Article

Mind Wandering (Internal Distractibility) in ADHD: A Literature Review

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Abstract

Objective: Mind wandering, the unintended shifting of attention from a task, has been previously associated with symptoms of ADHD. To this end, we conducted a literature search to investigate the association between mind wandering and ADHD. **Method:** We conducted a systematic search of the literature of relevant articles assessing mind wandering and ADHD in PubMed, PsycINFO/OVID, and Medline. Included were original articles in English that had operationalized definitions of ADHD and mind wandering, adequate sample size, and reliance on statistical evaluation of findings. Excluded were reviews, opinions, and case reports. **Results:** Only nine studies met our a priori inclusion and exclusion criteria ($N = 8$ in adults; $N = 1$ in pediatrics). Findings suggest that ADHD is frequently associated with spontaneous mind wandering and when present heralds more functional impairments. **Conclusion:** The limited research on mind wandering in ADHD indicates that it is prevalent and morbid supporting further research on the subject. *(J. of Att. Dis. XXXX; XX(X) XX-XX)*

Keywords
mind wandering, distractibility, attention, ADHD

Introduction

Mind wandering refers to an unintended shifting of attention from a task at hand toward internal thoughts (Seli, Carriere, & Smilek, 2015; Smallwood, McSpadden, & Schooler, 2007; Smallwood & Schooler, 2006). There are two basic forms of mind wandering, one that is unconscious and unintentional and another one that is deliberate and conscious (Carriere, Seli, & Smilek, 2013; Giambra, 1989; Seli et al., 2014; Seli, Carriere, & Smilek, 2015; Shaw & Giambra, 1993). Non-deliberate or spontaneous mind wandering is thought to be the result of a failure of executive functioning or lack of internal control of the mind's processing (Seli, Carriere, & Smilek, 2015) that could result in lack of required attention to a task (Seli, Carriere, Levene, & Smilek, 2013; Seli, Cheyne, & Smilek, 2013) (hence "internal distractibility"). This latter type of mind wandering can be associated with functional impairments, such as performance at work or academics (McVay & Kane, 2009).

Research on mind wandering has found associations with inattention (Smallwood & Schooler, 2006), impulsivity (Cheyne, Carriere, Solman, & Smilek, 2011), and hyperactivity (i.e., fidgeting) (Seli, Carriere et al., 2013), which are features that overlap with symptoms of attention deficit/hyperactivity disorder (ADHD), suggesting that there may be an association between mind wandering and ADHD. Yet, little is known about the nature of this association. Whether there is an association between ADHD and mind wandering has important implications, as it could help identify a subgroup of patients with ADHD with unique correlates and treatment response.

The main aim of this study was to investigate what is known about the overlap between ADHD and mind wandering. To this end, we conducted a systematic literature search on the subject. We hypothesized that mind wandering in ADHD will be prevalent and morbid.

Method

Data Sources

We reviewed literature through PubMed, PsycINFO/OVID, and Medline utilizing the search (mind wander OR mind-wander OR mind wandering OR mind wandering) AND (ADHD OR attention deficit hyperactivity disorder OR ADD OR attention deficit disorder). References from relevant articles were reviewed. We included original human research in English. Our inclusion criteria included the following: operationalized definitions of ADHD and mind wandering, adequate sample size, reliance on statistical evaluation of findings, the main aim of the research article

