**ADHD PHENOTYPE ALGORITHM**

**Background:** Attention deficit-hyperactivity disorder (ADHD) is a complex neuropsychiatric disorder, with an estimated prevalence of 7% of school-age children and a smaller percentage (~4%) of adults. Three subtypes include predominantly inattentive, predominantly hyperactive-impulsive, and combined hyperactive-inattentive. In ICD-9 and ICD-10, ADHD is listed with hyperkinetic disorder/hyperkinetic syndrome (HKD).

**Cases:** Cases must be 4 years of age or older, and are defined by a diagnostic history of ADHD/HKD as determined by ICD9 codes and/or a history of ADHD medications.

Case inclusion criteria:

1a) Individual is 1460 days-old or older

 *plus*

1b) Individual’s medical record includes a relevant ICD9 code (see **Table 1**) in one or more in-person visits, on separate calendar days

*plus*

1c) Individual’s medical record includes one or more prescriptions of ADHD-related medications (see **Table 2**)

 *or*

2a) Individual is 1460 days-old or older

 *plus*

2b) Individual’s medical record includes a relevant ICD9 code (see **Table 1**) in two or more in-person visits, on separate calendar days.

Case exclusion criteria:

Individual’s medical record includes one or more of the ICD9 codes shown in **Table 3**.

**Controls:** Controls must be 4 years of age, or older. Exclusionary criteria for controls include psychiatric, neurological and related disorders as defined by ICD9 codes or patient chart. Additionally, controls are excluded if his/her medical record includes a medication used to treat psychiatric, neurological and related disorders.

Control inclusion criterion:

1. Individual is 1460 days-old or older.
2. Individual must have two or more visits in the last five years (of last day in record)

Control exclusion criteria:

1) Individual’s medical record includes one or more prescriptions for a medication addressing psychiatric, neurological or related disorders (see **Table 4**)

*and/or*

2) Individual’s medical record includes one or more ICD9 codes addressing psychiatric, neurological or related disorders (see **Table 5**)

*and/or*

3) Individual’s patient chart includes one or mentions of an ADHD or hyperkinesias (see **Table 1**).

**Covariates:** Relevant covariates are: 1) age, 2) gender, 3) ethnicity, race, and 4) birth month (younger children can be more hyperactive in the classroom, which may be mis-diagnosed as ADHD) Ref: Elder Todd. The Importance of Relative standards in ADHD Diagnoses: Evidence Based on Exact Birth Dates. J. Health Economy. Sept 2010;29(5):641-656).

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| **Table 1, ADHD Cases: Inclusionary ICD Codes**  |
| **ICD-9 Code**  | **Diagnosis**  |
| **314**  | Hyperkinetic syndrome of childhood  |
| **314.0**  | Attention deficit disorder  |
| **314.01**  | With hyperactivity  |
| **314.1**  | Hyperkinesis with developmental delay, Developmental disorder of hyperkinesis  |
| **314.2**  | Hyperkinetic conduct disorder  |
| **314.8**  | Other specified manifestations of hyperkinetic syndrome  |
| **314.9**  | Unspecified hyperkinetic syndrome  |

