National Resource Center on AD|HD
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WHAT WE KNOW

Managing Medication for Adults with ADHD

Attention-deficit/hyperactivity disorder (ADHD) is a common neurobiological condition affecting 5-8 percent of school age children[1,2,3,4,5,6,7] with symptoms persisting into adulthood in as many as 60 percent of cases (i.e. approximately 4% of adults).[8,9] Medication, which is an integral part of the multimodal treatment of ADHD in children, is the cornerstone of treatment for adults.[10,11,12] Although there is a significant amount of research in children, there is much less controlled research data on medication therapy in adults.

[13,14] Regarding the use of medication in the treatment of ADHD, it has been said that "pills do not substitute for skills."[15,16] This means that medication alone is not sufficient to help a person improve his or her problems in areas such as organization, time management, prioritizing, and using cognitive aids. However, medication levels the neurobiologic playing field, and allows adults with ADHD to learn and develop the skills they need to succeed.

This sheet will:

- provide a basic understanding of how stimulants can be used safely and effectively to treat ADHD in adults
- discuss nonstimulant medications for ADHD in adults, including those approved by the Food and Drug Administration for the treatment of ADHD in adults
- discuss the effect of co-existing psychiatric disorders on the medical treatment of adults with ADHD

HOW MEDICATION WORKS

Medications that most effectively improve the core symptoms of ADHD seem to primarily and directly affect certain neurotransmitters (brain molecules that facilitate the transmission of messages from one neuron [brain cell] to another). The neurotransmitters involved are dopamine and norepinephrine. Both neurotransmitters appear to play a role in the attentional and behavioral symptoms of ADHD. However, the exact contribution of each neurotransmitter to each type of symptom is not known. Similarly, one cannot predict which medication, with its own specific actions on the individual neurotransmitters, will result in the best clinical response for a particular person.[17,18,19]

PSYCHOSTIMULANTS

Psychostimulants continue to be first line medications for the treatment of ADHD in adults as well as children and adolescents.[20] To date, none of the psychostimulants are approved by the Food and Drug Administration (FDA) for the treatment of ADHD in adults and so are routinely prescribed off label. The two stimulants most commonly used, methylphenidate (MPH) and amphetamines (AMP), are regulated as Schedule II drugs by the Drug Enforcement Administration because they have a potential for abuse when not used as prescribed by a medical professional.

Several factors contribute to an adult's response to stimulant medication:

- **Dose.** Recent controlled studies indicate that the clinical response of adults with ADHD to MPH[21] and mixed amphetamine salts (Adderall)[22] is dose-related. So, within the therapeutic range, higher doses may produce a better individual response as long as the medication is tolerated. Lower and inconsistent response rates seen in early controlled studies were due to low doses of medication, inconsistent diagnostic criteria, and a lack of control for co-existing psychiatric conditions.[23] Recent short-term controlled studies using relatively high doses of stimulants have demonstrated the efficacy of the stimulants (MPH,[24] Adderall,[25] and Adderall XR)[26,27] in about 70% of adults. Underdosing stimulant medication in adults can result in decreased effectiveness.[28,29]
- **Blood Levels.** The level of medication in the blood varies from person to person, and blood levels alone do not seem to directly correlate with clinical response.
- **Changes in Blood Levels.** There is some evidence to indicate that the clinical response is, in part, related to the rate of increase or decrease of the blood levels of the medicine. As the blood levels of the stimulants fall, a rebound or recurrence of the original ADHD symptoms may take place. In some cases, the rebound may involve even more intense symptoms including significant irritability.[30,31,32]

" … medication levels the neurobiologic playing field, and allows adults with ADHD to learn and develop the skills they need to succeed."

Studies have demonstrated the short-term safety of stimulants. Preliminary results from a long-term controlled study of adults taking MPH demonstrated continued efficacy and safety over six months.[33,34] As with all medication therapy, the doctor (or other medical professional) and the individual must work together to find a medication with characteristics that fit the needs of the individual.

FREQUENTLY ASKED QUESTIONS ABOUT PSYCHOSTIMULANTS

Q. When an adult has been diagnosed with ADHD and decides to seek medical treatment, should the person try MPH or AMP first?