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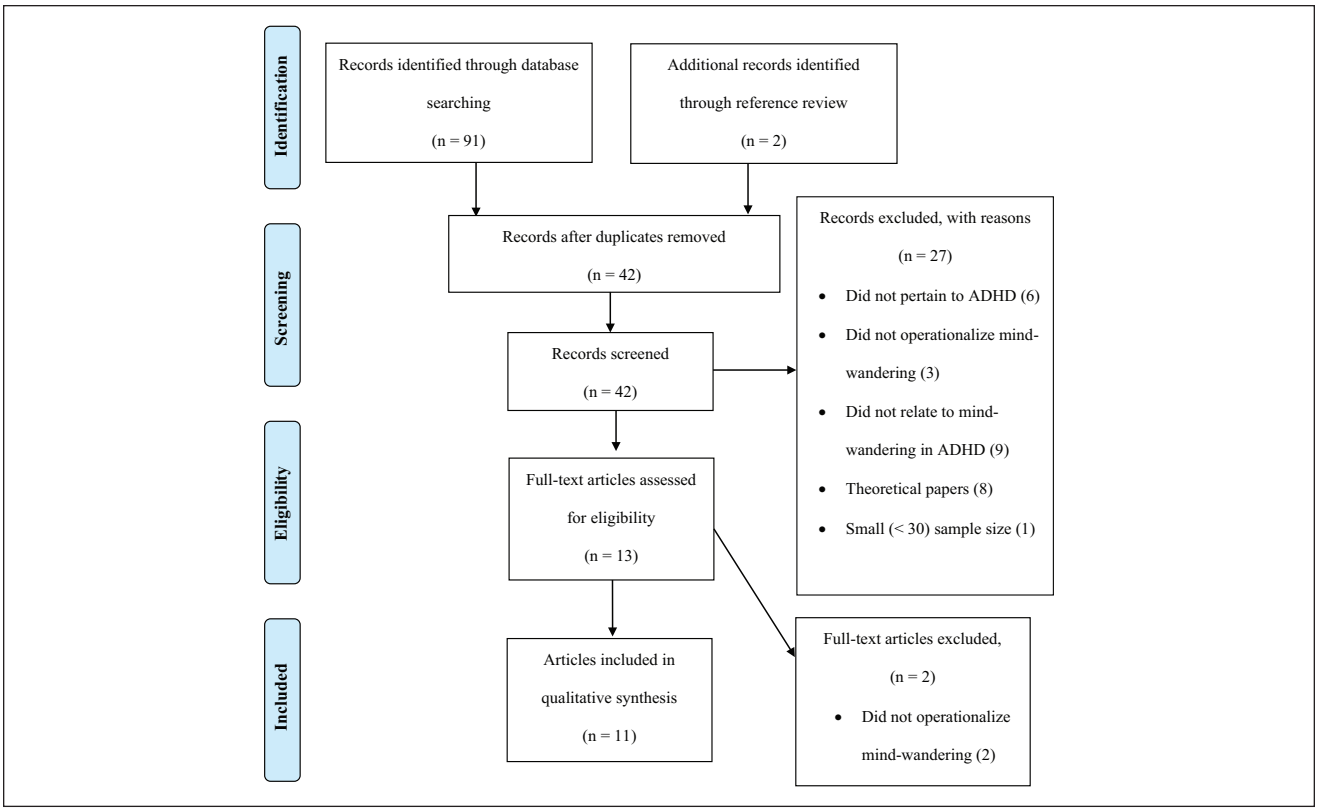

Figure 1. PRISMA Diagram.

was to assess the relationship between ADHD and mind wandering, and articles published in the English language. Excluded were reviews, opinions, and case reports.

Results

Our initial search identified 35 PubMed, 25 PsycINFO/OVID, and 31 Medline articles, of which 49 were duplicates. Two additional articles were identified as relevant from cross-reference review. From the 42 identified articles, only 11 met our a priori inclusion and exclusion criteria. We excluded six articles that did not pertain to individuals with ADHD, three did not operationalize mind wandering, nine did not relate to mind wandering in ADHD, eight were theoretical (not primary research) about mind wandering (Figure 1), and one included an inadequate sample size of only five participants. Given the heterogeneity of the studies, we were unable to extract data for a meta-analysis. Thus, our results include only a qualitative review of these studies.

As shown in Table 1, of the 11 studies included, 10 pertained to adult populations and only one to a pediatric population. Eight of the 10 adult studies used non-referred samples, mostly college students. Only two adult studies focused on a referred clinical sample. The sole pediatric study relied on a mixture of clinical and non-clinical sample.

Mind wandering was assessed with a variety of measures and a range of definitions including rating scales ($N = 9$) and probes ($N = 2$) such as tracking mind wandering during daily life on a portable device. Four adult studies differentiated between spontaneous and deliberate mind wandering. These latter studies found a positive association between ADHD symptoms and levels of *spontaneous* mind wandering (Arabaci & Parris, 2018; Biederman et al., 2017; Mowlem et al., 2019; Seli, Smallwood, Cheyne, & Smilek, 2015). One study (Franklin et al., 2017) differentiated detrimental versus useful mind wandering and found that individuals with high ADHD symptoms engaged in more detrimental mind wandering. Another study (Jonkman, Markus, Franklin, & van Dalfsen, 2017) measured frequency of task-related interfering thoughts (TRI) and task unrelated thoughts (TUT) during a task. One adult and the only pediatric study differentiated between mind wandering, defined as self-generated content-rich thoughts, and mind blanking, defined as the absence of reportable content (Van den Driessche et al., 2017).

