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# ADHD Prevalence and Risks of ADHD Medications in Virginia Interim Report

Joint Commission on Health Care  
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# Outline

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- Study mandate
- Background to ADHD and psychotropic treatment
- ADHD epidemiology
- ADHD treatment
- ADHD diagnosis and treatment policies in Virginia

# Study Mandate

HB1500, Item 30(A), requested that JCHC identify methods:

1. To raise awareness of health/addiction risks of Attention Deficit Hyperactivity Disorder (ADHD) medication use
2. To compile/track statistics on Virginia school children diagnosed with ADHD or other categories such as “specific learning disabilities, other health impairment, multiple disorder, and emotional disturbances”
3. Used by other states/countries to limit antipsychotic use
4. To identify the incidence/prevalence of prescribing anti-psychotics for off-label use

The analysis shall be reported by the JCHC to the Chairmen of the House Appropriations and Senate Finance Committees no later than November 30, 2018

# Background – Terms and Definitions

- Psychotropic, psychiatric, antipsychotic medications
  - Psychotropic/psychiatric medications: psychoactive medications that change brain function and result in alterations in perception, mood, consciousness or behavior
  - Antipsychotic medications: subset of psychotropic medications
- Typical and atypical antipsychotic medications
  - FDA-approved medications for various mental disorders (e.g., schizophrenia)
- Off label: use of a medicine outside scope of marketing authorization from the Food and Drug Administration (FDA) with respect to:
  - Disorder being treated;
  - Patient demographics (e.g., age); and/or
  - Prescribed dosage/route of administration
  - Note: “From the FDA perspective, once the FDA approves a drug, healthcare providers generally may prescribe the drug for an unapproved use when they judge that it is medically appropriate for their patient.”
- Misuse/non-medical use, abuse, dependence, addiction:
  - Misuse/non-medical use: use of drug for purpose other than intended (e.g., performance enhancement)
  - Abuse: consumption of drug in harmful amounts
  - Dependence: physical need for drug
  - Addiction: physical/psychological need for drug

# Background – ADHD Diagnosis

- Diagnosis by psychological assessment (no clinical biomarkers)
  - In the United States, diagnoses are guided by American Academy of Pediatrics (AAP) recommendations:
    - Diagnostic evaluation using DSM criteria
    - Assessment of extent/pervasiveness of impairment across multiple settings
    - Collection of information from multiple informants (e.g., parents, teachers, other adults involved in the child's care)
    - Assessment of co-existing conditions
  - Globally, diagnostic methodologies differ:
    - Some countries (e.g., UK) have historically relied on more restrictive ICD-based hyperkinetic disorder
    - Some countries rely on symptomology alone (vs. requiring evidence of impairment in the daily environment)

# Background – DSM Criteria

- DSM criteria have evolved: five editions of the DSM have been published, expanding ADHD diagnostic eligibility each time

## **Current diagnostic criteria (DSM-5):**

- 6+ symptoms of inattention (≥6 month duration) AND/OR
- 6+ symptoms (≥6 month duration) of Hyperactivity and impulsivity

**AND** • Several symptoms present: before 12 years old; in >1 setting

**AND** • Symptoms clearly interfere with/reduce quality of functioning

**AND** • Symptoms do not occur exclusively during course of schizophrenia/psychotic disorder and are not another mental disorder

## **Examples:**

- Has difficulty remaining focused during lengthy reading
- Often fidgets with or taps hands or feet or squirms in seat
- At home, in school
- Social, academic, occupational
- Mood/anxiety/personality disorder; substance intoxication/withdrawal

# ADHD Epidemiology: Nationally

- ADHD is most diagnosed neurodevelopmental disorder among children and adolescents in U.S.
  - 53% of diagnoses by primary care physicians; 23% by psychiatrists
- Estimated children/adolescent prevalence:
  - 2011 (parent reports): 11%
  - 2013 DSM-5 estimate: 5%
  - Note: Estimated global prevalence among children / adolescents is 3.4% - 7.2% (2014) and 2.5% for adults (2015)
- 2016 prevalence in colleges/Universities: 6.7% (national student survey)
- Populations more likely to be diagnosed in U.S.: boys, non-Hispanic Caucasians, southern/Midwest States
- High incidence of concurrent disorders (e.g., conduct, mood, anxiety, substance use disorders)

# Possible Drivers of ADHD Diagnostic Variation in the US\*

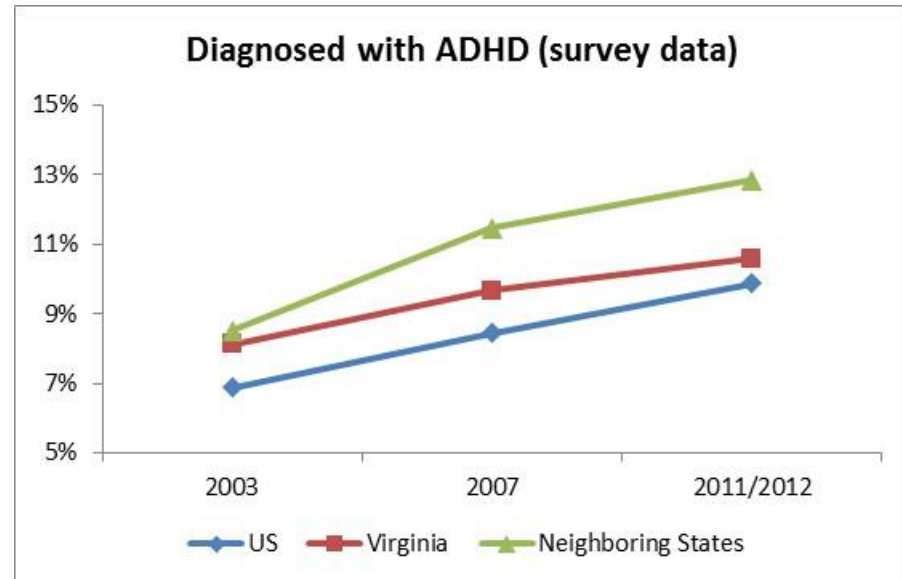
- State-level demographic differences (e.g., ADHD prevalence in CA and NC is 6% and 15.5%, respectively)
- Schooling factors
  - Evidence that No Child Left Behind law was associated with increase in ADHD diagnosis among certain populations
  - Laws limiting school involvement in recommendation and/or administration of psychotropic medications may be associated with lower diagnostic prevalence
  - Children born just before school cut-off dates are more likely to be diagnosed with ADHD/receive stimulants compared to those born after cut-off dates
- Diagnostic factors
  - Evolving DSM criteria
  - Application of DSM criteria used (e.g., diagnoses can be reduced by 50% when full criteria are rigorously applied)

\* See Appendix for additional detail on the content of this slide



# ADHD Epidemiology: Prevalence in Virginia\*

- ADHD prevalence in general population (2003-2012):



Source: National Survey on Child Health (NSCH)