A. At this stage of our knowledge, there is no scientific basis for choosing one type of stimulant over the other for a given individual who has not yet tried either. Because MPH and AMP affect dopamine and norepinephrine somewhat differently, it is reasonable to assume that they would also affect people differently.

Both MPH and AMP block the reuptake of dopamine and norepinephrine and increase their levels in the synapse (space where the brain cells connect). AMP also increases the level of dopamine and norepinephrine in the synapse through another mechanism in the pre-

synaptic (pre-connection) brain cell.[35,36]

After an unsuccessful treatment attempt with one family of stimulants (MPH or AMP), an attempt with the other is warranted.[9] Because MPH and AMP have different mechanisms of action, combining MPH and AMP may be useful in a person who does not respond to either type alone.[37,38]

Q. Are adults who take psychostimulant medications more likely to have substance abuse problems?

A. No. Generally, the stimulants are well tolerated in therapeutic doses without any abuse. There is no evidence to substantiate the fear that stimulant use leads to substance abuse or dependence. On the contrary, studies indicate that successful treatment of ADHD with stimulants lowers the chances of substance use disorders, compared to adults with untreated ADHD.[39,40,41]

Adults with ADHD who have a co-existing substance use disorder and are actively using sometimes abuse psychostimulants. Generally, the active substance use disorder needs to be treated before the co-existing ADHD can be treated. In this case, it may be advisable not to use a psychostimulant for the treatment of ADHD. For people with a recent history of substance use but no current use, deciding to use stimulant medication needs to be dealt with on a case-by-case basis. Certain extended release preparations are less likely to be abused, like Concerta (a recent extended release preparation of MPH with an osmotic delivery system that cannot be crushed and used other than as prescribed orally).

"Psychostimulants continue to be first line medications for the treatment of ADHD in adults…"

Q. What are the possible side effects of stimulant use in adults with ADHD?

A. Side effects of stimulant use in adults are generally not severe. For MPH, one controlled study showed side effects such as insomnia, headaches, anxiety, loss of appetite, weight loss (but less weight loss than is seen in children), and some cardiovascular effects.[42]

The cardiovascular effects in those with normal blood pressure include increases in blood pressure (systolic and diastolic increases of about 4 mm Hg) and increases in heart rate (less than 10 beats per minute).[43,44] No long-term controlled studies of cardiovascular effects have yet been published. Likewise, there are no studies on the effects of stimulants in people with borderline hypertension (high blood pressure) or with hypertension that is controlled by medication. Regular monitoring of blood pressure is generally recommended in adults with or without ADHD.

METHYLPHENIDATE (MPH)

In a controlled MPH study of adults with ADHD, 78 percent experienced a therapeutic response with an average dose of 0.92mg/kg/day split into three daily doses. The most common side effects were loss of appetite, insomnia and anxiety.[45,46] Preliminary results of a recent unpublished long-term (six-month), controlled study demonstrated MPH's efficacy in almost 75 percent of adults with ADHD.[47,48]

IMMEDIATE RELEASE MPH

The immediate release preparations of MPH are a mixture of the mirror-image molecules (d and l isomers) in a 1 to 1 ratio. They are available as Ritalin, Metadate, Methylin, and generic MPH. The formulations are short-acting and last up to three or four hours. The d isomer, which is the active MPH isomer, has been isolated and released as Focalin. It lasts about as long as or possibly slightly longer than the others.[49,50]

EXTENDED OR SUSTAINED RELEASE MPH

Older first generation sustained release preparations, which contain a wax matrix, do not have an immediate release portion and the release of the sustained portion is somewhat irregular. These medications include Ritalin SR, Metadate ER and Methylin ER.[51,52]

The new second generation extended release MPH preparations include Concerta, Metadate CD and Ritalin LA. So far, there are no controlled efficacy studies of these three products in adults, and none is yet approved by the FDA for the treatment of ADHD in adults.[53,54,55]

These newer extended release MPH preparations (as well as the newer extended release AMP preparation mentioned below) differ from each other in several ways:

- The way MPH is released and how it works in the body.
- The amount of stimulant that is released immediately and the amount that is in the extended release portion.
- Whether the extended release portion is released all at once (for example, four hours after the immediate release portion) or gradually and continuously over a certain period of time.
- Under some circumstances, premature release of the extended release portion. For example, for a given total dose, one extended release stimulant preparation could have a more gradual onset and last longer than the others; another could have a bigger initial effect but not last as long.

