately equal in numbers of males ($n = 309, 51.2%$) and females ($n = 294, 48.8%$). The current sample is a general sample of youth, not an at-risk sample. In regards to ethnicity, income, country of birth and family composition, the sample was representative of the community from which they were drawn. Average family income is low for the national average but reflects the relatively high degree of poverty and transient status of man of the families in the city of origin. Demographic information is presented in Table 1.

Parental consent was obtained in all cases. Parents and children were each provided with separate survey packets which were returned in sealed envelopes to ensure confidentiality. Recruitment occurred through a “snowball” approach in which youth were nominated for inclusion by members of the community. Several avenues of recruitment were employed simultaneously, including

through undergraduate students at the local university, by employing newspaper and radio appeals for participation and by approaching community organizations. Multiple approaches were used to get the broadest and most representative sample possible. During recruitment the study was billed simply as a study of “youth health” and none of the study hypotheses were discussed, nor was the issue of media effects or attention problems mentioned. This approach is commonly used in studies of youth as it proves reasonably effective in returning a representative sample of youth, including youth who might otherwise be missed (e.g. school drop-outs), although of course the resulting sample remains non-random.

1.2. Predictor materials

With exceptions noted below, all materials used Likert-scale items and demonstrate psychometric properties suitable for use in multiple regressions.

1.2.1. Demographic variables

Several demographic variables were considered as potential risk factors for attention. These included male gender, number of children in the family and family income.

1.2.2. Negative life events

The Negative Life Events instrument (NLE, 24) includes the following scales used in this study:

- 1) *Neighborhood problems* (e.g., How much of a problem are each of the following in your neighborhood? Vandalism, traffic, burglaries, etc.; alpha in current sample = .87).
- 2) *Negative relations with adults* (e.g., My parents think I break rules, My parents think I get in trouble, etc.; alpha = .95)
- 3) *Antisocial personality* (e.g., It's important to be honest with your parents, even if they become upset or you get punished, To stay out of trouble, it is sometimes necessary to lie to teachers, etc.; alpha = .70)
- 4) *Family attachment* (e.g., On average, how many afternoons during the school week, from the end of school or work to dinner, have you spent talking, working, or playing with your family, etc.; alpha = .87)
- 5) *Delinquent peers* (e.g., How many of your close friends purposely damaged or destroyed property that did not belong to them, etc.; alpha = .84).

This measure tapped multiple constructs related to family, peer and school environment as well as antisocial behavior and beliefs. The NLE has been widely used, particularly in the criminal justice literature and has demonstrated good reliability and validity (Paternoster and Mazerolle, 1994). There are no item overlaps between subscales.

1.2.3. Family violence

The child's primary guardian was asked to fill out the Conflict Tactics Scale (CTS; Straus et al., 2003), a measure of positive and negative behaviors occurring in marital or dating relationships. The CTS has been shown to have good reliability and corresponds well to incidents of dating and family violence. It is used here to get a measure of conflict and aggression occurring between the primary caregiver and their spouse or romantic partners and thus a sense of the child's exposure to domestic violence. Subscales related to physical assaults (alpha = .88) and psychological aggression (alpha = .81) was used in the current study. The physical assaults subscale was found to have a significantly skewed distribution and

Table 1
Sample Demographics.

Gender	51.2% Male
Mean age	12.35 ($SD = 1.34$)
Hispanic ethnicity	96.8%
Child birthplace	92.5% United States 6.5% Mexico .5% Other
Mean household income	Approximately \$27,000

a square-root transformation was conducted to produce a normalized distribution.

1.2.4. Media use questionnaire

Child participants were asked to list their 3 favorite television shows and video games, rate how often they play or view the media and rate the media's violence level. Children also reported on their average weekly viewing time of television and video games, whether violent or not. This measure has demonstrated good reliability and validity in previous research (Ferguson et al., 2008). With the current study the video game violence portion demonstrate a coefficient alpha reliability of .83, and television violence demonstrated alpha of .71. Thus this measure includes estimates of total television and video game viewing time, as well as measures of television and video game violence exposure.

1.2.5. Depression and anxiety

The withdrawal/depression and anxious/depressed scales of the *Child Behavior Checklist Youth Self-Report* (Achenbach and Rescorla, 2001) indicated child depression and anxiety. These scales have no item overlaps with the attention problems scales described below. Coefficient alpha of the scales with our sample was .71 for withdrawal/depression and .81 for anxious/depressed.

