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Exploring the Relationship Among ADHD, Stimulants, and Substance Abuse

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TOPIC: There is an ongoing debate among prescribers concerning the risk of inadvertently contributing to the initiation of substance abuse (SA) in children and adolescents through the use of stimulants in the treatment of attention-deficit/hyperactivity disorder (ADHD). Psychiatric nurses at all levels of practice must be informed about this important discourse in order to provide accurate and timely interventions to clients and their families.
PURPOSE: This literature review explores the current state of prescriptive stimulant use for ADHD and the possible links to SA. Developmental, genetic, and neurochemical theories of the disorder that may contribute to SA as well as the burden of comorbidity are considered. The impact of gender, cultural, legal, and ethical influences on diagnostic and treatment recommendations is also included.
SOURCE: U.S. and other English language articles were identified through PubMed and the Cumulated Index of Nursing and Allied Health Literature. These sources were used to determine the current practice of stimulant prescription and the prevalence of SA as a comorbidity to other child psychiatric disorders including ADHD. Textbooks were consulted for information regarding relevant neurochemistry, genetics, and psychopharmacology.
CONCLUSIONS: The authors conclude that the use of stimulants is appropriate for children and adolescents with ADHD when opportunities for screening, family and child education, and counseling concerning SA are consistently integrated into the ongoing treatment regimen.

A debate is ongoing in the healthcare and prescribing community about the relationship between prescribed stimulant treatment and substance abuse (SA), including cigarettes and marijuana (Wilens et al., 2008). Recent research suggests that early treatment decisions may influence the emergence of SA and thus the course and prognosis for the person with ADHD into their adult life (Mannuzza et al., 2008). Therefore, the appropriate clinical management of persons with ADHD in childhood and adolescence is a critical concern for nurses at all levels of practice.

This debate is appropriately considered when contemplating the use of psychostimulants for the treatment of attention-deficit/hyperactivity disorder (ADHD) in children and adolescents, as well as in the treatment of adults. Studies show that 30–60% of children diagnosed with ADHD will continue to exhibit symptoms into adulthood (McCann & Roy-Byrne, 2004), and thus will continue to need treatment.

In addition, stimulants are also being used as adjunctive therapy for depression. Though it is common practice to initiate adults with ADHD on a nonstimulant drug, such as atomoxetine, children and adolescents generally begin treatment with stimulants, based on protocols and reimbursement practices. It is only after treatment failure with two stimulants that alternative pharmacotherapy is considered appropriate.

The debate has moved to a discussion on the wisdom of stimulant use at any time as some clinicians, including psychiatric advanced practice nurses (APNs), believe that prescribing stimulants to children and adolescents increases the likelihood of developing SA later in life. Alternatively, others claim that not treating (ADHD) or using more expensive agents may leave those suffering from the disorder to self-medication (Lin, Crawford, & Lurvey, 2004). This literature review will focus on this debate concerning stimulant use and the role of psychiatric APNs and nurses, in the

unintended consequence of prescribed stimulants leading to SA in the ADHD population.

SA is considered here as the inappropriate use of prescription or nonprescription drugs, alcohol, or other agents. The *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR) (American Psychiatric Association, 2000) describes SA as "a maladaptive pattern of substance use leading to clinically significant impairment" (p. 199). SA can lead to a substance use disorder (SUD). SUD or substance-related disorder/dependence is a maladaptive pattern of substance use that includes three of the following: tolerance, withdrawal symptoms, use of increasing amounts of the substance, expressed desire to cut down, investing a great deal of time and energy in pursuit of substances, neglect of social and occupational activities, and the continuation of the behavior despite knowledge of the worsening of the condition (American Psychiatric Association, 2000). It should be noted that proposed changes in *Diagnostic and Statistical Manual of Mental Disorders-V* may eliminate this distinction, replacing both with the new category SUD. The rationale for the change is related to analyses suggesting that abuse and dependence cannot be consistently clearly delineated (Frances, 2010).