There are no published controlled data in adults that use accurate and frequent measures of medication efficacy over time.[56,57,58,59,60,61] The reader is referred to Table 1 for a detailed comparison.

AMPHETAMINE (AMP)

Immediate Release Preparations of AMP

One of the immediate release preparations is d-amphetamine (Dexedrine and Dextrostat), which contains the d isomer and lasts about 4 hours clinically. A recent short-term, controlled study showed the efficacy of d-amphetamine in adults with ADHD, with weight loss being the only significant side effect.[62]

There is also an immediate release preparation of mixed amphetamine salts that contains both the d and l mirror-image molecules of amphetamine in a 3 to 1 ratio. The preparation has been released as Adderall and mixed amphetamine salts (generic), and lasts about 4-6 hours. In a recent controlled study, Adderall was efficacious in about 70% of adults with ADHD who had an average total dose of 54 mg with twice daily dosing. Adderall was well tolerated with only two significant side effects: loss of appetite and agitation. Adults also experienced insomnia.[63]

Since both of the mirror-image isomers of AMP are active but have different effects,[64,65,66,67] Dexedrine and Dextrostat (the d-AMP preparations) will likely have a different therapeutic effect than Adderall or mixed amphetamine salts (3 to 1 mixture of both d and l AMP isomers).[68,69] However, there are no controlled studies comparing the two types of amphetamine medication in adults.

Extended or Sustained Release AMP

There are no controlled data on the use of older first generation sustained release preparations of the d-amphetamine isomer in adults. This preparation is available as Dexedrine Spansules and dextroamphetamine sulfate sustained release capsules (generic).

The newer second generation extended release AMP mixed salt preparation has d and l isomers in a 3 to 1 ratio (Adderall XR).[70] Preliminary unpublished results of a multi-center controlled adult study of once daily Adderall XR indicate efficacy in about 70% of adults with symptom improvement that was dose dependent. The most commonly reported side effects were dry mouth, decreased appetite, insomnia, and headache.[71,72] During the first 10 months of a 24-month, open label (non-controlled) study of Adderall XR, adults in the study tolerated the medication and experienced improvement in symptoms.[73,74] The reader is referred to Table 2 for details of the AMP preparations.

METHAMPHETAMINE HCL

Methamphetamine hydrochloride (brand name Desoxyn) is a central nervous stimulant and is also approved by the FDA for the treatment of ADHD. Because it can be abused or lead to dependence, it is classified as a controlled substance. This medication is not commonly prescribed, except in rare circumstances.

OTHER STIMULANT TREATMENT CONSIDERATIONS

Matching the characteristics of the various extended release stimulants with the needs of the adult requires both a knowledge of these medications as well as an understanding of the specific needs of the adult with ADHD and how these needs change over time. It is often useful for the prescribing professional and adult to chart the adult's needs and individual response to the medication. Fine tuning may require changing the amount and/or timing of the dosing, changing the extended release stimulant to one with different characteristics, or adding an immediate release preparation at the beginning, middle or end of the extended release preparation's action. For example, if an adult has a business meeting later in the day or

Table 1

Methylphenidate Medications Used for the Treatment of ADHD in Adults

Category of Release	% Immediate Release (IR)	% Extended Release (ER) or Sustained Release (SR)	Characteristics of ER or SR	Approx. Duration of Action (hours)	Approx. Target Dosage Range
Immediate release preparations					
Methylphenidate • d & l isomers, 1/1 • Ritalin, Metadate, Methylin, generics	100%	0%	-	3-4 (ref. 4) 3-6 (ref. 22)	1-2 mg/kg/day
D-Methylphenidate or Dexmethylphenidate • Focalin	100%	0%	-	3-6	0.5-1 mg/kg/day
Sustained release preparations (older delivery systems)					
Methylphenidate • d & l isomers, 1/1 • Ritalin SR, Metadate ER, Methylin ER	0%	100%	• Waxy matrix • Temperature sensitive • Erratic continuous release	5-8 (ref. 22) 6-8 (ref. 4) but erratic after 4-5	1-2 mg/kg/day
Extended release preparations (newer delivery systems)					
Methylphenidate • d & l isomers, 1/1					
Concerta	22%	78%	• OROS: osmotic delivery system • Continuous release	12 (ref. 22)	1-2 mg/kg/day
Metadate CD	30%	70%	• Beads • Continuous release	6-8 (ref. 22)	1-2 mg/kg/day
Ritalin LA	50%	50%	• Beads • Pulsatile release 4 hours after IR • If low acidity, premature release possible	6-8 (ref. 22)	1-2 mg/kg/day

