

Overall Media Use and ADHD-Related Behaviors Among Children in China: A Meta-Analysis

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Abstract: There are several theoretical reasons to believe that overall media use might be related to attention deficit hyperactivity disorder (ADHD) or ADHD-related behaviors (i.e., attention problems, hyperactivity, and impulsivity). Although studies on media-ADHD relationship have accumulated, they have yielded inconsistent results, especially those from different countries. Therefore, it is still undisclosed whether children's overall media use and ADHD-related behaviors are related to region and culture. A meta-analysis has been performed on three empirical studies investigating the relationship between overall media use and ADHD-related behaviors in children and adolescents from China. The results indicated significant relationship between overall media use and ADHD-related behaviors, OR = 2.597.

Keywords: ADHD; Media use; China; Child ADHD symptoms

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1. Introduction

Attention deficit hyperactivity disorder (ADHD) is one of the most common childhood behavioral disorders. China and western countries have different prevalence rates, ranging from 2.18% to 6.4% in China and 5% to 6% in western countries [1-3]. Based on the American Psychiatric Association, ADHD has been traditionally viewed as a discrete disorder, characterized by extreme levels of inattentiveness, hyperactivity, and impulsivity.

So far, the cause of ADHD is still uncertain, but it is generally believed to be associated with genetic, social, family, nutritional diet, and prenatal dates [4].

Studies have shown that in recent years, the incidence of attention deficit hyperactivity disorder (ADHD) in China is increasing year by year [1].

With the rapid development of electronic media, such as television, mobile phone, and tablet computer, the time spent on media among children is also increasing [5].

Overexposure to electronic media has a significant impact on children, affecting their language learning ability and leading to attention deficit as well as various negative effects, such as aggression, eating disorders, sleep problems, and learning difficulties [6-8]. There have been recurrent claims in literatures that specific features of entertainment media may cause ADHD-related behaviors among children [9]. Several scholars have attributed the potential effects of entertainment media on ADHD-related behaviors to their violent nature [10-12].

However, Chinese scholars have not been paying much attention to the relationship between media use and ADHD; therefore, a number of cross-section studies have been employed to evaluate the associations

between overall media use and childhood ADHD.

This study sought to achieve the goal of assessing the association between overall media use and children’s ADHD-related behaviors in China through a meta-analysis.

2. Methods

2.1. Literature search

This meta-analysis was designed to follow the principles of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Relevant studies were obtained using a two-step approach.

First, China Knowledge Resource Integrated (CNKI) databases were searched back to September 28, 2016, for studies on the relationship between overall media use and ADHD in children from among Chinese literatures. The following keywords were used to search for related studies by two independent investigators: “TV or television or game or hyperactive or impulsive” (in Chinese) and “ADHD or attention” (in Chinese). Second, the reference sections of the studies related to overall media use and ADHD-related behaviors were searched for additional citations.

The studies had to meet three criteria to be included in this meta-analysis.

First, they required the inclusion of overall media use. Overall media use refers to the overall amount of time spent viewing television (including movies) or playing video games on any platform (e.g., in hours per day).

Second, the studies had to be cross-sectional studies with a measure of ADHD-related behaviors. The included studies consisted of samples that compared children who have been clinically diagnosed with ADHD with those who do not have ADHD (control group).

Third, only studies with child participants younger than 18 years of age were included in this meta-analysis.

Figure 1 shows the results of literature search and selection. A total of 453 articles were identified from CNKI.