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| **Table 2, ADHD Cases: Inclusionary medications by sub-type.**  |  |
| **Stimulants**  | **Non-Stimulants**  | **Other Drugs**  | **Other Drugs**  |
| Methylphenidate  | Norepinephrine reuptake inhibitor  | NDRI  | Imipramine  |
| Attenta  | NRI | Amfebutamone | Melipramine  |
| Concerta  | Atomoxetine | Aplenzin | Tofranil |
| Daytrana  | Attentin  | Buproprion  | Lithium  |
| Desoxyn  | Strattera  | Elontril  | Eskalith  |
| Hynidate  | Tomoxetin  | Prexaton | Lithobid |
| Metadate  |  | Voxra | Olanzapine  |
| Methylin  |   | Wellbutrin  | Zyprexa  |
| Methyllin  | **Alpha-2 Agonists**  | Zyban | Paroxetine  |
| Rilatine  | Clonidine  | SNRI's (Tricyclics)  | Aropax  |
| Ritalin  | Guanfacine  | Imipramine  | Brisdelle  |
| Dexmethylphenidate |  | Melipramine | Paxil  |
| Attenade  |  | Tofranil | Pexeva  |
| Celgene  |  | Carbamazepine  | Sereupin  |
| Focalin  |  | Equetro | Seroxat  |
| Amphetamine  |  | Tegretol  | Pemoline  |
| Adderall  |  | Clonazepam  | Betanamin  |
| Dexedrine  |  | Clonex  | Ceractiv |
| DextroStat  |  | Klonopin | Cylert |
| Prodrug Amphetamines  |  | Kriadex | Tradon |
| Lisdexamfetamine (Vyvanse)  |  | Linotril | Risperidone  |
|  |  | Paxam | Risperdal |
|  |  | Petril | Sertraline  |
|  |  | Ravotril | Altruline |
|  |  | Rivatril  | Besitran |
|  |  | Rivotril | Daxid |
|  |  | Divalproex  | Deprax |
|  |  | Depakote  | Eleval |
|  |  | Epilim  | Emergen |
|  |  | Fluoxetine  | Gladem |
|  |  | Fontex  | Implicane |
|  |  | Prozac  | Lowfin |
|  |  | Sarafem  | Lustral |
|  |  | Hydroxyzine  | Sealdin |
|  |  | Alamon  | Sedoran |
|  |  | Atarax  | Serivo |
|  |  | Aterax  | Sertralin  |
|  |  | Durrax  | Stimuloton |
|  |  | Equipose | Tresleen |
|  |  | Orgatrax |  Zoloft  |
|  |  | Masmoran | Trazodone  |
|  |  | Paxistil | Beneficat |
|  |  | Quiess | Deprax |
|  |  | Tran-Q | Desirel |
|  |  | Tranquizine | Desyrel |
|  |  | Vistaril | Mesyrel |
|  |  |  | Molipaxin |
|  |  |  | Oleptro |
|  |  |  | Thombran  |
|  |  |  | Trazorel  |
|  |  |  | Trialodine  |
|  |  |  | Trittico  |
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| **Table 3, ADHD Cases: Exclusionary ICD9 Codes.**  |
| **Psychiatric and Related** |
| **ICD-9 Codes** | **Diagnosis**  |
| 290 | Dementias |
| 294 | Persistent mental disorders due to conditions classified elsewhere- |
| 300.8x  | Somatoform disorders  |
| 301.51 | Chronic factitious illness with physical symptoms |
| 307.3x  | Stereotypic movement disorder  |
| 317-317.x  | Mild mental retardation  |
| 318-318.x  | Other specified mental retardation  |
| 319-319.x  | Unspecified mental retardation  |
| **General**  |
| **ICD-9 Codes** | **Diagnosis**  |
| 006.5  | Amebic brain abscess  |
| 013.2  | Tuberculoma of brain  |
| 191-191.x | Malignant neoplasm of brain  |
| 192-192.x | Malignant neoplasm of other and unspecified parts of nervous system  |
| 237.7x  | Neurofibromatosis  |
| 290.1  | Presenile dementia  |
| 348.1  | Anoxic brain damage  |
| 348.2 | Benign intracranial hypertension  |
| 348.3  | Encephalopathy, not elsewhere classified  |
| 348.4  | Compression of brain  |
| 348.5  | Cerebral edema  |
| 348.8  | Other conditions of brain  |
| 348.9  | Unspecified condition of brain  |
| 437.2 | Hypertensive encephalopathy  |
| 742-742.x  | Other congenital anomalies of nervous system  |
| 764-764.x  | Slow fetal growth and fetal malnutrition  |
| 767.0  | Subdural and cerebral hemorrhage  |
| 767.9  | Birth trauma, unspecified  |
| 800-804 | Fracture of skull  |
| 959.01  | Head injury, unspecified  |