Note: Two references, referred to as "ref. 4" and "ref. 22", are mentioned in Tables 1 and 2. The structures of Tables 1 and 2 are adapted from reference 22. The references from which information was adapted include 4, 22, 27, 28, 29, 30, 31, and 34.

Table 2

Amphetamine Medications Used for the Treatment of ADHD in Adults

Category of Release	% Immediate Release (IR)	% Extended Release (ER) or Sustained Release (SR)	Characteristics of ER or SR	Approx. Duration of Action (hours)	Approx. Target Dosage Range
Immediate release preparations					
D-Amphetamine • Dexedrine, Dextrostat	100%	0%	-	4-6 (ref. 22) 5-6 (ref. 4)	0.5-1 mg/kg/day
D, L-Amphetamine • 3/1 • Adderall, generic mixed amphetamine salts	100%	0%	-	4-6 (ref. 22) 6-8 (ref. 4)	0.5-1 mg/kg/day
Sustained release preparations (older delivery systems)					
D-Amphetamine • Dexedrine Spansules, generic dextroamphetamine sulfate sustained release capsules	40%	60%	• Beads • Continuous release	6-8 (ref. 22) 8-10 (ref. 4)	0.5-1 mg/kg/day
Extended release preparations (newer delivery systems)					
D, L-Amphetamine • 3:1 • Adderall XR	50%	50%	• Beads • Pulsatile release 4 hours after IR • If low acidity, premature release possible	10-12	0.5-1 mg/kg/day

Note: Two references, referred to as "ref. 4" and "ref. 22", are mentioned in Tables 1 and 2. The structures of Tables 1 and 2 are adapted from reference 22. The references from which information was adapted include 4, 22, 27, 28, 29, 30, 31, and 34.

after dinner, he or she could take the extended release medication later than usual or add an immediate release dose or two late in the day.

Further consideration needs to be given to the effect of a high fat meal on blood levels of the medication. Generally, such a meal tends to delay the onset of the medication's clinical effects.[75,76,77,78,79,80] In addition, a recent study indicated that after a high fat breakfast, the blood levels of AMP associated with Adderall XR were significantly reduced over the first eight hours, in contrast to the MPH levels associated with Concerta, which were not reduced. However, the clinical significance of these findings is not yet known.[81]

PEMOLINE (CYLERT)

Pemoline (Cylert) is another psychostimulant that has been used over the years with good to moderate clinical responses. However, because of infrequent but potentially severe and even life threatening liver damage, the use of pemoline in both adults and children has decreased significantly. It is not considered a first line treatment, as its use continues to be highly problematic.[82,83,84]

NONSTIMULANT MEDICATIONS

With the exception of atomoxetine (Strattera), which will be discussed below, non-stimulant medications have generally been considered second line medications. They have been used in people who have an incomplete response or no response to stimulants, cannot tolerate stimulants, or have certain co-existing psychiatric conditions.

Atomoxetine (Strattera)

Atomoxetine (Strattera) was recently approved by the FDA for the treatment of ADHD in children, adolescents and adults. It is a potent selective norepinephrine reuptake inhibitor. It is the first nonstimulant medication to be approved by the FDA for the treatment of ADHD and the first medication of any kind specifically approved for the treatment of ADHD in adults.[85] It lacks the abuse potential of stimulants, and since it is not a controlled Schedule II drug, atomoxetine can be prescribed with refills and on the phone.