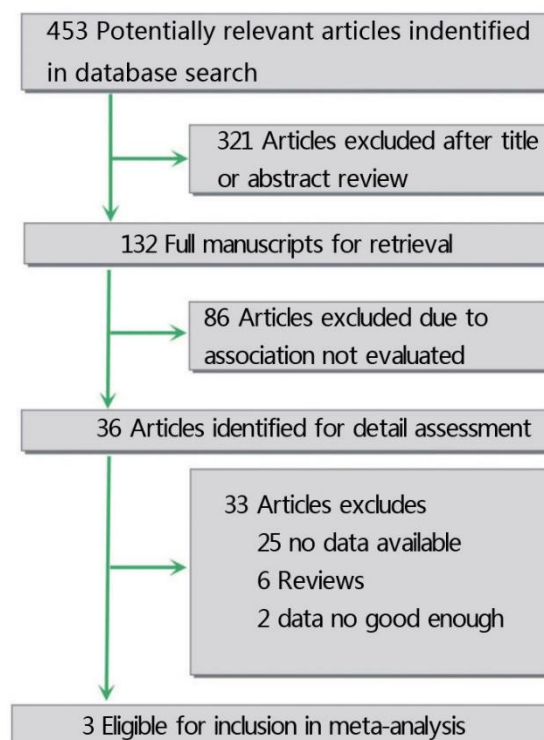


Figure 1. Flowchart of articles identified

After the exclusion of duplicates and studies that did not fulfill the inclusion criteria, out of the five studies that met the aforementioned three inclusion criteria, two studies were excluded because the effect sizes could not be computed due to missing statistics [13,14]; therefore, three articles with a total of 632 subjects were included in this meta-analysis.

For the outcome of interest, pooled estimates and 95% confidence intervals for effect sizes (OR) were calculated by using the Mantel-Haenszel weighted fixed effect meta-analysis. The I^2 statistic was used to assess heterogeneity among studies; I^2 values of 0%, 25%, 50%, and 75% represent no, low, moderate, and high heterogeneity, respectively.

2.2. Statistical analysis

The following data were extracted from each study: first author's surname, publication year, study location, study size, overall media use categories, and adjustment factors in the multivariable analysis. The OR and 95% CI for each study were calculated from the original data. For those studies with several media use categories, they were combined according to one-hour media use, which is over or below one-hour media use each day.

All analyses were performed using STATA 12.0 (Stata Corp, College Station, TX, USA). A two-sided P value < 0.05 is considered statistically significant.

3. Results

The OR for each study and the combined OR for the overall media use categories are shown in **Figure 2**.

Study	OR	[95% Conf. Interval]	% Weight
Zhang (1986)	2.480	1.648 3.732	72.45
Zhang (2009)	3.500	1.386 8.835	12.00
Zhao (2016)	2.448	1.001 5.983	15.55
M-H pooled OR	2.597	1.840 3.666	100.00

Heterogeneity chi-squared = 0.47 (d.f. = 2) p = 0.793
 I-squared (variation in OR attributable to heterogeneity) = 0.0%
 Test of OR=1 : z= 5.43 p = 0.000

Figure 2. Overall media use with presence or absence of childhood ADHD

3.1. Assessment of heterogeneity and sensitivity analysis

According to **Figure 3**, the pooled OR was 2.597 (95% CI 1.84-3.67) with no significant heterogeneity ($P = 0.793$, $I^2 = 0\%$), which means that there was no significant difference observed across all three studies. Influence analysis via the leave-one-out method was used to examine potential outliers and influential cases. No outliers and influential cases were found as shown in **Figure 4**.

