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The role of media entertainment in children's and adolescents' ADHD-related behaviors: A reason for concern?

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Publication date

2016

Document Version

Final published version

[Link to publication](#)

Citation for published version (APA):

Nikkelen, S. W. C. (2016). *The role of media entertainment in children's and adolescents' ADHD-related behaviors: A reason for concern?* [Thesis, fully internal, Universiteit van Amsterdam].

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English summary

Recent decades have witnessed an increasing concern that excessive use of entertainment media (i.e., television programs and games) may elicit symptoms of attention-deficit/hyperactivity disorder (ADHD) in children. ADHD is a developmental disorder characterized by high levels of inattention (i.e., difficulties staying concentrated), hyperactivity (i.e., being restless), and impulsivity (i.e., problems inhibiting inappropriate behavior, American Psychiatric Association, 2013). ADHD is one of the most common childhood developmental disorders, with a prevalence ranging from 5.0 to 7.1% in Western countries (Willcutt, 2012). Simultaneously with the growing concerns, research on the potential relationship between media use and ADHD symptoms has accumulated. However, this has not yet resulted in a clear picture of this association. The goal of this dissertation is therefore to provide a detailed understanding of the media-ADHD relationship. Although ADHD is traditionally conceptualized as a clinical diagnostic disorder, it has been frequently argued that it is best viewed as a spectrum of behavioral problems (e.g., Larsson, Anckarsater, Råstam, Chang, & Lichtenstein, 2012). The studies in this dissertation employ this continuous view, and therefore, the term *ADHD-related behaviors* is used throughout.

Arguments for why media use and ADHD-related behaviors are likely to be associated center mainly around children's arousal functioning. It is frequently argued that the behaviors characteristic of ADHD are caused by a dysfunctional arousal system (Nigg, 2006; White, 1999). Also, use of entertainment media, particularly the use of exciting content, has been associated with elevations in arousal (Anderson & Bushman, 2001; Fleming & Rickwood, 2001). Applying these arousal hypotheses, there are two main roles media use may play in children's ADHD-related behaviors. First, from a media effects perspective, media use may contribute to the development of ADHD-related behaviors by affecting children's arousal functioning. Second, from a media selection perspective, the differences in arousal functioning between children with high and low ADHD-related behaviors may lead to different media preferences.

Dissertation Aims and Outline

The aims of this dissertation are guided by three important gaps in previous literature. First of all, to be able to examine the media-ADHD relationship in close detail, it is essential to first have a thorough understanding of the specific media use behaviors that are associated with ADHD-related behaviors, that is, *what* media children use and *how* they respond when using it. This is unclear from previous literature and is therefore examined in the first part of this dissertation (**Chapters 1 and 2**).

Second, there has been little focus on individual differences in the media-ADHD

relationship. Current theoretical models, such as the Differential Susceptibility to Media effects Model (DSMM, Valkenburg & Peter, 2013a), posit that the relationship between media use and behavior is not universal. Instead, individual difference factors can directly influence media use (i.e., what media a child is exposed to) and can strengthen or weaken the effect of media use on behavior. Hence, it is crucial to investigate child and social context factors when examining media-behavior relationships. This is the aim of the second part of this dissertation (**Chapters 3 and 4**).

The third and final aim of this dissertation is to examine causality in the media-ADHD relationship. As aforementioned, there is argumentation for why media use may elicit ADHD-related behaviors, as well as for why ADHD-related behaviors may cause differences in media use. Both processes may also work simultaneously (Slater, 2007; Valkenburg & Peter, 2013a). However, most existing longitudinal studies on the media-ADHD relationship have been conducted from a media effects perspective and did not consider these reciprocal relationships. Those that did have resulted in different conclusions concerning causality (Gentile, Swing, Lim, & Khoo, 2012; Johnson, Cohen, Kasen, & Brook, 2007; Stevens, Barnard-Brak, & To, 2009). Therefore, the final chapter of this dissertation (**Chapter 5**) examines causality in the media-ADHD relationship.

Main Findings

Part 1: Describing Differences in Media Use Behaviors

Chapter 1: Meta-analysis

In Chapter 1 a quantitative meta-analysis was conducted of 45 empirical studies investigating the relationship between screen media use and ADHD-related behaviors in children and adolescents up to the age of 18. Although relationships were small (r 's around .12), this meta-analysis showed that increased ADHD-related behaviors were associated with higher media use in general as well as higher violent media use specifically. Moreover, the results suggest that study effects sizes increased as the percentage of boys in the sample increased, indicating stronger relationship between media use and ADHD-related behaviors for boys than for girls. Potential age differences were also explored, but no effect of age on the strength of the effect sizes emerged.