Atomoxetine was approved for once or twice daily dosing, but so far there is only published controlled data in adults on twice a day dosing.[86]

While the effects of stimulants are almost immediate, atomoxetine takes longer to produce a response. In terms of its effectiveness, a preliminary open label study in children indicated that its effectiveness might be similar to that of stimulants.[87] It may be useful in adults with ADHD and co-existing depression and/or anxiety, but controlled data is not yet available for atomoxetine's efficacy in this population.

It is not clear what atomoxetine's role in the treatment of adult ADHD will eventually be. It certainly looks very promising and will likely either be another first line medication, like psychostimulants, or a first second line medication after stimulants.

In controlled studies of adults, atomoxetine was associated with cardiovascular side effects including increased heart rate of five beats per minute and an increase in blood pressure of 3 mm Hg for systolic and 1 mm Hg for diastolic blood pressure. No controlled studies comparing the cardiovascular effects of atomoxetine and of stimulants have yet been published. Atomoxetine use has not been seen with the cardiac side effects associated with tricyclic antidepressants. Other side effects can include dry mouth, insomnia, nausea, constipation, decreased appetite, dizziness, decreased libido, erectile disturbance, and urinary retention, hesitation or difficulty.[88] Atomoxetine may lead, in rare cases, to severe liver injury resulting in liver failure if not stopped immediately on finding any liver effects (itching, dark urine, right upper quadrant tenderness or unexplained "flu-like" symptoms).

In a long-term, open label study of atomoxetine, two-thirds of adults with ADHD continued to have a positive therapeutic response through an average of 34 weeks.[89,90,91]

Atomoxetine With Other Medications

Atomoxetine is metabolized (broken down) in the liver by the CYP2D6 enzyme. Drugs that inhibit this enzyme, such as fluoxetine, paroxetine and quinidine, can inhibit this enzyme and slow the metabolism of atomoxetine. Decreasing the dosage of atomoxetine may be necessary when the person is taking these medications. Atomoxetine (as with the stimulants and TCAs) should not be taken with a mono-amine oxidase inhibitor (MAOI) or within two weeks of discontinuing a MAOI. Likewise, treatment with a MAOI should not be initiated within two weeks of discontinuing atomoxetine.[92]

ANTIDEPRESSANTS

Antidepressants that have a direct effect of increasing the neurotransmitter norepinephrine (but not serotonin as in the selective serotonin reuptake inhibitors [SSRIs] like fluoxetine) appear to have a positive effect on the core symptoms of ADHD. None of the antidepressants has been approved by the FDA for the treatment of ADHD in children, adolescents or adults; such treatment is considered off-label.[93]

Tricyclic Antidepressants (TCAs)

Desipramine (Norpramine) and nortriptyline both inhibit norepinephrine reuptake significantly. Both moderately reduce the core symptoms of ADHD in adults. The TCAs show negligible risk of abuse, have once daily dosing with 24 hour coverage, and are efficacious in those with co-existing anxiety and depression. However, it takes several weeks before a positive clinical effect, which is generally less robust than that of the stimulants, is seen. They are associated with potentially serious side effects including cardiac problems and possible death by overdose.[94,95,96,97]

Mono-amine Oxidase Inhibitors (MAOI)

MAOIs help ADHD by blocking the metabolism (breakdown) of norepinephrine and dopamine. There are no controlled studies on the treatment of ADHD in adults with MAOIs. The use of MAOIs requires strict adherence to a special diet to prevent a hypertensive crisis (massive, acute rise in blood pressure). The MAOIs, therefore, may have only limited usefulness in treating adults with treatment-resistant, non-impulsive ADHD symptoms with co-existing depression and anxiety.[98,99,100]

Bupropion (Wellbutrin)

Bupropion is an atypical antidepressant that increases dopamine and norepinephrine levels. It has a "moderate" response in adults with ADHD, but the effect is not considered as large as the effect of stimulants and may take several weeks to develop. When co-existing bipolar disorder is present, buproprion may result in less mood instability than TCAs. Presently, it must be dosed twice daily, but there is a once daily dose set to appear soon. It may be associated with a higher than average rate of drug-induced seizures if given in excessively high doses or to those with a history of seizures or bulimia.[101,102,103,104,105,106]