- ADHD prevalence in insured populations:
  - Commercial health insurance markets (2014/2015): 6.9%-7.8% of individuals <20 (3.3% of individuals 20+)\*\*
  - Medicaid (2014): 7.9% of children 4-17 (3.3% of adults 18-25) in Managed Care Organizations (MCO)

\* See Appendix for additional detail on the content of this slide

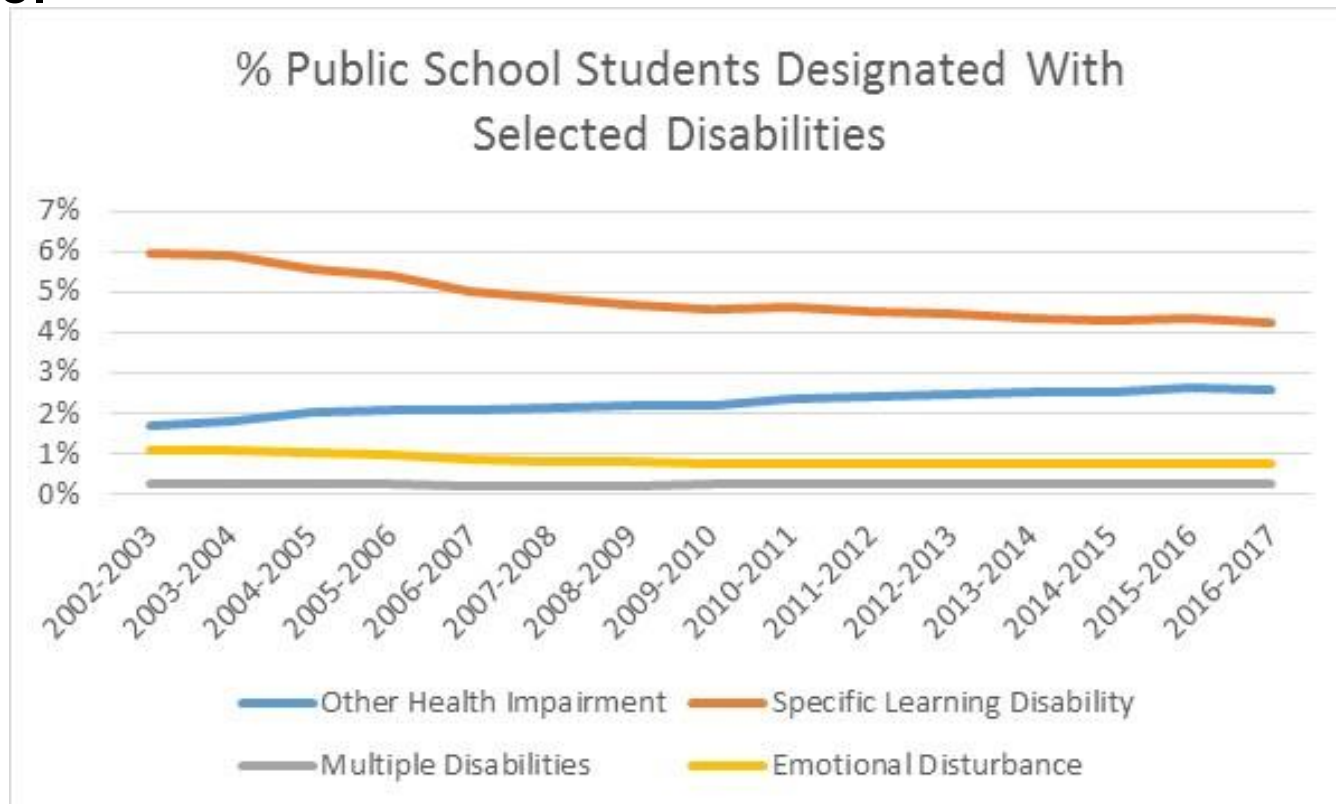
\*\*Data represent: 100% of individuals with fully insured policies; an estimated 50% of individuals with self-insured policies

# ADHD Epidemiology: Prevalence in Virginian School Children

- Two federal laws – the Individuals with Disabilities Education Act (IDEA) and Rehabilitation Act – guarantee that public school students diagnosed with disabilities are eligible for educational accommodations through Individualized Education Plans (IEPs) and “Section 504” plans, respectively
- Under IDEA, ADHD is listed as an eligible disability in the “Other Health Impairment” (OHI) designation that also includes:
  - Diabetes
  - Epilepsy
  - A heart condition
  - Lead poisoning
  - Leukemia
  - Nephritis
  - Rheumatic fever
  - Sickle cell anemia
- While federal reporting requirements exist for disabilities including OHIs, no direct measure of ADHD is collected by the Virginia Department of Education (DOE)

# ADHD Epidemiology: Prevalence in Virginian School Children (2)

- Between 2002 and 2017, the percentage of students designated with an OHI disability increased from 1.7% to 2.6%
- Without ADHD-specific data, it is unknown the degree to which ADHD has played a role in the increase of OHI designations over time.