Brief Description of ADHD

According to the DSM-IV-TR (American Psychiatric Association, 2000), ADHD manifests in the inattentive or hyperactivity–impulsivity types. Even though ADHD is categorized as a childhood illness, it often carries over into adulthood; ADHD can also develop later in life. It is characterized by inability to sustain attention to tasks, difficulty organizing and/or problem solving, fidgetiness, excessive motor functioning, difficulty engaging in leisure activities, hyperactivity, and disruptive or intrusive behavior (American Psychiatric Association, 2000). Stahl (2008) notes a paradigm shift in the last decade from classification as a disorder of childhood to a clinical syndrome that includes diagnosis and treatment into adulthood.

There is no clear consensus on the etiology of ADHD, though its genesis is likely influenced by genetic, neurological, environmental, and psychosocial determinants (Stahl, 2008; Tsai, 2007). It is thought that the origin of the triad of symptoms of ADHD (inattention, hyperactivity, and impulsivity) is related to information processing abnormalities in the prefrontal cortex of the brain. Attention deficits, including inattention and the sustained attention necessary for problem solving, appear to originate in the anterior cingulated cortex and the dorsolateral prefrontal cortex. The second symptom of the triad, hyperactivity, arises in the supplementary motor cortex/prefrontal motor cortex. Finally, the third symptom, impulsivity, which is considered most problematic for both children and adults, is linked to the orbital frontal cortex. The three separate origins and their respective unique neural pathways which lead to subcortical areas of the brain, including the nucleus accumbens, thalamus, and caudate nucleus, likely account for the variability in intensity of the three symptoms manifested in individual cases of ADHD (Stahl, 2008).

Although persons with ADHD appear overstimulated, their difficulties are likely related to a decreased state of arousal in the prefrontal cortex. This hypoarousal results in inefficient information processing. The neurotransmitters dopamine (DA) and norepinephrine (NE) stimulate arousal in the prefrontal cortex which results in increased efficiency in information processing and the ability to focus attention on the most salient stimuli present at the time. Medications that influence the release or metabolism of DA and NE are useful in the treatment of symptoms of ADHD (Stahl, 2008).

Medications for the hyperactivity cluster of symptoms include, but are not limited to, methylphenidate (Focalin, Focalin XR), which increases NE and DA by blocking the reuptake of both neurotransmitters and facilitating their release primarily in the basal ganglia, and also in the prefrontal cortex and hypothalamus. The similar but less potent methylphenidate form (Concerta, Metadate CD, Ritalin, Ritalin LA) and amphetamine (Dexedrine; Adderall, Adderall XR) have a more selective effect on DA (Stahl, 2006).

Other researchers have been building on the conceptualization of ADHD as a disorder of catecholamine dysregulation as well as a genetic, environmental, and psychosocial disorder. Spencer et al. (2007) found that dopamine transporter (DAT), a protein membrane transporter that removes dopamine from the synaptic cleft, binds more readily in the right caudate nucleus in those with ADHD. This decreases the available dopamine in an area of the brain involved in higher cognitive functioning. Tsai (2007) suggests that ADHD susceptibility may be related to decreased brain-derived neurotrophic factor (BDNF), which is genetically and environmentally determined. BDNF is a widely dispersed neurotrophin, one of a group of proteins that control the survival, development, and function of neurons, including those in the midbrain influencing dopaminergic activity. Psychostimulants elevate BDNF in the midbrain which increases functional dopamine, thus decreasing symptomatology. Environmental origins are suggested by Son et al. (2007) in their research describing the effects of maternal stress during gestation on the induction of hyperactivity in mice. They postulate that both DAT and dopamine receptors are targets of the alterations imposed by maternal stress situations and speculate that a similar environmental process may be at work in humans.