Venlafaxine (Effexor)

Venlafaxine blocks the reuptake of both norepinephrine and serotonin. Although there are no controlled studies of venlafaxine use in adults with ADHD, several non-controlled studies show some encouraging results. It may have a role in treating ADHD with co-existing depression and/or anxiety. Side effects of higher doses of venlafaxine may include increases in blood pressure, so blood pressure monitoring is recommended.[107,108,109,110,111]

ANTIHYPERTENSIVE AGENTS

Clonidine (Catapres) and guanfacine (Tenex, Intuniv) are alpha-2 and alpha-2a noradrenergic agents, respectively, that may indirectly affect dopamine by first affecting norepinephrine. Although they have been used to help children who have ADHD with hyperactive and aggressive symptoms, their use in adults has been generally minimal. A recent preliminary controlled study showed some efficacy of guanfacine in adults with ADHD. However, sedation and hypotensive effects as well as potential hypertensive rebound are issues of concern.[112,113,114,115]

WAKE-PROMOTING AGENT

Modafinil (Provigil) is approved by the FDA for the treatment of narcolepsy. Its main effect appears to be indirect activation of the frontal cortex rather than direct involvement in central dopamine and norepinephrine pathways. In a recent two week, controlled study of modafinil, 48% of adults responded favorably to the medication. Longer, controlled studies in adults are clearly needed. At this time, modafinil's utility may be limited to adults with ADHD who do not respond to first line medications.[116,117,118,119]

CHOOSING A MEDICATION

With or without a co-existing psychiatric disorder, the importance of matching the needs of the individual with the characteristics of the ADHD medication cannot be overemphasized. To date, the stimulants have been considered first line medications for ADHD. The process of choosing a medication should involve recognizing the negative side effects of a medication so that the risks and benefits can be adequately weighed in the decision. It is often useful to construct a daily timeline of the needs (both attentional and behavioral) of the adult.

For example, an adult who has severe ADHD symptoms that threaten his/her job may also have difficulty

controlling his/her hypertension. In this case, choosing a treatment for ADHD that has a significant effect during the most crucial hours of the work day but does not destabilize the tentatively controlled hypertension will require knowledge of the medications' actions over time as well as their cardiovascular side effects.

MONITORING THE EFFECTS OF MEDICATION

Monitoring the effectiveness of medication over time is important and may require substantial effort. However, fine tuning of the timing and dosing of the medication can often improve the time-related clinical response. Sometimes the prescribing professional alone may fulfill these functions; sometimes an experienced therapist who is familiar with the adult can provide additional input to help maximize the effectiveness of the medicine.[120] Clinical adjustment may include adding other medications or adding or changing the psychosocial interventions, such as behavioral, cognitive or supportive psychotherapy, coaching, and tutoring.

IMPROVING FUNCTIONING AND QUALITY OF LIFE

While improvement of the core symptoms of ADHD is important and crucial, it is often not the only goal of treatment. Rather, improved functioning in the real world (being self-sufficient, having a better quality of life and being able to cope with the demands of daily life) may be the most important outcome for an adult with ADHD. Recent controlled medication studies in adults with ADHD have begun to track and measure these functional improvements including psychosocial and quality of life functioning.[121,122,123,124,125]

Preliminary results of recent longer-term, open label studies with Adderall XR[126,127] and Strattera[128,129,130] have also become available. Future controlled, long-term medication studies in adults with ADHD are needed to accurately measure the effect of medication on functioning in the workplace, college and interpersonal relationships.

MEDICATION THERAPY IN ADULTS WITH ADHD AND CO-EXISTING PSYCHIATRIC DISORDERS

Approximately two-thirds to three-quarters of adults with ADHD will have at least one other psychiatric disorder during their lifetime.[131] These other disorders include antisocial personality disorder, anxiety disorders, depressive disorders, bipolar disorder, and substance use disorders (SUD). After diagnoses have been made, the clinician and adult should decide which diagnoses need to be treated and in what order.

There is no controlled research on medication therapy in adults with ADHD and co-existing conditions. The treatment decisions of the medical professional and the individual will be guided by their previous therapeutic and clinical experience, extrapolations from others' clinical experiences, and a rational, empirical approach to the individual's clinical response.