1.3. Outcome materials

1.3.1. Attention problems

Regarding attention problems, youth and their primary caregivers filled out the *Child Behavior Checklist* (CBCL, 13). The CBCL consists of youth self-report, parent report, and teacher report on problematic behaviors which may represent psychopathology. The CBCL is a well researched and validated tool for measuring behavioral problems in children and adolescents. Caregivers filled out the parental version of the CBCL, whereas children filled out the *Youth Self-Report* on themselves. These indices were used to indicate outcomes related to clinically significant attention problems. Coefficient alpha for the child report was .82 and with the parent report .84.

1.3.2. GPA

Parents were asked to report on the GPA of their children based upon the most recent report card received from their school.

1.4. Statistical analyses

Main analyses consisted of hierarchical multiple regression equations. Separate hierarchical multiple regressions were run for each of the outcome measures related to attention problems (parent and child report) and GPA. In each case, gender was entered on the first step, number of children and family income entered on the second step, depression and anxiety entered on the third step, CTS psychological aggression and physical assault were entered on the fourth step, NLE variables (neighborhood, negative adult relationships, antisocial personality, family attachment and delinquent peers) were entered on the fifth step, and television and video game total use and television and video game violence exposure entered on the final step. Multicollinearity was examined using tolerance and VIF statistics and found to be acceptable in all cases. Highest VIF values were 2.1, and lowest tolerance values were .46, which fall within most recommended acceptable guidelines (Keith, 2006).

Follow up analyses employed path analyses in order to examine for potential indirect and interaction effects of media exposure through family income to examine for the possibility that media use may have differential effects for children of different income

levels. Interaction terms between media exposure variables and family income were constructed by centering the variables to avoid multicollinearity effects, then multiplying the terms. It should be noted that path analysis, in this case, uses correlational data and should not be used to imply causality. However this can be an important tool for testing the utility of competing models of behavior. Several indices of "good fit" such as the Normed Fit Index (NFI) Comparative Fit Index (CFI) or Root Mean Squared Error of Approximation (RMSEA) have been developed for testing path analyses. Theoretical models with NFI and CFI indices greater than .90 and RMSEA lower than .10 are considered good fits to the data. For the outcome, a combined attention problems variable was computed from the child and parent reports. Path analysis allows for testing a basic model developed from the regression outcomes against models which include both indirect and interaction media effects terms.

2. Results

Results for bivariate correlations between measures are presented in Table 2. Table 3 presents the standardized regression coefficients and 95% confidence intervals (for significant coefficients) for all variables in the three regression equations. For attention problems as reported by the child significant correlates included mental health problems such as depression ($\beta = .18$), anxiety ($\beta = .32$) and antisocial traits ($\beta = .17$), as well as negative relations with adults ($\beta = .14$) and association with delinquent peers ($\beta = .10$). For parent rated attention problems significant correlates included male gender ($\beta = .13$), anxiety ($\beta = .17$), family income ($\beta = -.12$) and psychological aggression in the family ($\beta = .25$). Physical aggression between the primary caregiver and their romantic partners was negatively related to reported attention problems in children in the household as rated by the parents (but not the child), although this relationship was weak ($\beta = -.13$). Analysis of GPA revealed a correlation with family income only ($\beta = .21$), where higher income was associated with higher GPA scores. In all cases neither total television nor video game viewing time, nor exposure specifically to violent on television or in video games correlated with negative outcomes related to attention problems or GPA.

In developing the path model, an initial model was tested using all statistically significant variables from the regression equation results. This model proved to be a poor fit to the data. Next all path coefficients which were trivial in size (i.e. standardized path coefficient less than .10) were trimmed. This removed several variables from the model, including family income. This trimmed model had an NFI of .96, CFI of .97 and RMSEA of .08, indicating a good fit to the data. This model is presented as Fig. 1.

Next, media effects (total television and video game use, video game and television violence exposure) interaction terms with family income were added to the trimmed model. Doing so returned a poor fit to the data. Adding interaction terms singularly to the trimmed model similarly did not improve the model. Finally media exposure terms and family income were placed in the trimmed model indicating an indirect effect for media exposure through family income. This, likewise proved to be a poor fit for the data. Thus, little evidence emerges from the current study for differential effects for media across income.