Previous Research

Multiple studies document that SA rates in persons with ADHD treated with stimulants are greatly increased (Darredeau, Barrett, Jardin, & Pihl, 2007; Faraone, Biederman, Wilens, & Adamson, 2007; Lin et al., 2004). Lin et al. (2004) report that there was a 187% increase in amphetamine and amphetamine derivative prescriptions written over a 3-year period ending in 1997. Of those prescriptions, 33.3% were written for ages 10–14, 23% were for 5 to 9-year-olds, 16% were for 15 to 19-year-olds, and 2% were for under the age of 5 (Lin et al., 2004). The remaining 26% were prescribed for those over the age of 19 years. While adult clients are the age group who most commonly report SA, the rate in the adolescent population is largely unknown, but is thought to be equal to their adult counterparts (Lin et al., 2004). In a study of adults, Darredeau et al., (2007) found that 41% of participants, for whom methylphenidate was prescribed, admitted to giving away or selling their medication, and 29% admitted to abusing their medication.

Methylphenidate and amphetamines influence DA and NE in the pleasure centers of the nucleus accumbens in a manner similar to cocaine, thus following what might be a common path to abuse (Fone & Nutt, 2005). Kollins (2008) reports that while having ADHD increases the risk of developing an SUD, it is not necessarily true that prescribing a stimulant will increase that risk. Rather, he opines that not medicating someone with ADHD can increase the risk of seeking relief through the use of illicit substances. Faraone et al. (2007) supported Kollins' contention with their study of adults with a lifelong history of ADHD, noting that although the prevalence of SUD is higher in those with ADHD, it had no correlation with the prescription of a stimulant medication. They clarify that while the population of those with ADHD has a higher rate of SUD, the rate of those treated with psychostimulants is essentially equal to that of the general population.

So why do persons with ADHD present so frequently with SA and SUD? ADHD is frequently a comorbid diagnosis (Connor & Doerfler, 2008; Darredeau et al., 2007; Looby, 2008). In children and adolescents, the most common comorbid diagnoses are oppositional defiant disorder (ODD) and conduct disorder (CD) that are also associated with a vulnerability to SUD (Connor & Doerfler, 2008). Darredeau et al. (2007) state that 53% of adults who reported misusing their stimulant medication also reported being prescribed "at least one psychiatric medication other than methylphenidate in their lifetime" (p. 531), which supports the dual diagnosis hypothesis. Looby (2008) notes that many of the symptoms of ADHD bear a striking similarity to those of SUD, indicating the importance of a careful assessment including a detailed history of substance use to insure prescribers are not providing inappropriate access to psychostimulants.

Legal and Ethical Issues

Before prescribing, careful consideration should be given to the differential diagnosis of ADHD versus ODD, CD, SUD, seizure disorder, or other psychiatric syndromes. A comprehensive family history is imperative for an accurate diagnosis as well. While the effect of repeated stimulant use on human brain development is unknown (Fone & Nutt, 2005), growth retardation and new onset seizures have been cited in studies (Peterson, McDonagh, & Fu, 2007). It is also reported that ADHD is more prevalent in those with epilepsy or other seizure disorders (Peterson et al., 2007).

As benzodiazepines are a common treatment for seizures, and also have considerable abuse potential, their use in clients with co-occurring ADHD must be carefully monitored. Some clinics require that their providers do not prescribe benzodiazepines at all. In addition, many prescribers have curtailed their use of stimulants and are turning to the use of medications such as atomoxetine, clonidine, bupropion, and/or guanfacine to minimize adverse effects and avoid potential liability. There is an increasing concern that stimulants may be classified as medications in which the abuse potentials outweigh the effectiveness.

Additional liability concerns for clinicians treating persons with ADHD include: use of a stimulants alone without other psychosocial interventions for persons suffering from ADHD, exacerbation of a mood disorder by the use of stimulants, misdiagnosis, failure to obtain informed consent, and potential battery. For example, Ouellette (1991) notes that a situation in which a school system compels a student with ADHD to take a stimulant to control that student's disruptive or inattentive classroom behavior may constitute battery. In addition, rights to privacy may be compromised by school medication regimens that single out children from their peers for treatment.

Gender and Cultural Influences

Boys are 2.3 times more likely to have ADHD than girls. Girls are more likely to present with inattentive type; boys are likely to present with hyperactive type (Bauermeister et al., 2007). As girls have the less dramatic symptoms, they may be less likely to be compelled by school officials to seek treatment.