Significant co-existing conditions are usually treated first, before ADHD, especially if they cause more significant clinical and functional impairment and disturbance. This is particularly true with substance use disorders, severe depression and bipolar disorder, psychoses, and homicidal or suicidal ideation. It is important to consider how the ADHD may be affected by medication for a co-existing disorder—both positive and negative, both helpful and harmful. For example, treating depression with bupropion may also help ADHD. On the other hand, some medications for major depression and bipolar disorder may actually worsen ADHD symptoms. In an apparent middle case, the SSRIs (selective serotonin reuptake inhibitors), which by themselves do not appear to effectively treat ADHD symptoms directly, appear to be successful in the treatment of individuals who have co-existing depression and who are taking stimulants at the same time for ADHD.[132,133,134]

It is also important to note that medications for ADHD may affect co-existing disorders. For example, psychostimulants may worsen an untreated anxiety or bipolar disorder. The risk of stimulant abuse is also greater in an adults with substance use disorder and are actively using. However, as previously mentioned, successful treatment of ADHD tends to decrease the chances of a person with ADHD eventually developing a SUD.[135,136,137]

Some nonstimulant treatments of ADHD may simultaneously and adequately treat the co-existing disorder along with the ADHD. For example, an antidepressant (TCA, bupropion, venlafaxine) may effectively treat co-existing depression and ADHD, and similarly, a TCA or venlafaxine may successfully treat co-existing anxiety and ADHD. The use of atomoxetine in treating a co-existing depression and/or anxiety disorder is promising, but there are no data from controlled adult studies.

CONCLUSION

As awareness of ADHD's persistence and consequences throughout the lifespan has increased, so has the desire for successful treatment in adulthood. Medication continues to be a mainstay of treatment for ADHD. Psychostimulants continue to be the first line medications. The newest addition is atomoxetine, the first nonstimulant to be approved by the FDA for the treatment of ADHD and the first to be approved for treatment in adults with ADHD. Atomoxetine also shows promise to be a first line medication. Many other nonstimulant treatments are available and their roles in the medication therapy of adult ADHD are continually assessed. Addressing co-existing psychiatric disorders needs to be part of the decision-making process with adults with ADHD.

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For further information about ADHD or CHADD, please contact:

National Resource Center on AD/HD
Children and Adults with
Attention-Deficit/Hyperactivity Disorder
4601 Presidents Drive, Suite 300
Lanham, MD 20706
800-233-4050
www.help4adhd.org

Please also visit the CHADD Website at **www.chadd.org.**

National Resource Center on AD|HD
A Program of CHADD

Medications Used in the Treatment of ADHD

Generic Name	Brand Names	Duration	Form	Dosage Range	Common Side Effects
Stimulants					
Methylphenidate *Immediate release*	Methylin Ritalin	3-4 hours	tablets	5 mg 10 mg 20 mg	Moderate appetite suppression, mild sleep disturbances, transient weight loss, irritability, emergence of tics.
	Methylin Chewables	3-4 hours	tablets	2.5 mg 5 mg 10 mg	
	Methylin Solution	3-4 hours	liquid solution	5 mg/5ml 10 mg/5ml	
Extended release	Metadate ER Methylin ER	6-8 hours	tablets	10 mg 20 mg	Moderate appetite suppression, mild sleep disturbances, transient weight loss, irritability, emergence of tics.
	Metadate CD	8-10 hours	capsules	10 mg 20 mg 30 mg	
	Ritalin LA	8-10 hours	capsules	10 mg 20 mg 30 mg 40 mg	
	Concerta	10-12	tablet	18 mg 27 mg 36 mg 54 mg	
Transdermal Patch	Daytrana	10-12 hours (9 hours applied + up to three hours after removal)	transdermal patch	10 mg 15 mg 20mg 30mg	Moderate appetite suppression, mild sleep disturbances, transient weight loss, irritability, emergence of tics, skin irritation.
Methylphenidate SR *Sustained release*	Ritalin SR	4-8 hours	tablet	20 mg	Moderate appetite suppression, mild sleep disturbances, transient weight loss, irritability, emergence of tics.
Dexmethylphenidate SR	Focalin	4-6 hours	tablets	2.5 mg 5 mg 10 mg	Moderate appetite suppression, mild sleep disturbances, transient weight loss, irritability, emergence of tics.
Extended release	Focalin XR	6-10 hours	capsule	5 mg 10 mg 15 mg 20 mg 30 mg 40 mg	Moderate appetite suppression, mild sleep disturbances, transient weight loss, irritability, emergence of tics.