Three studies examined the specific symptom domains of ADHD that correlated with mind wandering. One of such studies used data from a clinical sample (Biederman et al., 2017) and found that inattentive ADHD scores were the most strongly correlated ADHD symptoms with

Table 1. Summary of Studies Included in Systematic Literature Review on Mind Wandering and ADHD.

Year	Authors	Population	*N*	Aims	Design	Main findings and comments
2015	Seli, Smallwood, et al.	Non-referred college students	*N* = 2,708 surveyed *N*= 69 with ADHD (69 matched controls)	To examine the rate of spontaneous mind wandering in ADHD relative to age/sex-matched controls	Participants completed online, self-report questionnaires to measure deliberate and spontaneous mind wandering and ADHD symptoms	Spontaneous but not deliberate mind wandering associated with ADHD symptomatology in non-clinical and clinical samples
2017	Keith et al.	Non-referred college students	*N* = 151 100 with ADHD 51 controls	To determine whether self-reports of attention and awareness on a mind wandering scale corresponded to self-reports of symptoms of ADHD and Go/No-Go performance	Participants completed self-reports of ADHD symptoms and mind wandering and completed a Go/No-go task on a computer	Self-reported mindfulness and ADHD symptoms are negatively correlated ($r = -.74$). Participants with ADHD scored significantly lower on scale of mindfulness. Mindfulness defined as awareness of one's own mind wandering.
2019	Mowlem et al.	Non-referred adults (from the MIRIAD project)	Study 1: *N* = 88 41 with ADHD and 47 controls Study 2: *N* = 111 81 with ADHD and 30 controls	To test the efficacy of a mind wandering scale (MEWS) and its association with ADHD symptoms and functional impairment	Study 1: Participants completed MEWS for mind wandering and self-reported scale for ADHD symptoms. Study 2: MEWS for mind wandering and Conners' scale for ADHD symptoms; WFIRS-S for total impairment score.	Elevated levels of mind wandering (as indexed by the MEWS) in participants with ADHD correlated to self-report measures of functional impairment independently of ADHD symptoms. Mind wandering in ADHD correlated with higher levels of impairment.
2017	Franklin et al.	Non-referred college students	*N* = 105	To examine the relationship between mind wandering, meta-awareness, and ADHD symptomatology in college students	Mind wandering tasks and self-report scales	Self-reports of detrimental mind wandering in daily life was associated with high ADHD symptoms. Lack of awareness of mind wandering also associated with high ADHD symptoms.
2017	Jonkman, Markus, Franklin, and van Dalfsen	Non-referred college students	*N* = 90	To investigate the effects of laboratory-induced dysphoric mood on mind wandering and consequences on cognitive task performance in college students	Self-rated ADHD symptoms (categorized as high ADHD or low ADHD). Negative and positive mood induction. Reading task.	Dysphoric mood increased frequency of mind wandering in high ADHD symptom group with detrimental effects on text comprehension in reading task
2017	Van den Driessche et al.	Non-referred adults	*N* = 40	To characterize the subjective aspects of mind wandering episodes in ADHD participants assessed through a reading task	Reading task and thought probes about mind wandering during reading task	ADHD participants had more symptoms of mind wandering (mind blanking). No differences between ADHD groups on performance on a Go/No-go task. No clear difference between mind blanking, mind wandering, and distraction—all are symptoms of mind wandering.
2017	Biederman et al.	Clinical sample adults	*N* = 41	To investigate whether specific symptoms of ADHD can help identify ADHD patients with mind wandering	Participants completed a mind wandering questionnaire and ADHD module of a structured interview	ADHD items "failure to pay attention to detail" and "trouble following instructions" correlated with high mind wandering scores
2017	Van den Driessche et al.	Clinical sample children 20 med 20 unmed 20 healthy controls 20 controls with other psychological disorders	*N* = 80	To characterize the subjective aspects of mind wandering episodes in ADHD participants assessed through a reading task	Reading task and thought probes about mind wandering during reading task	Unmedicated ADHD had more mind wandering than medicated children. Medicated children experienced the same frequency of mind wandering as controls compared with nonmedicated ADHD participants.
2018	Arabaci and Parris	Non-referred college students	*N* = 80	To investigate the relationship between self-reported symptoms of ADHD and types of mind wandering	Self-report questionnaires	All ADHD domains (inattention, hyperactivity, and impulsivity) correlated with spontaneous but not deliberate mind wandering. Spontaneous mind wandering was not uniquely associated with inattentive symptoms.