Culture influences how adults perceive the behavior of children. Pierce and Reid (2004) found that clinicians rating ADHD judge the criteria differently based on cultural differences. Raters from China and Indonesia score behaviors higher (more severe) than raters from the United States and Japan. ADHD is less likely to co-occur with ODD, CD, and SUD in the African American population, but is more likely to occur with mood disorders (Miller, Nigg, & Miller, 2009). However, the African American population seems to have more severe ADHD, based on intensity and impairment

caused by the behaviors, when compared wih Caucasians (Miller et al., 2009). Rates of ADHD differ among cultural/ethnic groups. Germany has the highest rate of ADHD at 17.8%, followed by the United States at 15.1%, Australia at 2.4%, and England at 2.2%; however, the United States has the highest incidence of SUD related to ADHD (Skounti, Philalithis, & Galanakis, 2007).

Wu, Pilowsky, Schlenger, and Galvin (2007) reported that persons most likely to abuse prescription stimulants are between 20 and 25 years, Caucasian, of nonstudent status, unemployed, single, living in a small metropolitan area, reported receiving other mental health treatment in the last year (including treatment for ADHD), and have a history of arrest. Income had little to no influence on the rate of SA among those in this population.

Assessment/Evaluation

Persons with ADHD may have multiple assessments by both medical and nonmedical treatment providers including educators, social workers, and occupational therapists. When performing an assessment of the child or adolescent with ADHD, this varied information has both advantages and drawbacks. Integrating and constructing the history, considering the developmental aspects, and interdigitating that information with the nurse's current clinical observations can complicate the assessment process and require considerable additional perseverance and skill. Assessments may be even more complex for children served in a mental health system, with frequent staff turnover and possible treatment interruptions.

Assessment tools for diagnosing ADHD are mostly self-report measures, with little consensus among providers on which is best overall. The scales used to evaluate adults include: Adult Rating Scale, the Attention-Deficit Scales for Adults, the Connors' Adult ADHD Rating Scales, the Wedner Utah Rating Scale, and the Copeland Symptom Checklist (McCann & Roy-Byrne, 2004). There is a paucity of data on the reliability or validity of any of these scales and it is believed they are subject to social desirability bias.

Scales for children require rating from parents and teachers, in addition to self-report. These scales include: Connors Parents Rating Scale, the Child Attention Problem Rating Scale, Strength and Weakness ADHD symptom and Normal Behavior Scale, Connors Teachers Rating Scale, and Child Behavior Checklist. The TOVA version 6.x is also used, though Schatz, Ballantyne, and Trauner (2001) found it over diagnosed ADHD in children and young adults, which may lead to an unnecessary label of a stigmatizing psychiatric disorder. A biological marker in children can be identified through the methionine allele of the *catechol-O-methytransferase* gene, which is known to cause impairment in the prefrontal cortex; however, implementation of widespread use of this procedure is years away due to cost (Bellgrove et al., 2005).

Several studies have looked at the functional impairment of adults with ADHD. Holmes et al. (2010) found significant impairment in response inhibition and working memory. Able, Johnston, Adler, and Swindle (2006) found lower education levels and socioeconomic status in persons with undiagnosed ADHD similar to findings for those with SUD. Weafer, Camarillo, Fillmore, Milich, and Marczinski (2008) report that because of distractibility, persons with untreated ADHD have driving impairment equivalent to those driving under the influence of drugs or alcohol, and have significantly more vehicular accidents than the general population, hence effective treatment is critical.

Every client with ADHD, including children and adolescents, especially those on a stimulant, should be screened for SA during every appointment. Clinicians should be alert to signs in the client's appearance and demeanor in addition to soliciting the self-report of substance use. Information concerning employment, educational, and relationship difficulties should be pursued as they may be clues to SUD. Treatment will need to be adjusted accordingly.