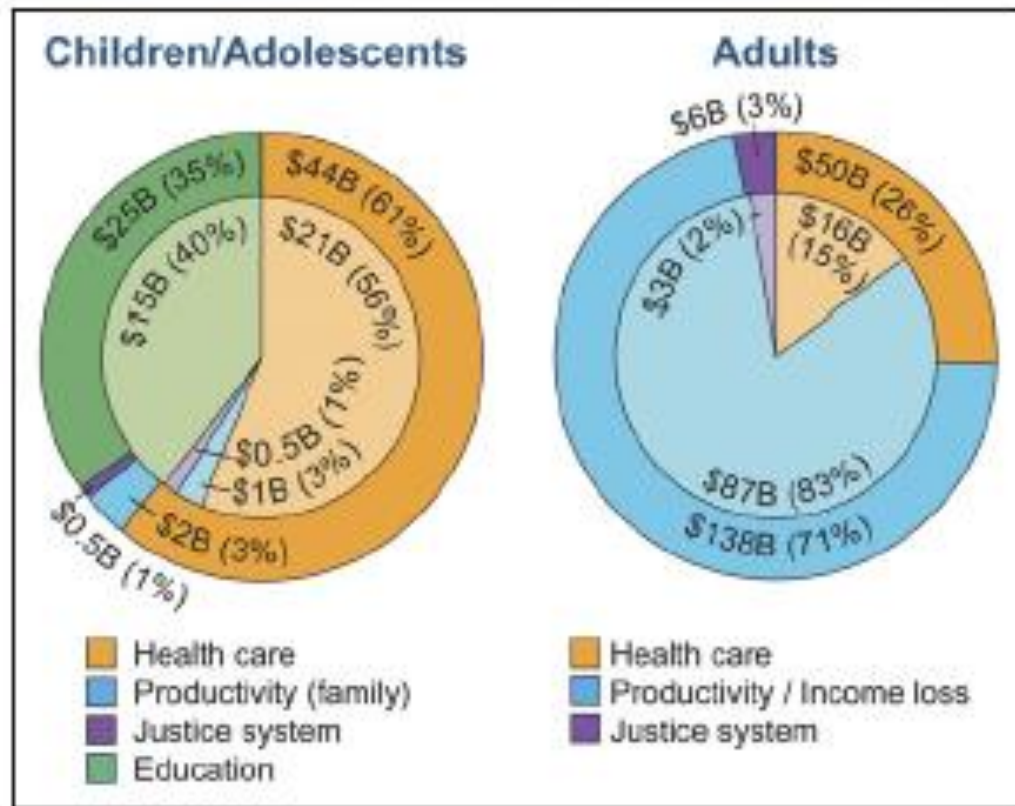


# Adverse Impacts of ADHD – Individuals\*

- An estimated 15%-65% of ADHD-diagnosed children experience symptoms into adulthood
  - Wide variation likely reflects heterogeneity in definition of symptom persistence
- Impacts on health/social outcomes include:
  - Decreased life expectancy; increased mortality risk
  - Increased risk of vehicle accident
  - Mixed evidence of association with obesity
  - Higher odds of failure to complete high school
  - Higher odds of unemployment; reduction in earnings
  - Increased probability of arrests, convictions, and incarcerations

# Adverse Impacts of ADHD – Societal

- Estimated annual national costs are \$140B - \$265B



Source: Doshi et al (2011)

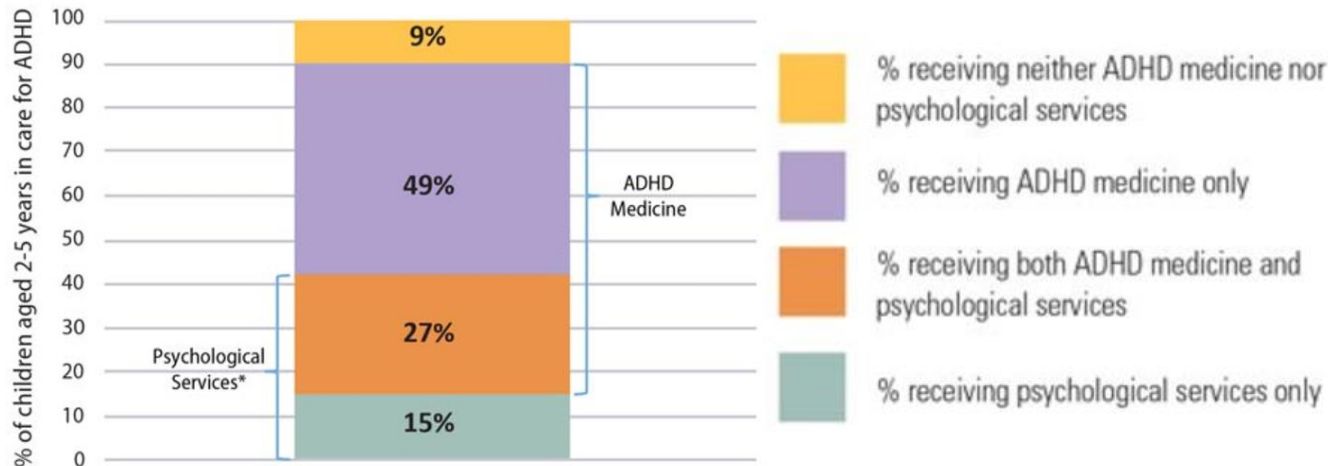
# ADHD Treatment

- Pharmacological treatments
  - 26 formulations of stimulant and non-stimulant medications targeting norepinephrine and dopamine are FDA-approved for treating ADHD among varying age groups (3+ years old)
  - AAP recommendations:
    - Preschoolers (< 6 years of age)
      - Behavior therapy; methylphenidate (stimulant) if no significant improvement
    - Elementary age (>=6 – <12)
      - ADHD medications (preferably stimulants) and/or behavior therapy
    - Adolescents (12 - <19)
      - ADHD medications; behavior therapy optional (but combination preferable)
  - Differing recommendations in other countries (e.g., UK: medications never recommended for preschoolers)
- Psychological interventions (e.g., behavioral/cognitive interventions, parent training, social skills training)

# ADHD Treatment – National Trends

- FDA-approved ADHD medication
  - Two-thirds to 75% of children/adolescents diagnosed receive medications
  - Stimulant prescriptions tripled between 1990 and 2000
- Psychological services
  - 2008-2015: 54% of Medicaid population and 45% of employer-sponsored population received psychotherapy

## Treatment types among young children with employer-sponsored insurance in clinical care for ADHD



Data Source: Truven Health MarketScan Commercial Database (weighted), 2014

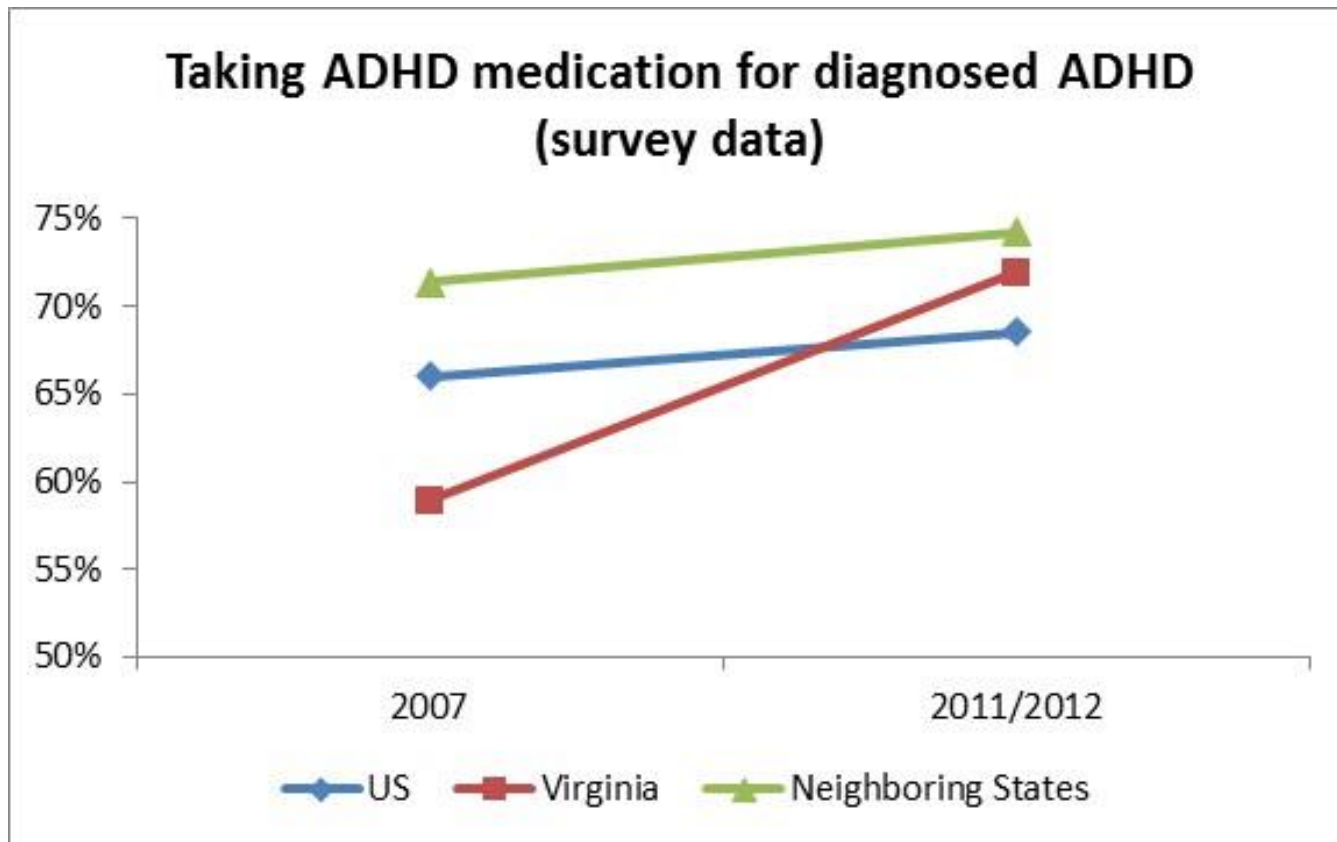
Note: Using the most recent data, the percentage of young children with ADHD who received psychological services was higher among Medicaid (54%) compared to those with Employer-Sponsored Insurance (42%).