(continued)

Table 1. (continued)

Year	Authors	Population	*N*	Aims	Design	Main findings and comments
2019	Mowlem et al.	Non-referred adults (from online survey data)	*N* = 1,484	To further validate the MEWS in a large adult population sample across sex, ADHD diagnostic status, and age	Self-report questionnaires	No sex differences in mind wandering in ADHD. Mind wandering is associated with both increased impairment and reduced well-being beyond accounting for ADHD symptoms.
2019	Helfer et al.	Clinical sample adults	*N* = 81	To investigate the effect of mind wandering, emotional lability, and sleep quality on ADHD symptom severity in a sample of adults diagnosed with ADHD	Self-report questionnaires	Mind wandering causes emotional lability and leads to higher ADHD symptom severity. Poor sleep quality exacerbates mind wandering.

Note. MIRIAD = Mood Instability Research in ADHD; MEWS = Mind Excessively Wandering Scale; WFIRS-S = Weiss Functional Impairment Rating Scale–Self-Report.

mind wandering scores. The second study (Jonkman et al., 2017) found a relationship between ADHD inattention symptoms and mind wandering but not for hyperactivity–impulsivity symptoms. In contrast, another study (Arabaci & Parris, 2018) in non-referred adults found that all three ADHD domains—inattention, hyperactivity, and impulsivity—correlated with spontaneous but not deliberate mind wandering.

Six adult studies examined functional impairments of mind wandering. One study found that individuals with ADHD engaged in more mind wandering that had a negative effect on an attempted task (thus "detrimental"), to their daily activities (Franklin et al., 2017). One study (Mowlem et al., 2019) found that high levels of mind wandering in ADHD participants correlated with self-report measures of functional impairment independently of ADHD symptoms. Another study found greater attentional errors in daily life reported by individuals with high inattentive ADHD symptoms and mind wandering (Jonkman et al., 2017). One study reported mind wandering in those with ADHD symptomatology increased impairment and reduced overall well-being even after accounting for the effects of ADHD symptoms (Mowlem et al., 2019). Another study in a clinical sample of adults found that mind wandering leads to heightened emotional lability and that poor sleep quality increases mind wandering (Helfer et al., 2019). In contrast, another study (Van den Driessche et al., 2017) found no difference in task performance on a reading task in participants with ADHD with high symptoms of mind wandering. One previously mentioned study (Franklin et al., 2017) also measured levels of creativity and found no association between mind wandering and creativity.

Three adult studies assessed "meta-awareness" (i.e., one's awareness of own thoughts wandering) within mind wandering. One study (Franklin et al., 2017) found that non-referred college students with high levels of ADHD symptoms reported a lack of awareness of their mind wandering when compared with those without ADHD symptoms. Another study in another college-age population (Keith, Blackwood, Mathew, & Lecci, 2017) showed a negative correlation ($r = -.74$) between awareness of mind wandering and ADHD symptoms suggesting that participants with ADHD may be more unaware of their mind wandering compared with controls. Jonkman et al. (2017) found those with high ADHD inattention symptoms had lower levels of daily mindfulness.

One study (Jonkman et al., 2017) examined the effect of mood on mind wandering in a sample of college students, by inducing dysphoric mood in a laboratory setting and subsequently tested participants' ability to sustain attention on a reading task. Findings suggested that negative mood increased mind wandering in participants with ADHD. Conversely, another study (Helfer et al., 2019) reported that mind wandering may cause emotional lability in adults with ADHD. However, those with low ADHD symptoms had no difference in mind wandering scores with mood induction.

The single pediatric study identified used data from a mixed clinical and non-clinical sample of children with ADHD and controls found that children who were treated with methylphenidate experienced less "mind-blanking" (i.e., an inability to report one's current thoughts when asked) than those who were untreated, but treatment did not lead to more on-task thoughts. In contrast, medicated children with ADHD experienced the same frequency of mind wandering as non-ADHD clinical sample of children (Van den Driessche et al., 2017).

Discussion

The present literature review identified a small number of studies that examined the association between ADHD and mind wandering. This literature is largely confined to non-referred samples of college students and focuses almost exclusively on young adults. Findings from the existing data suggest that ADHD is associated with the spontaneous type of mind wandering, that this type of mind wandering is common in individuals with ADHD symptomatology, and its presence is associated with functional impairments.