Dextroamphetamine *Short acting*	Dexedrine	4-6 hours	tablet	5 mg 10 mg	Moderate appetite suppression, mild sleep disturbances, transient weight loss, irritability, emergence of tics.
	ProCentra	4-6 hours	liquid	5 mg/5ml	
Intermediate acting	Dexedrine Spansule	6-8 hours	capsule	5 mg 10 mg 15 mg	Same as for short-acting dextroamphetamine
Lisdexamfetamine Dimesylate *Prodrug*	Vyvanse	10-12 hours	capsule	20 mg 50 mg 30 mg 60 mg 40 mg 70 mg	Moderate appetite suppression, mild sleep disturbances, transient weight loss, irritability, emergence of tics.
Mixed Amphetamine salts *Intermediate acting*	Adderall	4-6 hours	tablets	5 mg 7.5 mg 10 mg 12.5 mg 15 mg 20 mg 30 mg	Moderate appetite suppression, mild sleep disturbances, transient weight loss, irritability, emergence of tics.
Extended release	Adderall XR	8-12 hours	capsule	5 mg 10 mg 15 mg 20 mg 25 mg 30 mg	Moderate appetite suppression, mild sleep disturbances, transient weight loss, irritability, emergence of tics.
Nonstimulants					
Atomoxetine *Extended release*	Strattera	24 hours	capsule	10 mg 18 mg 25 mg 40 mg 60 mg 80 mg 100 mg	Nervousness, sleep problems, fatigue, upset stomach, dizziness, dry mouth. In rare cases, may lead to severe liver injury or possibly to suicidal ideation.
Atypical Antidepressants					
Bupropion	Wellbutrin	4-5 hours	tablets	75 mg 100 mg	Difficulty sleeping, headache, and in rare cases, seizures.
	Wellbutrin SR	12 hours	tablets	100 mg 150 mg 200 mg	
	Wellbutrin XL	24 hours	tablets	150 mg 300 mg	
Tricyclic Antidepressants					
Imipramine	Tofranil	8-24 hours	tablets	10 mg 25 mg 50 mg	Nervousness, sleep problems, fatigue, upset stomach, dizziness, dry mouth, accelerated heart rate, possible risk of cardiac arrhythmias.

Desipramine	Norpramin	8-24 hours	tablets	10 mg 25 mg 50 mg 75 mg 100 mg 150 mg	Has been associated with deaths from cardiac problems. Not recommended for children.
Nortriptyline	Aventyl Pamelor	8-24 hours	capsules	10 mg 25 mg 50 mg 75 mg	Nervousness, sleep problems, fatigue, upset stomach, dizziness, dry mouth, accelerated heart rate, possible risk of cardiac arrhythmias.
Antihypertensives					
Clonidine	Catapres	4-6 hours	tablets	0.1 mg 0.2 mg 0.3 mg	Fatigue, dizziness, dry mouth, increased activity, irritability, behavior problems, low blood pressure; abrupt discontinuation may lead to elevated blood pressure.
		24 hours	skin patch	0.1 mg/24 hrs 0.2 mg/24 hrs 0.3 mg/24 hrs	
Extended release	Kapvay	12-24 hours	tablets	0.1 mg 0.2 mg	
Guanfacine *Intermediate acting*	Tenex	6-8 hours	tablets	1 mg 2 mg	Fatigue, dizziness, dry mouth, increased activity, irritability, behavior problems, low blood pressure; abrupt discontinuation may lead to elevated blood pressure.
Extended release	Intuniv	12 - 24 hours	tablets	1 mg 2 mg 3 mg 4 mg	Fatigue, dizziness, dry mouth, increased activity, irritability, behavior problems, low blood pressure; abrupt discontinuation may lead to elevated blood pressure.