\*Psychological services may include behavior therapy training for parents.

Source: CDC (n.d.)

# ADHD Treatment – Virginia

- ADHD treatment in general population
  - In 2011, an estimated 72% of Virginia youth diagnosed with ADHD were taking ADHD medications



Source: NSCH



# ADHD Treatment – Virginia (2)\*

- ADHD treatment in insured populations
  - Commercial health insurance markets (2014-2015)\*\*
    - 51% – 54% of enrolled individuals <20 years old (61% - 64% of adults 20+) who were diagnosed with ADHD were prescribed an ADHD medication
    - Around 4% of all enrolled individuals <20 years old (2% of adults 20+) were prescribed ADHD medication
  - Medicaid (2015): around 7.4% of all enrolled individuals <18 years old (1.2% of adults 18+) were prescribed ADHD medication

\* See Appendix for additional detail on the content of this slide

\*\*Data represent: 100% of individuals with fully insured policies; an estimated 50% of individuals with self-insured policies

# ADHD Treatment Quality – Medicaid\*

- Magellan Clinical Practice Guideline (CPG) review of 139 patient records in 2015-2016\*\*

Assessment	CPG Provider Assessment Score <=3: Adherent; >3: Not Adherent	
	2015	2016
Suicide Risk	2.5	1.1
Major Depressive Disorder	3.2	2.5
Schizophrenia	4.7	1.39
ADHD	6.8	6.6

Source: Magellan (2017); Magellan (2016)

- Follow-up care for children 6-12 years old prescribed ADHD medication (2016) in MCOs

Phase	Virginia	US average
Medication initiation	44%	42%
Medication continuation/maintenance	56%	52%

Source: DMAS (2017)

\* See Appendix for additional detail on the content of this slide

\*\* Records covered individuals receiving carved-out behavioral health services

# ADHD Pharmacological Treatment – Effectiveness\*

- In the short-term:
  - Consistent evidence that FDA-approved ADHD medications reduce symptoms (e.g., 20% reduction in ADHD rating score)
  - Consistent evidence that combined psychotherapy/ADHD medications more effectively improves outcomes beyond ADHD symptoms than ADHD medications alone (e.g., comorbidities, academic achievement, social functioning)
  - However, a recent meta-analysis concluded that the strength of evidence on ADHD medication effectiveness is low, primarily due to a high risk of bias in ADHD studies
- In the long-term:
  - Inconsistent/limited evidence of effectiveness of ADHD pharmacological treatment on outcomes
  - Evidence base may reflect limited long-term ADHD medication efficacy and/or varying provider/patient practices

# ADHD Pharmacological Treatment – Safety\*

- Studies generally find increased risk of non-serious adverse events (AEs) from stimulant use (e.g., decreased appetite, GI pain, headache), although:
  - Follow-up periods to study AEs are typically short
  - There is evidence of a large number of individuals dropping out of studies due to serious AEs, likely underestimating the number of serious AEs
- Concerns have been raised about the number of studies conducted by the same groups of authors and/or sponsored by pharmaceutical companies manufacturing ADHD medications

# ADHD Pharmacological Treatment – Safety (2)\*

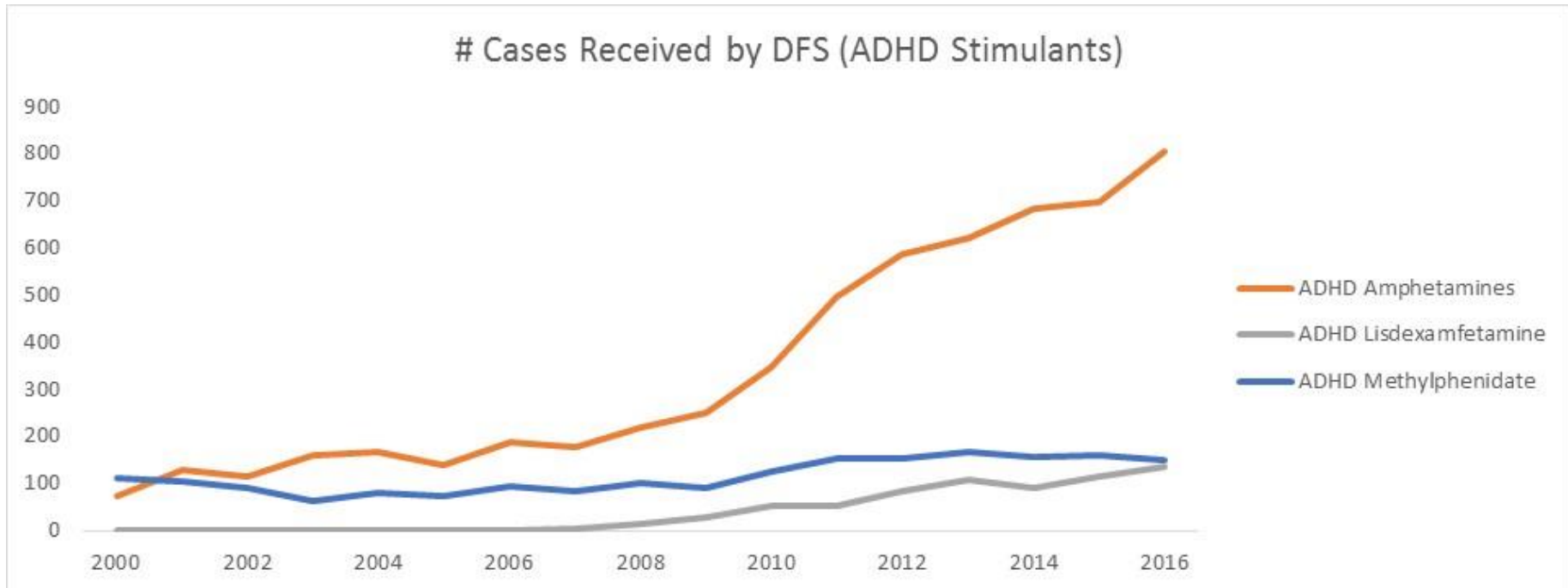
- Strong evidence that stimulant use can cause short-term weight loss/slowed growth
- Mixed evidence on effects on longer-term growth
- Studies have found increased risk in cardiovascular disease (CVD), ranging from small increases to over 2 times the risk
- Most studies find stimulants are not associated with – or are protective against – developing a substance use disorder (SUD)
- Evidence that long-term stimulant use is protective against depression