The available literature suggests there are multiple methods of operationalizing and quantifying mind wandering. Some differentiate between spontaneous and deliberate mind wandering and argue that mind wandering may be detrimental or useful. One study (Van den Driessche et al., 2017) differentiated between mind blanking and mind wandering; however, it is not clear how these differ functionally as they both lead to off-task focus.

Although one study (Jonkman et al., 2017) found mind wandering to be selectively associated with ADHD symptoms of inattention, another study (Arabaci & Parris, 2018) found all three domains of ADHD symptomatology (inattention, hyperactivity, and impulsivity) to be associated with mind wandering. More research is needed to elucidate these contradictory findings.

Most studies indicate that the spontaneous type of mind wandering associated with ADHD confers vulnerability to functional impairments in activities of daily living. This spontaneous type of mind wandering has also been termed detrimental mind wandering as it was associated with impeding performance on task, which in turn causes real-life impairments for those with ADHD who experience high levels of mind wandering. Taken together, these findings support the importance of identifying and targeting ADHD participants with high levels of mind wandering.

Two studies found that mindfulness was negatively correlated with mind wandering in samples of non-referred adults suggesting that "meta-awareness" (i.e., one's awareness of own thoughts wandering) of mind wandering in individuals with ADHD may decrease the frequency of mind wandering. This would suggest that interventions aimed at enhancing meta-awareness about mind wandering, such as mindfulness training, could have therapeutic benefits in ADHD participants with high levels of mind wondering.

Another factor that may impact mind wandering in ADHD is mood. One study (Jonkman et al., 2017) found that after negative mood induction, individuals with high ADHD symptomatology had more TUT compared with task-related ones. This suggests that negative mood may worsen mind wandering, which in turn may cause more functional impairment. More work is needed to confirm this intriguing finding.

Our findings need to be viewed considering some methodological limitations. The scant literature on mind wandering and ADHD used non-clinical samples of college students with high ADHD symptomatology, not ADHD diagnoses. There is no universally agreed upon definition of mind wandering, and it is unclear how different definitions or aspects of mind wandering may have different functional impacts on individuals with ADHD. Findings are limited due to the heterogeneity of methods used to quantify mind wandering. While most studies used some form of self-reporting to measure mind wandering, others utilized thought probes and reading tasks. This suggests that there is not yet consensus on the definition or a validated tool to measure mind wandering.

Despite these methodological limitations, the available literature suggests that mind wandering in ADHD is common and impairing, especially the spontaneous, non-conscious type of mind wandering calling for more clinical and scientific attention to the subject.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: J. B. is currently receiving research support from the following sources: AACAP, Feinstein Institute for Medical Research, Food & Drug Administration, Genentech, Headspace Inc., Lundbeck AS, Neurocentria Inc., NIDA, Pfizer Pharmaceuticals, Roche TCRC Inc., Shire Pharmaceuticals Inc., Sunovion Pharmaceuticals Inc., and NIH. He has a financial interest in Avekshan LLC, a company that develops treatments for attention deficit hyperactivity disorder (ADHD). His interests were reviewed and are managed by Massachusetts General Hospital and Partners HealthCare in accordance with their conflict of interest policies. His program has received departmental royalties from a copyrighted rating scale used for ADHD diagnoses, paid by Ingenix, Prophase, Shire, Bracket Global, Sunovion, and Theravance; these royalties were paid to the Department of Psychiatry at MGH. In 2019, he is a consultant for Akili and Shire. Through MGH corporate licensing, he has a US Patent (#14/027,676) for a non-stimulant treatment for ADHD and a patent pending (#61/233,686) on a method to prevent stimulant abuse. In 2018, he was a consultant for Akili and Shire. In 2017, he received research support from the Department of Defense and PamLab. He was a consultant for Aevi Genomics, Akili, Guidepoint, Ironshore, Medgenics, and Piper Jaffray. He was on the scientific advisory board for Alcobra and Shire. He received honoraria from the MGH Psychiatry Academy for tuition-funded CME courses. In 2016, he received honoraria from the MGH Psychiatry Academy for tuition-funded CME courses and from Alcobra and APSARD. He was on the scientific advisory board for Arbor Pharmaceuticals. He was a consultant for Akili and Medgenics. He received research support from Merck and SPRITES. J. L. and E. N. have no conflicts of interest.

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