3. Discussion

Results from the current study suggest that attention problems are predicted most accurately by intrinsic factors such as anxiety, antisocial traits and male gender, as well as by delinquent peers and negative associations with adults. Anxiety symptoms, in fact,

Table 2
Bivariate Correlations Between Measures.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1) Gender	1.00	.02	.03	.06	.09*	.09*	.05	-.08	-.01	-.08*	.06	.00	-.03	-.25**	-.19**	-.47**	-.04	-.09*	.09*
2) # Children		1.00	-.01	.02	-.02	-.04	-.02	.01	.05	.03	.00	.03	-.04	-.04	.03	.07	-.01	-.04	.01
3) Family income			1.00	-.06	.02	.03	-.01	-.16**	-.09*	-.14**	.07	-.11**	.01	.01	-.02	-.03	.01	-.12**	.17**
4) Depression				1.00	.71**	.19**	.12**	.16**	.33**	.16**	-.22**	.31**	.06	.04	.10*	.05	.52**	.29**	-.05
5) Anxiety					1.00	.24**	.16**	.15**	.32**	-.16**	-.24**	.30**	.11**	.04	.05	.04	.56**	.29**	-.03
6) Psychological aggression						1.00	.72**	.06	.13**	.14**	-.07	.16**	.02	-.02	.00	-.02	.22**	.27**	.01
7) Physical assault							1.00	.04*	.11**	.16**	-.14**	.13**	-.01	-.07*	-.04	-.02	.14**	.14**	-.03
8) Neighborhood								1.00	.27**	.19**	-.03	.19**	-.02	.02	.03	.06	.13**	.14**	-.01
9) Neg. adult relations									1.00	.31**	-.15**	.38**	.05	.05	.04	.13**	.38**	.22**	-.10*
10) Antisocial										1.00	-.18**	.41**	.02	.04	.03	.09*	.33**	.23**	-.06
11) Family attachment											1.00	-.08	-.03	.01	-.02	-.01	-.19**	-.17**	-.01
12) Delinquent peers												1.00	.08*	.09*	.07	.11**	.36**	.25**	-.05
13) Television use													1.00	.29**	.29**	.12**	.12**	.02	.06
14) Video game use														.49**	.310**	.45**	.11**	.04	-.05
15) Television violence															1.00	.47**	.14**	.10*	-.04
16) Video game violence																1.00	.16**	.10*	-.04
17) Attention problems, child																	1.00	.51**	-.09
18) Attention problems, parent																		1.00	-.12**
19) GPA																			1.00

* $p \leq .05$.
** $p \leq .01$.

appear to be one of the strongest and most consistent risk factors for attention problems. This may be because the rumination symptoms of anxiety interfere with attention. For GPA, it appears that wealthier families are better able to provide resources that lead to improved school performance, but otherwise the risk factors that predict attention problems don't necessarily predict reduced GPA. It should be noted that using GPA as a marker of cognitive outcome has considerable limitations. GPA may be influenced by multiple factors, ranging from parental investment to individual school policies to difficulty of individual teachers. Thus, although examining GPA can be instructive to some degree, it should not be considered a proxy for cognitive abilities as measured by a well-validated test of the same.

Related to the central question of whether television and video game use, total hours spent or violence exposure specifically, can predict attention problems, the answer appears to be a cautious no. Previous research has not been consistent in regards to whether media use can predict attention problems. Two problems with much of the past research may include failure to rely on well-validated clinical measures of attention problems, and failure to control adequately for other risk factors, allowing spurious correlations to produce misinformative results. The current research improves upon these issues by using well-validated outcome measures, and controlling for multiple risk factors for attention problems. It is important to note that not all risk factors can be examined in a single analysis. With these steps in place the current study found little reason for clinicians or policy makers to focus solely on media use, at least in regards to attention problems. However it should be noted that there may be other issues related to media use such as family engagement, or the degree to which media replaces other activities, that could still potentially influence attention problems, even if direct exposure and violence content do not. Other scholars have cautioned that media may sometimes be spuriously blamed for negative outcomes in children, and this tendency may ultimately prevent the positive use of this media ((Grimes et al., 2008; Ferguson, 2010; Ceranoglu, 2010)). Current results suggest this line of thinking may be correct, at least in regards to the limited harm brought on by media. There is also a risk that an over focus on media effects may distract available resources from addressing important factors for attention problems and academic success. Nonetheless, caution is still advised that heavy media use or excessive preoccupation with media may also result from an unaddressed problem or need and may require further assessment of the youth by clinicians.

Several other results bear mentioning. The small negative relationship between parental physical assaults in their romantic relationships and attention problems in the child as rated by the parent may reflect a pathology tolerance in some parental respondents. This is particularly possible, since the child report of attention problems did not show the same influence. Use of teacher report in further analyses should help elucidate this issue further. Particularly given this result was not a good fit in the path analysis, interpretation of this result should be undertaken with the greatest of caution.