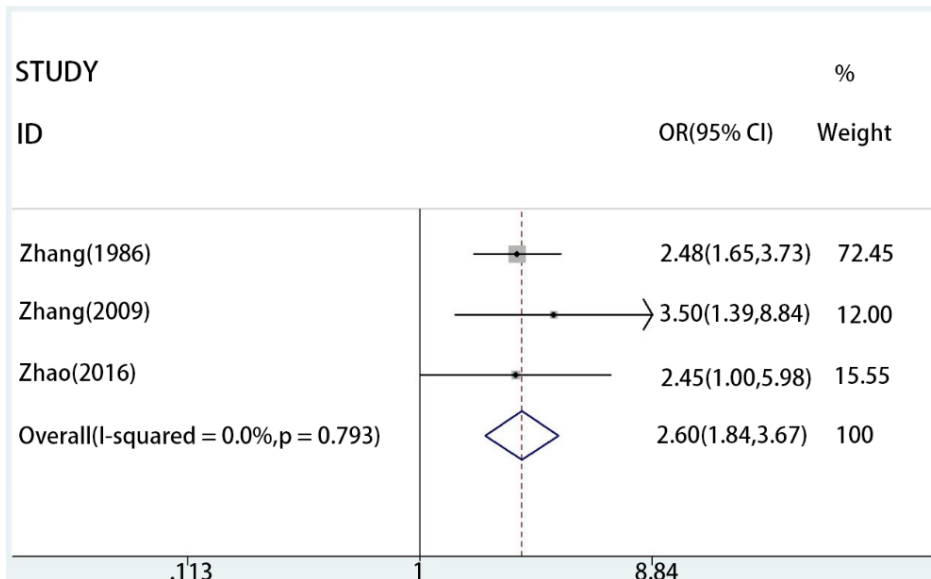


Figure 3. Heterogeneity among studies

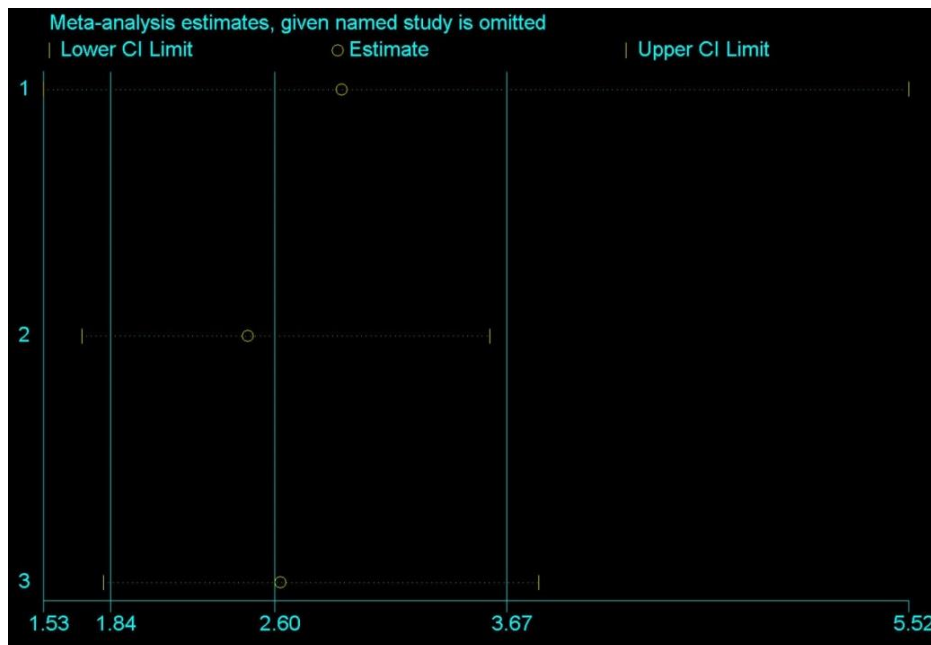
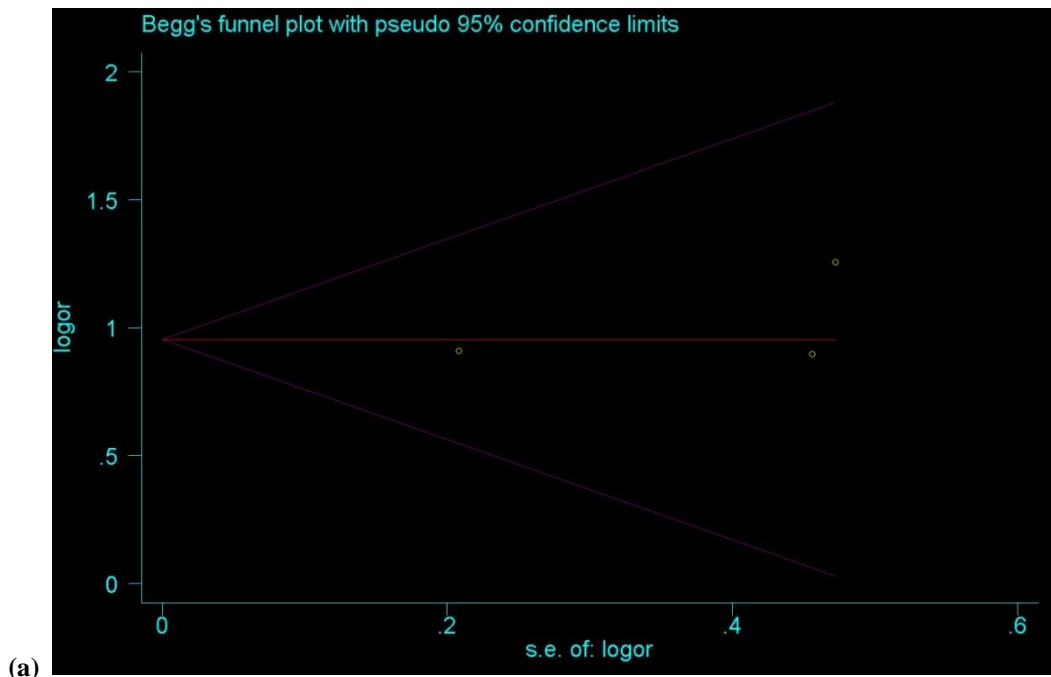