Chapter 2: A television diary study of television use and responses

Chapter 2 examined the relationship between ADHD-related behaviors and television viewing in general and specific content viewing (i.e., violent/scary and

educational) in young children (ages 3-7). Furthermore, it examined children's arousal and attention responses when viewing television. Finally, it investigated sex differences in all aforementioned relationships. To examine these relations, this study combined a survey with a comprehensive four-day television diary, filled out by children's parents ($N = 865$). The television diary enabled a close examination of what content children actually watched and how they responded to that content. The results showed that high ADHD-related behaviors were associated with more overall viewing of television and more viewing of violent/scary content, but only in boys. ADHD-related behaviors were not related to educational content viewing. Furthermore, high ADHD-related behaviors were related to more arousal when viewing television, regardless of content. Finally, children with high ADHD-related behaviors showed less attention to overall and educational television, but showed no difference in attention level when watching violent or scary content.

Part 2: Individual Susceptibility

Chapter 3: Genetic disposition

Chapter 3 examined the role of children's genetic disposition in the relationship between violent media use and children's ADHD-related behaviors. Specifically, this study examined (1) whether genetic disposition is directly related to violent media use, and thereby indirectly related to ADHD-related behaviors, and (2) whether genetic disposition moderates the relationship between violent media use and ADHD-related behaviors. This study focused on a specific gene variant that has repeatedly been linked to ADHD: the 5-HTTLPR polymorphism. Using genetic data and parent-report surveys of 1,612 children (5-9 years), this study showed that a specific variation in the 5-HTTLPR polymorphism (the "long" variant) was related to higher violent media use, and indirectly related to ADHD-related behaviors via the relationship between the gene variation and violent media use. Variation in the gene did not moderate the relationship between violent media use and ADHD-related behaviors.

Chapter 4: Parental media mediation

Chapter 4 focused on the role of parental media mediation in the relationship between media violence and ADHD-related behaviors in early adolescents (10-14 years, $N = 1,017$). This study distinguished two commonly examined mediation strategies, namely restrictive mediation (i.e., rule-setting) and active mediation (criticizing violent media content), and how these strategies are communicated to the adolescent: in a controlling way (i.e., using punishment, threat, or shame), inconsistent way (i.e., being alternately strict and permissive), or

autonomy-supportive way (i.e., being encouraging and considerate of the child's perspective). Two models were tested, one for restrictive mediation, and one for active mediation. For restrictive mediation, the study examined whether the way in which parents set rules about media use was directly related to adolescents' violent media use and therefore indirectly related to adolescents' ADHD-related behaviors. For active mediation, the study investigated whether the way in which parents criticized violent content strengthened or weakened the violent media-ADHD relationship. The findings of this survey study indicated that parents play an important role in the relationship between violent media use and ADHD-related behaviors. This, however, depended on the media mediation strategies that parents used and how they applied these strategies. Specifically, the results showed that *inconsistent* restriction was associated with more violent media use, and indirectly associated with more ADHD-related behaviors through the relationship with violent media use. In contrast, *autonomy-supportive* restriction was related to less violent media use, and indirectly related to less ADHD-related behaviors. Results were less clear for controlling restriction. Finally, active mediation, in any form, did not strengthen nor weaken the violent media-ADHD relationship.

Part 3: Longitudinal Relationships

Chapter 5: A longitudinal study

In the final chapter, a three-wave longitudinal study (with one-year intervals) among early adolescents (10-14 years old, $N = 1,032$) was conducted. Using a cross-lagged panel design, the findings indicated that media use can both serve as a cause and as an effect of ADHD-related behaviors, depending on the content and the type of media use. Specifically, it was found that violent media use can elicit ADHD-related behaviors, and that ADHD-related behaviors, in turn, predicted violent media use. Adolescents' general amount of media use did not predict subsequent ADHD-related behaviors, but high ADHD-related behaviors did lead to increased media use. When distinguishing between medium, this latter effect appeared to be only true for overall game use, and not overall TV use.

Discussion

The findings of this dissertation provide three important insights. First of all, the results show that there are specific differences in media use and media responses associated with ADHD-related behaviors. Consistently, the chapters show that children who display high ADHD-related behaviors use more media in general and specifically more exciting content, particularly violent content.

Moreover, Chapter 2 suggest that children with high ADHD-related behaviors also show differences in arousal and attention when exposed to media. Most importantly, the findings suggest that although educational content is specifically designed to grab and hold attention, these efforts may be less effective for children with high ADHD-related behaviors. Interestingly, these children were as attentive as their peers when viewing violent/scary content, which may indicate that these children are able to remain focused if the content is highly arousing. For producers of educational content it is therefore important to think about how to design content that can also hold the attention of children displaying high ADHD-related behaviors.