# ADHD Stimulants – Non-medical Use/Misuse Nationally\*

- FDA label (“black box”) warnings on ADHD medications:
  - Amphetamines: have a high potential for abuse; administration for prolonged periods of time may lead to drug dependence and must be avoided; misuse may cause sudden death/serious cardiovascular adverse events
- 3.4% of those 12+ years old estimated to have used prescription ADHD stimulants for non-medical purposes during their lifetime
- Misuse of stimulants among grade school and high school-age children estimated at 5% to 9%
- Misuse of stimulants among college-age population estimated at 5% to 35%
- Emergency Department (ED) visits for non-medical use of stimulants:
  - Tripled between 2005 and 2010
  - Doubled among those 18+ years old

# ADHD Stimulants – Non-medical Use/Misuse in Virginia

- The number of law enforcement cases in Virginia involving ADHD stimulants increased from 184 in 2000 to 1,089 in 2016



Source: Department of Forensic Sciences

# ADHD Stimulants – Abuse/Addiction

- Stimulant misuse and/or abuse does not equate to addiction
- While ADHD stimulants have abuse potential:
  - Their pharmacological properties considerably reduce their abuse potential compared to non-prescription stimulants (e.g., cocaine)
  - There is evidence that long-acting formulations have successfully limited actual abuse in comparison to abuse potential
- There is little evidence of addiction to ADHD stimulants



# Antipsychotic Medication Use – National Trends

- Atypical antipsychotics (AAPs) are FDA-approved for:
  - Autism
  - Bipolar mania
  - Major depressive disorder
  - Schizophrenia
  - Schizoaffective disorder
  - Tourette's disorder
- ADHD co-occurs with several of these conditions (e.g., 10% - 28% with bipolar disorder)

# Antipsychotic Medication Use – National Trends (2)\*

- Use of antipsychotics has grown substantially since the early 2000s
- ADHD is one of the most common mental health diagnoses among youth prescribed antipsychotics, which may reflect a combination of:
  - Co-occurrence of ADHD with FDA-indicated conditions for antipsychotics (e.g. major depressive disorder, bipolar mania, autism)
  - Off label use for a condition co-occurring with ADHD (e.g. aggression)
  - Off label use for ADHD
- In terms of off label use, studies have found:
  - Increased off-label use of Atypical Antipsychotics (AAPs) over time
  - A significant percentage (e.g., 18%-20% in the mid-2000s) of ADHD-diagnosed youth are prescribed AAPs without a condition indicated for use
  - More recent data on off label use of AAPs are limited

# Antipsychotic Medication Use – Virginia Trends

- AAP medication prevalence among those diagnosed with ADHD in commercial health insurance markets (2014-2015)\*
  - 5.4% - 6.1% of ADHD-diagnosed individuals < 20 years (5.0% - 6.4% of ADHD-diagnosed individuals 20+ years) were prescribed atypical antipsychotics
- Off label AAP medication prevalence among all enrollees in commercial health insurance markets (2014-2015)\*\*
  - Of the approximately 29,000 individuals prescribed AAPs, 31% did not have a FDA-indicated diagnosis for the prescribed AAP
  - Of the approximately 8,800 individuals with an ADHD diagnosis and prescribed AAPs, 46% did not have a FDA-indicated diagnosis for the prescribed AAP

\* Data represent: 100% of individuals with fully insured policies; an estimated 50% of individuals with self-insured policies

\*\* “Off label”: based on non-FDA-indicated diagnosis only, not non-indicated age or dosage level

# Antipsychotic Medication Use Quality – Medicaid

- Among children and adolescents 1-17 years old in the Medicaid population, data from 2016 indicate:
  - Higher than national average use of multiple concurrent antipsychotics
  - Lower than national average use of 1<sup>st</sup>-line psychosocial care
  - Around the national average use of metabolic monitoring for side effects

Indicator	VA MCO Average	National Median
Multiple concurrent antipsychotic use	2.66%	1.99%
Metabolic monitoring for side effects	29.8%	29.6%
1 <sup>st</sup> -line psychosocial care (psychosocial care used before antipsychotics)	51.83%	60.43%

Source: DMAS (2017)

# Atypical Antipsychotics – Effectiveness and Safety

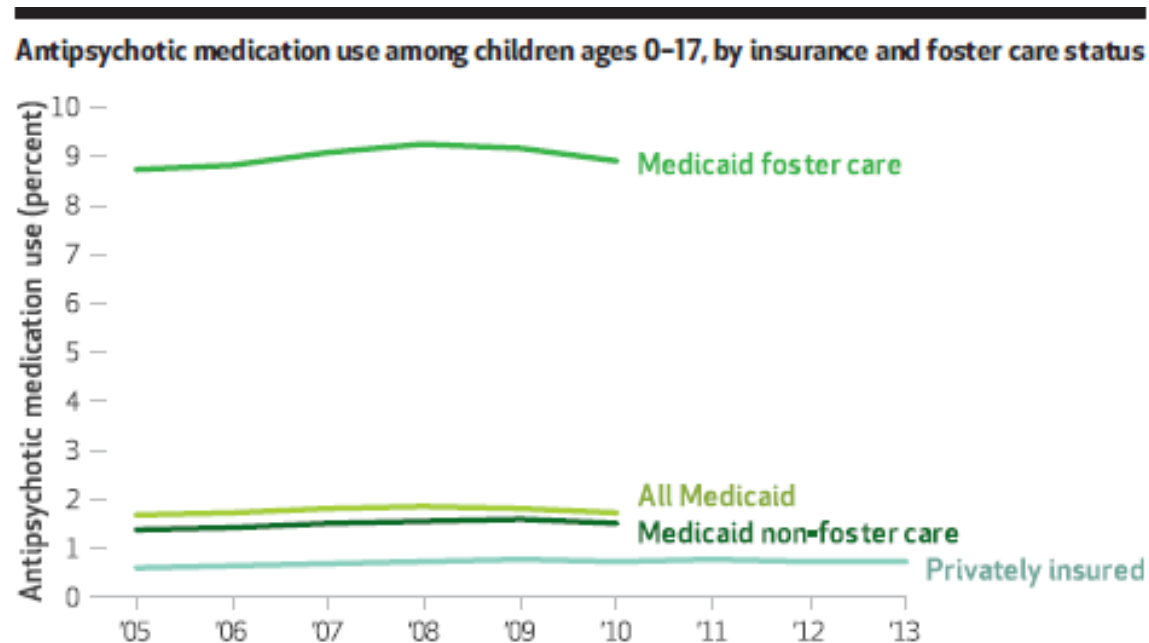
- A recent Agency for Health Research Quality (AHRQ) study (2017) assessed both effectiveness and harms of AAPs
- AAP effectiveness among patients with ADHD:
  - Probably reduces conduct problems and aggression in children with ADHD and/or conduct disorders
  - Appears to reduce clinical severity in patients with ADHD (although probably more for patients with a primary diagnosis of other behavioral disorder)
  - There is moderate evidence of clinical benefit only for those unresponsive to stimulants medications for ADHD or have other behavioral disorders as the primary diagnosis
- AAP safety among all populations:

Adverse Event/Side Effect	Evidence of Risk
Any drug-induced movement disorder	Probably increases
Weight/BMI	Probably increases slightly
Total cholesterol	May increase
Triglycerides	Probably increases
Sedation/somnolence	Probably increases

Source: AHRQ

# Psychotropic Medications – Foster Youth Populations (Nationally)

- Concerns in 2000s of use of psychotropic medications in foster care populations
- Since late 2000s, federal legislation has required States to develop psychotropic medication monitoring programs
- After peaking in 2008, rates of AAP prescriptions in foster children stabilized



Source: Crystal (2016)

# Psychotropic Medications – Foster Youth populations (Virginia)

- A study from 2015-2016 on Virginia children and adolescents 1-17 years old in foster care provide data on use of ADHD medication and antipsychotics
- While no benchmarks were provided by which to compare these data to other States or foster populations, compared to data from the general Medicaid population from 2016\*:
  - Multiple concurrent use of antipsychotics (1.9% compared to 2.7% of Medicaid enrollees)
  - Use of 1<sup>st</sup>-line psychosocial care before initiating antipsychotics was higher (86% compared to 52% of Medicaid enrollees)

Indicator	Percentage
<b>ADHD Medications</b>	
ADHD medication prevalence	43%
Newly prescribed ADHD medication	9%
<b>Antipsychotics</b>	
Multiple concurrent antipsychotic use	1.9%
1 <sup>st</sup> -line psychosocial care (psychosocial care used before antipsychotics)	86%

Source: HSAG (2017)

\* See Slide 28

# Summary – ADHD

- Variations in prevalence of ADHD across countries, States and populations likely reflect a combination of inherent differences, differing diagnostic criteria (including multiple changes over time in the DSM criteria) and practices, and schooling factors.
- Untreated ADHD is associated with sizeable adverse impacts to individuals and society.
- While there is consistent evidence that 1<sup>st</sup>-line ADHD medication treatment reduces ADHD symptoms in the short-term, its longer-term effectiveness is not as well-established. Additionally, there is well-documented evidence that ADHD stimulant use can have short-term health side effects, but implications on longer-term health is more uncertain.
- Data from Virginia suggest that ADHD prevalence and medication use are largely in line with national trends. While some quality data indicate better-than-national-average practices (e.g., follow-up care), other suggest practices lag behind those for other behavioral health conditions (e.g., clinical practice guideline scores).
- Misuse of ADHD stimulants may be sizeable among some populations (e.g., college-aged individuals), although there is little evidence of addiction to stimulants.



# Summary – Antipsychotics

- Conditions for which atypical antipsychotics (AAPs) are FDA-approved co-occur at elevated rates with ADHD, and ADHD is one of the most common mental health diagnoses among youth prescribed AAPs.
- Off label use of AAPs has increased over time, and there is evidence that a significant percentage of ADHD-diagnosed youth are prescribed AAPs off label.
- Recent data from the commercial health insurance markets in Virginia suggest that around 31% of individuals were prescribed antipsychotics off label.
- Concerns since the 2000s have been raised in the US about the use of AAPs among foster populations. Recent quality data from Virginia suggest that practices are favorable compared to the general Medicaid population (e.g., lower multiple concurrent antipsychotic use).

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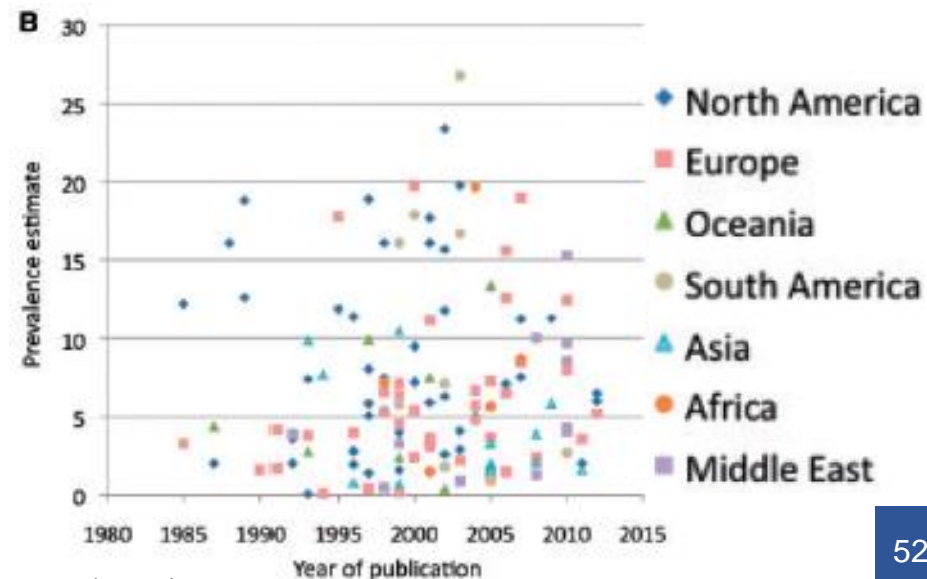
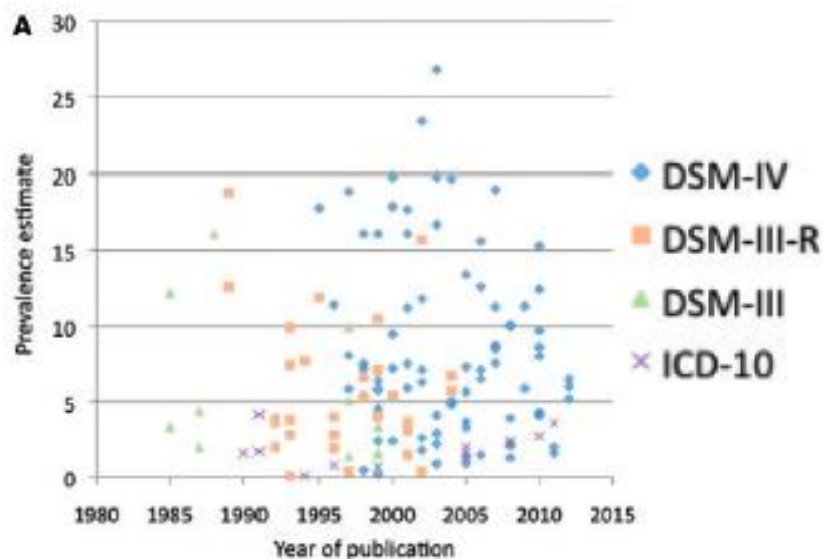
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# Appendix: Additional Detail