Figure 4. Influence analysis by leave-one-out method

3.2. Publication bias

In order to calculate the publication bias, $\text{gen logOR} = \log(_ES)$ was used to generate the logOR value. The publication bias of the literatures was evaluated by Begg's funnel plot (Figure 5(a)) with Begg's and Egger's tests (Figure 5(b)). There is no publication bias for the overall media use in these three studies.



(a)

Begg's Test

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adj. Kendall's Score (P-Q) =      3
  Std. Dev. of Score =      1.91
  Number of Studies =         3
        z =      1.57
  Pr > |z| =      0.117
        z =      1.04 (continuity corrected)
  Pr > |z| =      0.296 (continuity corrected)
  
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Egger's test

Std_Eff	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
slope	.7691541	.2452448	3.14	0.0196	-2.346977	3.885285
bias	.6552927	.8043785	0.81	0.565	-9.565305	10.87589

(b)

Figure 5. Publication bias by (a) Begg's funnel plot with (b) Begg's test and Egger's test

4. Discussion

In this meta-analysis, the aim was to summarize the findings in empirical literatures on the relationship between overall media use and ADHD-related behaviors in children and adolescents. The relationship between overall media use and ADHD was analyzed based on Chinese children.

Only three studies used the measure of overall media use and ADHD symptoms in children.

For all three studies, the OR was positive, reflecting that overall media use will cause ADHD. The results were similar to those of Nikkelen's [15-17].

Due to the lack of data, subgroup research, such as comparing age and sex, cannot be performed.

Moreover, the results for these outcomes should be interpreted with caution because of the limited number of studies and also in view of no heterogeneity across the studies; as known, individual studies differ greatly in their study designs and samples (i.e., children's age and sex distribution).

5. Limitation

Similar with any meta-analysis, this meta-analysis also has some limitations. First, this meta-analysis only included published studies, it is inevitable that an observed effect might suffer from publication bias because studies with null results tend not to be published. Other than that, this meta-analysis only included cross-sectional studies where causal inference is a real concern, and the time of media use was self-reported which may have led to measurement error.

6. Conclusion

In this meta-analysis, it was found that there is a positive relationship between overall media use and ADHD-related behaviors. More importantly, this meta-analysis clearly revealed a stronger combined OR value (OR = 2.597) than in Lingineni's research in the United States (OR = 1.32)^[18]. It appears that Chinese children are more susceptible to media influence than American children. To conclude the adjustment, there is a vital need for empirical research on more samples.

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Disclosure statement

The authors declare that there is no conflict of interest.

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