Second, this dissertation shows that individual difference factors can play an important role in the media-ADHD relationship. Chapter 3, which focused on the role of genetic variability, indicates that children are not universally attracted to violent media use, but that this is in part genetically determined. Thus, some children may be inherently more likely than others to be drawn to violent content, which subsequently may lead to increased ADHD-related behaviors. Chapter 4, which focused on parental mediation, argues that parents, by the way they set rules about media use, can play a meaningful role in adolescent's violent media consumption and as such, in adolescents' ADHD-related behaviors. Another individual difference factor that was examined throughout several studies in this dissertation is children's gender. Both chapter 1 and chapter 2 suggested that the relationship between media and ADHD-related behaviors would be stronger for boys than for girls. However, no such gender difference was found in the longitudinal study described in chapter 5. The potential role of gender thus warrants closer examination. Together, the findings of this dissertation highlight the importance of considering children's individual and context factors in the study of media use and ADHD-related behaviors.

Third, the findings of the longitudinal study argue that violent media acts both as a cause and as a consequence of ADHD-related behaviors, which suggests a negative cycle of effects between the two. General media use, however, was only found to be a consequence of ADHD-related behaviors. These findings therefore indicate that media effects on ADHD-related behaviors cannot be considered in isolation from media selection processes. These findings also indicate that media use is not a unidimensional construct, but that there are important content differences. Moreover, this chapter showed that differences between different types of media should be considered. Especially gaming, and not TV viewing, seems to be an attractive activity for children who display high ADHD-related behaviors. The aforementioned findings indicate that, when examining the role of media use in ADHD-related behaviors, the dynamic process between the two

should be taken into account and careful consideration should be given as to how media use is conceptualized.

In general, the findings of this dissertation only partly justify the public concerns about the role of media use in the development of ADHD-related behaviors, especially because only violent media use seems to predict ADHD-related behaviors, and not media use in general. In addition, it is noteworthy that the mean amount of violent media use was not particularly high throughout the studies in this dissertation. Still, although the majority of children use little violent media, the small group of children who do consume a great amount of violent media are of particular concern. In addition, effect sizes were small throughout the studies, which may indicate that the violent media-ADHD relationship mainly exists in certain vulnerable children, but may be negligible for the majority of children (Valkenburg & Peter, 2013b). For example, children who are already at risk for developing ADHD-related behaviors (for example because they have a genetic risk towards ADHD-related behaviors) may be especially vulnerable to violent media effects on these behaviors.

Directions for Future Research

Besides providing a detailed understanding of the relationship between media use and ADHD-related behaviors, this dissertation highlights several avenues for future research. First, future research should focus on the role of arousal in the media-ADHD relationship. Although the findings of several chapters in this dissertation do suggest that arousal may be involved, no study to date has directly examined whether and how arousal mediates the longitudinal relationship between media use and ADHD-related behaviors. Second, future studies are needed to disentangle the specific features of media that explain how media use can elicit ADHD-related behaviors and why certain content or medium types are especially attractive for children who display high ADHD-related behaviors. For example, in the case arousal indeed underlies the relation between violent content and ADHD-related behaviors, it is yet unclear whether the arousal-inducing effect can be attributed to the exciting narrative itself, its fast pace, or its frequent use of formal features. Third, further research is needed into other social context factors that may play a role in the relationship between media use and ADHD-related behaviors. After all, media use and ADHD-related behaviors do not occur in a vacuum. Instead, children grow up within a family and within a peer group. By setting certain norms, standards, rules, and examples, family and peers are likely to influence children's media use, their behavior, or the relation between media use and behavior (Valkenburg & Peter, 2013b). Finally, more extensive longitudinal research is needed. The longitudinal study described

in chapter 5 only included three data waves, and exclusively focused on pre- and early adolescents. The question therefore remains how this relationship develops over the life course.

Implications for Parents and Healthcare Professionals

The findings of this dissertation suggest that media use should be considered in future ADHD prevention and treatment programs. Although effect sizes were small, media use plays an important role in children's lives and is therefore a factor that should not be ignored. Specifically, parents should be made aware of the potential negative effect heavy violent media use can have on children's behavior. Further, they should be stimulated to regulate their child's violent media use. The findings of this dissertation indicate that this may help to prevent ADHD-related behaviors or, if these behaviors are already present, that it may curtail the negative cycle between violent media use and ADHD-related behaviors. Moreover, the findings also indicate that, for these rules to be effective, parents should set them in an autonomy-supportive way. Healthcare professionals can play an important role in advising parents about potential harmful effects of violent media use and about ways to regulate this use. Further, healthcare professionals may incorporate media use measures in their assessments of children displaying ADHD-related behaviors, to be able to evaluate whether violent media use is a factor that deserves attention in the treatment of these behaviors.

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