Anxiety symptoms were a particularly strong correlate of attention problems. In a correlational study such as this one it is difficult to establish temporal order. However the comorbidity of anxiety in the current sample was stronger even than for depression and antisocial traits, two elements which have been identified as highly comorbid with attention problems in past research (Alqahtani, 2010; Mayes et al., 2009; Biederman et al., December 2008). It is possible that anxiety and attention problems may feed into each other particularly well, however. The academic and social problems that tend to result from attention problems may increase anxiety. By contrast anxiety symptoms with rumination may

Table 3
Multiple Regression Results for Attention Problems and GPA in Hispanic Children.

Predictor Variable	Outcome Variables		
	Attention Problems (child)	Attention Problems (parent)	GPA
1) Male Gender	-.06	.13* (.05, .21)	.10
2) # Children	-.03	-.03	.04
3) Family Income	.03	-.12* (-.04, -.20)	.21* (.13, .29)
4) Depression	.18* (.10, .26)	.04	-.04
5) Anxiety	.32* (.25, .39)	.17* (.09, .25)	-.02
6) Psychological Aggression	.09	.25* (.18, .33)	.07
7) Physical Assault	-.03	-.13* (-.05, -.21)	-.7
8) Neighborhood	-.04	.03	.05
9) Neg. Adult Relations	.14* (.06, .22)	.03	-.11
10) Antisocial	.17* (.09, .25)	.07	-.03
11) Family Attachment	.00	-.09	-.05
12) Delinquent Peers	.10* (.02, .18)	.12* (.04, .20)	-.01
13) Television Use	.02	-.03	.07
14) Video Game Use	-.01	-.03	-.07
15) Television Violence	.02	.07	.11
16) Video Game Violence	.07	-.01	.02

* = significant at $p \leq .05$ or better.

Note: Numbers in parentheses represent 95% confidence interval for standardized regression coefficients. Confidence intervals included only for significant results.

decrease attention. Further research should examine this particular relationship between anxiety and attention problems.

Similarly a significant relationship was found for depression and attention problems, particularly as rated by the child. As noted, this

comorbid relationship has been found in other research (Alqahtani, 2010; Mayes et al., 2009; Biederman et al., 2008), yet arguably remains poorly understood. In particular it remains unclear the degree to which attention problems are caused by depression, or