Education/Counseling

Along with medication, education is critical in the treatment of those with ADHD who are prescribed stimulants. Cognitive-behavioral therapy (CBT) can be an adjunct approach to pharmacology and shows promise in minimizing symptoms, such as poor organization, distractibility, maladaptive thinking, procrastination, and substance abuse relapse (Mitchell, Nelson-Gray, & Anastopoulos, 2008). Monastra et al. (2005) recommend electroencephalographic biofeedback to alter the rhythms in the thalamic-cortical tract for those who are still struggling after medications and therapy have not resulted in significant symptom relief. For young children or those incapable of participating in CBT, behavior plans implemented at school and/or at home can decrease target symptoms (Hervey-Jumper, Douyon, Falcone, & Franco, 2008). Pierce and Reid (2004) discuss the need to educate parents to develop the specialized skills and knowledge to deal with problematic behaviors. Along with pharmacological treatment, families need anticipatory guidance about how the disorder affects educational opportunities, functioning in group and social activities, and the importance of vocational planning. The risk of SUD should also be discussed with the client and parents. As managing ADHD is likely to be a long-term and demanding endeavor, nurses and other clinicians must encourage and inspire commitment from parents and children to the treatment regimen.

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Implications for Clinical Management

Despite promising investigations into the use of nicotinic agents, modafinil, and fish oils, the recommended treatment for the management of ADHD in children and adolescents is a stimulant plus therapy that includes the family (Nutt et al., 2007; Son et al., 2007). For those suffering from co-occurring SA or for an adult with ADHD, a nonstimulant should be used along with therapy and close supervision after the stabilization of the SUD. SA treatment is recommended for those in need and is best provided in treatment facilities serving those with comorbidities (Nutt et al., 2007).

If a clinician or nurse suspects that a new client is seeking ADHD medication to merely abuse or sell it, it is wise to slow down the evaluation process and have him/her return for a second visit before prescribing medication. Insist on collateral input from teachers, parents, or significant others. Another strategy is to use an extended release preparation which has less abuse potential. Furthermore, older teens and adults should be warned about the addiction risk during the informed consent process. For children and adolescents, this will include psychoeducation for the guardians.

Conclusion

While there is limited research information on the current incidence and prevalence of co-occurring ADHD and SUD in both adults and adolescents, the National Institute on Drug Abuse (NIDA) notes that the rate of SUD alone has been increasing in the United States (NIDA, 2010). In addition, stimulant prescriptions have also increased. It is critical to remember that treatment with stimulants is well supported by clinical research (Kollins, 2008; Lin et al., 2004; Looby, 2008) and that the provision of adequate treatment of symptoms, specifically impulsivity, is one of the best ways to avoid initiation of a comorbid SUD. It is also important to remember that not all clients with ADHD are abusing their medications. Continued research needs to be conducted on children, adolescents, and young adults to identify those clients most prone to develop comorbidities in order to insure adequate treatment for those with ADHD as well as prevention strategies for SUD.

In summary, nurses need to engage fully in creating and implementing the treatment regimens for children and adolescents suffering from ADHD. Prescribing APNs must consider the risks (temporary growth deficits, seizures, risk of SA) against the benefits of stimulant treatment. They should consider the use of nonstimulants, especially in adolescents, who are currently using or those with increased risk. Nursing personnel involved in the diagnostic process should familiarize themselves with the valid and reliable tools to aid in the assessment and diagnostic process. Integrating pharmacotherapy with other treatment modalities including CBT, biofeedback, and social skills training should also be a focus. Parents and partners in community settings, such as school nurses and teachers, need anticipatory guidance concerning the increased risk of developing substance abuse as well as information about early signs and symptoms. Referral to appropriate substance abuse services sooner rather than later should be the norm.

Recent longitudinal studies suggest that successful treatment of ADHD symptoms is considered to be a protective factor, potentially decreasing SUD (Looby, 2008; Wilens et al., 2008). Therefore, effective management of ADHD while monitoring for SA and educating about addiction is the wiser course, rather than withholding treatment due to fear of substance abuse.

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