# ADHD Epidemiology: Globally

- Estimated ADHD prevalence:
  - Children/adolescents: 3.4% - 7.2%; adults: 2.5%
- Time trends:
  - Evidence of increased global diagnostic prevalence driven by successive DSM versions
  - Little evidence that temporal increase/geographic variation in diagnostic prevalence if standardized diagnostic procedures followed (e.g., DSM vs ICD criteria)



Source: Polanczyk et al (2014)

# ADHD Epidemiology: Prevalence in Virginia

- Sub-populations
  - Child Development Centers (CDCs) overseen by the Department of Health (VDH): In 2016, 1,081 children accessing CDCs were diagnosed with ADHD, representing 24% of diagnoses made

# Adverse Impacts of ADHD – Individuals

- An estimated 5% - 75% of ADHD-diagnosed youth experience symptoms into adulthood
  - Wide variation likely reflects heterogeneity in symptom assessment
  - Longest-running US study on ADHD found symptom persistence of 60% and impairment persistence of 41%.
- Estimated impacts on health/social outcomes include:
  - Health:
    - Decreased life expectancy/50% increase in mortality risk
    - 36% increase in risk of vehicle accident among adolescents/young adults
    - Mixed evidence of association with obesity
  - Academic achievement:
    - 3.7 times the odds of failure to complete high school
  - Employment:
    - Higher odds of unemployment/33% reduction in earnings
  - Criminality:
    - 2 to 3 times higher risks of arrests, convictions, and incarcerations

# ADHD Treatment – Virginia

- DBHDS inpatient facilities: between 2014 and 2017, approximately:
  - 2% of individuals across all DBHDS facilities were prescribed ADHD medication
  - 15% of children at the Commonwealth Center for Children were prescribed ADHD medication
- Community Services Boards: between 2015 and 2017, 15% - 16% of individuals seeking any services had an ADHD diagnosis

# ADHD Treatment Quality – Medicaid

- Magellan Clinical Practice Guideline (CPG) review of 139 patient records in 2015-2016\*

Assessment	CPG Provider Assessment Score <=3: Adherent; >3: Not Adherent	
	2015	2016
Suicide Risk	2.5	1.1
Major Depressive Disorder	3.2	2.5
Schizophrenia	4.7	1.39
ADHD	6.8	6.6

- Practices scoring <50% adherence (2015):

Diagnostic assessment	Therapeutic interventions
<ul style="list-style-type: none"> <li>• If provider is not a physician, reviewed findings from consultation with psychiatrist or primary care physician</li> </ul>	<ul style="list-style-type: none"> <li>• If referral for a medical/psychiatric evaluation, provider included the results of evaluation in the treatment planning</li> </ul>
<ul style="list-style-type: none"> <li>• Considered partial remission (fewer than full criteria met when full criteria were previously met)</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted education about ADHD/treatment including psychological services/pharmacological intervention</li> </ul>
<ul style="list-style-type: none"> <li>• Considered whether few/many symptoms are in excess of those required to make diagnosis of ADHD</li> </ul>	<ul style="list-style-type: none"> <li>• Co-morbid medical and psychiatric conditions discussed with parents, guardians, and if applicable patient</li> </ul>
<ul style="list-style-type: none"> <li>• Coordinated care with medical provider/medical evaluation during diagnostic process ruled out medical causes of symptoms of ADHD and assessed cardiovascular functioning</li> </ul>	<ul style="list-style-type: none"> <li>• Provider assessed if psychotherapy is indicated</li> </ul>
<ul style="list-style-type: none"> <li>• If suicidal thoughts or behaviors were present, appropriate actions were taken to intervene</li> </ul>	

\* Records covered individuals receiving carved-out behavioral health services



# ADHD Pharmacological Treatment – Long-term Effectiveness

- There is inconsistent/limited evidence of effectiveness of ADHD pharmacological treatment on outcomes. Strength of evidence may reflect limited long-term ADHD medication efficacy and/or varying provider/patient practices (e.g., treatment adherence) under uncontrolled/long-term conditions.

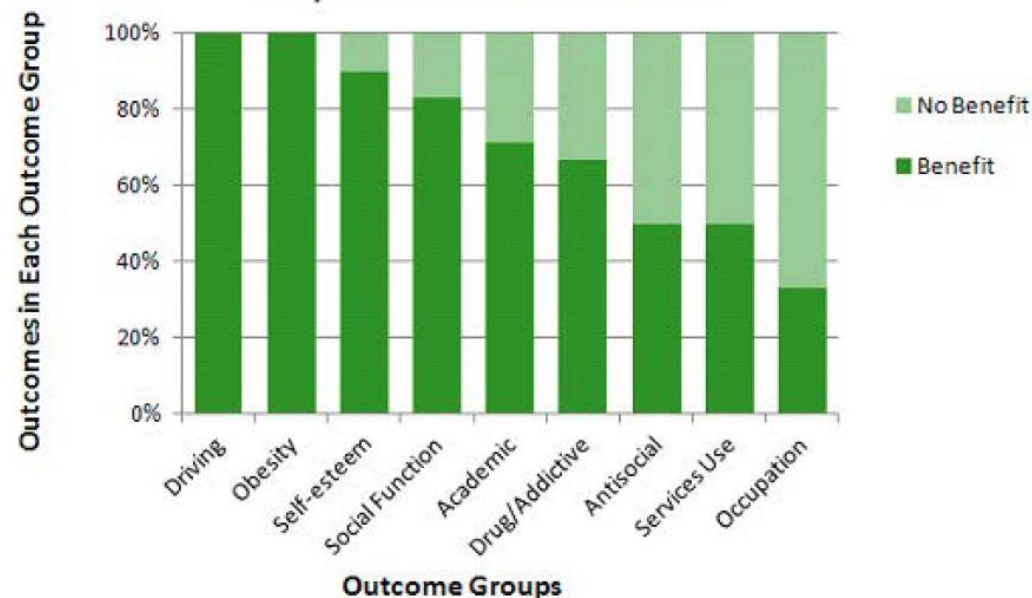
- For example:

- Systematic review found most studies reporting benefit of ADHD medications for multiple long-term outcomes
- Study of South Carolina Medicaid population over 10 years found ADHD medication associated with reduced: STDs by 3.6%; SUDs by 7.3%; injuries becoming injured by 2.3%

**BUT** • Three years after enrollment in landmark 14-month Randomized Control Trial on ADHD, no significant differences detected between children treated with ADHD medications and those without, on: ADHD/other behavioral symptoms; or functioning (e.g., grades earned in school)