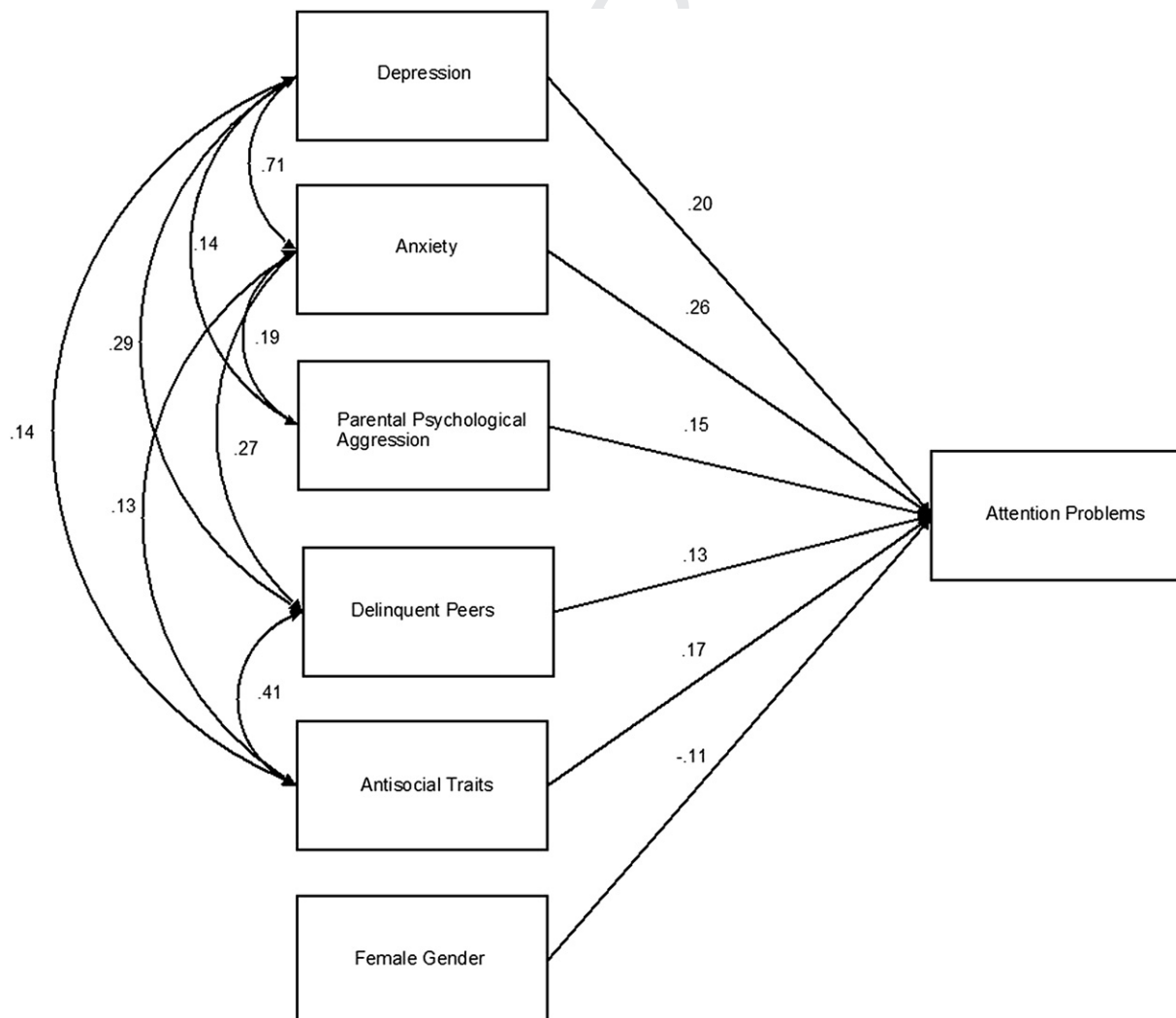


Fig. 1. Path Analysis Results for Attention Problems.

631 vice versa, or whether the two conditions tend to arise spontane-
632 ously, yet feed into one another.

633 Parental use of psychological aggression in romantic relation-
634 ships also correlated with attention problems. This appears to be
635 a particularly important family variable. It is possible that this
636 variable, as measured here, may tap into general dysfunction in
637 family communication that may indicate greater overall fighting
638 and conflict. Indeed if the “excitement” hypothesis (Christakis et al.,
639 2004; Anderson et al., 1977) of attention problems has any validity,
640 this may have less to do with media and more to do with discord
641 within the family which demands high vigilance on the part of the
642 child, but which is not replicated in comparatively calm school
643 environments.

644 Current results also suggest a small but consistent relationship
645 between delinquent peers and attention problems. Arguably much
646 of the research focus regarding peers and attention problems have
647 focused on children with attention problems being rejected by
648 peers. However this may be only part of the story. It is possible that
649 children with attention problems may gravitate towards peers who
650 are less well psychologically than others. Again, the effect here is
651 small, but suggests that a more sophisticated look at the peer
652 relations of children with attention problems may be warranted.

653 As with any study, this one has limitations which should be
654 discussed. First, as with any correlational study, causation cannot
655 be inferred. Second, results from this study are for a sample of
656 Hispanic children age 10–14 and should not be generalized to other
657 ethnic or age groups. Third, it is not possible to consider all
658 potential variables in a single analysis and it is worth examining
659 other potential predictors of attention problems. As one potential
660 issue, few studies have examined the impact of media exposure
661 session duration on attention problems. For example, media effects
662 may differ if a child's exposure of 4 h to media takes place in a single
663 long session, or is broken across several smaller sessions (Tahiroglu
664 et al., 2010). Unfortunately this data was not available in the current
665 study; however it is recommended that future research pay closer
666 attention to these possible effects. Although the current study
667 employed both child and parent report of behavioral problems, it
668 would be helpful for future research to consider teacher report as
669 a third source of data. Lastly, as noted earlier, GPA as an outcome
670 should not be conflated with overall cognitive ability, as GPA may
671 be influenced by other important factors.

672 There can be little doubt that extreme amounts of media
673 consumption can cause academic problems to the extent that they
674 may eliminate time for studying or other necessary activities by
675 simple action of the time consumed. However little evidence
676 suggests that media consumption can actually bring on psychopa-
677 thology in the form of attention problems. Little down debate on
678 media effects whether in the realm of attention or elsewhere will
679 continue for the foreseeable future. However, it is hoped that the
680 current results may be of value in identifying and prioritizing the
681 risk factors in order to inform prevention and intervention efforts
682 for children with attention problems.

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691 Contributors

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695 Conflict of interest

696 None declared.

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