- Natural experiment study from Canada: little evidence of positive effects on schooling attainment

**Treatment Benefit by Outcome Group**  
compared with untreated ADHD



# ADHD Pharmacological Treatment – Safety

- FDA safety communications on ADHD medications:
  - Permanent loss of skin color may occur (2015)
  - Methylphenidate may in rare instances cause prolonged/painful erections (2013)
  - Studies have not shown increased risk of serious CVD AEs in adults (2011)
  - Manufacturers should develop patient Medication Guides to alert patients to possible CVD/psychiatric symptoms risks (2007)
- FDA label (“black box”) warnings on ADHD medications:
  - Amphetamines: have a high potential for abuse; administration for prolonged periods of time may lead to drug dependence and must be avoided; misuse may cause sudden death/serious cardiovascular adverse events
  - Methylphenidates: should be given cautiously to patients with a history of drug dependence or alcoholism; chronic abusive use can lead to marked tolerance and psychological dependence with varying degrees of abnormal behavior; frank psychotic episodes can occur, especially with parenteral abuse
  - Strattera (non-stimulant): Increased risk of suicidal ideation in children or adolescents
- Meta analyses/systematic reviews generally find increased risk of non-serious adverse events (AEs) from stimulant use, although follow-up periods to study AEs are typically short-term
- Review study of AEs in pediatric populations (2011):
  - Very few reported serious AEs. However, a large number of children found to drop out of studies due to serious AEs, likely underestimating the number of serious AEs.
  - A large number of studies conducted by the same groups of authors and sponsored by the pharmaceutical companies manufacturing the respective medications effectiveness/safety

	Methylphenidate (MPH)	Atomoxetine (ATX)
Loss of appetite	+	+
Growth restriction	++	+
Other gastrointestinal symptoms: abdominal pain, nausea, vomiting, diarrhoea (MPH), constipation (ATX), dyspepsia, dry mouth	+	+
Increase in blood pressure and heart rate	+	+
Cough, nasopharyngitis	+	--
Sleep disturbances	++	+
Tics	+	--
Irritability, mood changes	+	+
Drowsiness	+	++
Dizziness	+	+
Headache	++	+

+-common side-effect. ++-if the side-effect is common for both drugs, the effect is more pronounced for this drug compared with the other. --side-effect not common.

Table: Some of the more common side-effects associated with pharmacological treatment

\* Thapar et al (2016)

# ADHD Pharmacological Treatment – Side Effects

- Growth
  - Strong evidence that stimulant use can cause short-term weight loss/slowed growth
  - Mixed evidence on effects on longer-term growth (some studies have found growth catch-up associated with “drug holidays” or treatment cessation, others have found persistent growth retardation)
- Cardiovascular Disease (CVD)
  - Studies have found increased risk in CVD, ranging from small increases to over 2 times the risk
  - Power of most studies to detect risk differences is generally low because CVD is a relatively rare event in study populations
- Substance Use Disorder (SUD)
  - Most studies find stimulants are not associated with – or are protective against – developing a SUD (over short- and long-term follow up)
- Depression
  - Evidence that long-term stimulant use is protective against depression
- Psychotic disorders
  - Little evidence of association between stimulant use and new onset or worsening of tics

# ADHD Stimulants – Non-medical Use/Misuse Nationally

- 3.4% of those 12+ years old estimated to have used prescription ADHD stimulants for non-medical purposes
  - School-age population:
    - Misuse of stimulants estimated at 5% to 9%
    - 7.5% of high school seniors reported past-year nonmedical use of Adderall (2015)
  - College-age population:
    - Misuse of stimulants estimated at 5% to 35%
    - Recent data indicate 17% of students estimated to have used prescription stimulants
- Among those using stimulants for non-medical use:
  - >95% use an illicit drug/non-medical use of another prescription drug
  - 10% - 13% have substance dependence
- Emergency Department (ED) visits for non-medical use of stimulants tripled between 2005 and 2010 (from 5,212 to 15,585)
  - Medical use ED visits doubled among those 18+ years old

# Antipsychotic Medication Use – National Trends

- Atypical antipsychotics (AAPs) are FDA-approved for:
  - Autism
  - Bipolar mania
  - Major depressive disorder
  - Schizophrenia
  - Schizoaffective disorder
  - Tourette’s disorder
- ADHD co-occurs with several of these conditions
  - Patients with psychotic disorders in general are twice as likely to have childhood ADHD diagnosis (2003 study)
  - Bipolar disorder: co-occurrence of ADHD: 10% - 28%
  - Other disorders indicated for AAPs:

**TABLE 1** Prevalence of Comorbid Disorders for Children With ADHD Versus Those Without (N = 61 779)

	No ADHD	ADHD	Adjusted Relative Risk <sup>b</sup>	95% CI
Learning disability (%)	5.3	46.1 <sup>a</sup>	7.79	6.86–8.86
Conduct disorder (%)	1.8	27.4 <sup>a</sup>	12.58	10.23–15.48
Anxiety (%)	2.1	17.8 <sup>a</sup>	7.45	6.08–9.12
Depression (%)	1.4	13.9 <sup>a</sup>	8.04	6.09–10.62
Speech problem (%)	2.5	11.8 <sup>a</sup>	4.42	3.41–5.73
Autism spectrum disorder (%)	0.6	6.0 <sup>a</sup>	8.72	5.97–12.72
Hearing problem (%)	1.2	4.2 <sup>a</sup>	2.77	1.87–4.11
Epilepsy or seizures (%)	0.6	2.6 <sup>a</sup>	3.93	2.19–7.06
Vision problem (%)	1.4	2.3 <sup>a</sup>	1.47	0.98–2.20
Tourette’s syndrome (%)	0.09	1.3 <sup>a</sup>	10.70	4.72–24.23
Any MH/ND disorder (%)	11.5	66.9 <sup>a</sup>	5.12	4.72–5.55

<sup>a</sup> P < .05 for  $\chi^2$  test.

<sup>b</sup> Relative risks were adjusted for child age, gender, race/ethnicity, parent education, household income, and family structure.

Source:  
Larson (2011)

# Antipsychotic Medication Use – National Trends

- Use of AAPs has grown substantially since the early 2000s (e.g., between 2002 and 2007, antipsychotic use increased by 62% in Medicaid enrolled children)
- Increased off-label use of Atypical Antipsychotics (AAPs) over time
  - ADHD is one of the most common mental health diagnoses among youth prescribed AAPs
    - 2001-2005: over 60% of Medicaid enrolled children prescribed AAPs diagnosed with ADHD
    - 2006-2010: 50% - 60% of children <12 years old prescribed AAPs diagnosed with ADHD (35% of children 13-18 years old)
  - A significant percentage of ADHD-diagnosed youth prescribed AAPs without an AAP-indicated condition (e.g., 18%-20% in the mid-2000s)
  - Concurrent used of ADHD medications and antipsychotics (e.g., in 2008, 59% to 69% of children <12 years old prescribed antipsychotics also prescribed stimulants)