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| **Table 4, ADHD Controls: Exclusionary medications by sub-type.**  |  |
| **Stimulants**  | **Non-Stimulants**  | **Other Drugs**  | **Other Drugs**  |
| Methylphenidate  | Norepinephrine reuptake inhibitor  | SNRI's (Tricyclics)  | Imipramine  |
| Attenta  | NRI | Imipramine  | Melipramine  |
| Concerta  | Atomoxetine | Melipramine | Tofranil |
| Daytrana  | Attentin  | Tofranil | Lithium  |
| Desoxyn  | Strattera  | Carbamazepine  | Eskalith  |
| Hynidate  | Tomoxetin  | Equetro | Lithobid |
| Metadate  |  | Tegretol  | Olanzapine  |
| Methylin  |  | Clonazepam  | Zyprexa  |
| Methyllin  |  | Clonex  | Paroxetine  |
| Rilatine  |  | Klonopin | Aropax  |
| Ritalin  |  | Kriadex | Brisdelle  |
| Dexmethylphenidate |  | Linotril | Paxil  |
| Attenade  |  | Paxam | Pexeva  |
| Celgene  |  | Petril | Sereupin  |
| Focalin  |  | Ravotril | Seroxat  |
| Amphetamine  |  | Rivatril  | Pemoline  |
| Adderall  |  | Rivotril | Betanamin  |
| Dexedrine  |  | Divalproex  | Ceractiv |
| DextroStat  |  | Depakote  | Cylert |
| Prodrug Amphetamines  |  | Epilim  | Tradon |
| Lisdexamfetamine (Vyvanse)  |  | Fluoxetine  | Risperidone  |
|  |  | Fontex  | Risperdal |
|  |  | Prozac  | Sertraline  |
|  |  | Sarafem  | Altruline |
|  |  | Hydroxyzine  | Besitran |
|  |  | Alamon  | Daxid |
|  |  | Atarax  | Deprax |
|  |  | Aterax  | Eleval |
|  |  | Durrax  | Emergen |
|  |  | Equipose | Gladem |
|  |  | Orgatrax | Implicane |
|  |  | Masmoran | Lowfin |
|  |  | Paxistil | Lustral |
|  |  | Quiess | Sealdin |
|  |  | Tran-Q | Sedoran |
|  |  | Tranquizine | Serivo |
|  |  | Vistaril | Sertralin  |
|  |  |  | Stimuloton |
|  |  |  | Tresleen |
|  |  |  |  Zoloft  |
|  |  |  | Trazodone  |
|  |  |  | Beneficat |
|  |  |  | Deprax |
|  |  |  | Desirel |
|  |  |  | Desyrel |
|  |  |  | Mesyrel |
|  |  |  | Molipaxin |
|  |  |  | Oleptro |
|  |  |  | Thombran  |
|  |  |  | Trazorel  |
|  |  |  | Trialodine  |
|  |  |  | Trittico  |

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| **Table 5, ADHD Control Exclusionary ICD9 Codes.**  |
| **ICD-9 Codes** | **Diagnosis**  |
| 006.5  | Amebic brain abscess  |
| 013.2  | Tuberculoma of brain  |
| 191-191.x | Malignant neoplasm of brain  |
| 192-192.x | Malignant neoplasm of other and unspecified parts of nervous system  |
| 237.7x  | Neurofibromatosis  |
| 290-319.x  | Mental disorders  |
| 327-327.x | Organic sleep disorders  |
| 330-337.x | Hereditary and degenerative diseases of the central nervous system  |
| 342-342.x  | Hemiplegia and hemiparesis  |
| 343-343.x  | Infantile cerebral palsy  |
| 344-344.x  | Other paralytic syndromes  |
| 345-345.x  | Epilepsy and recurrent seizures  |
| 347-347.x  | Cataplexy and narcolepsy  |
| 348-348.x  | Other conditions of brain  |
| 349-349.x  | Other and unspecified disorders of the nervous system  |
| 437.2 | Hypertensive encephalopathy  |
| 742-742.x  | Other congenital anomalies of nervous system  |
| 758.x | Chromosomal anomalies |
| 764-764.x  | Slow fetal growth and fetal malnutrition  |
| 765-765.x  | Disorders relating to short gestation and low birthweight  |
| 767.0  | Subdural and cerebral hemorrhage  |
| 767.9  | Birth trauma, unspecified  |
| 779.4  | Drug reactions and intoxications specific to newborn  |
| 779.5  | Drug withdrawal syndrome in newborn  |
| 781-781.x  | Symptoms involving nervous and musculoskeletal systems  |
| 800-804 | Fracture of skull  |
| 959.01  | Head injury, unspecified  |
| 996.2  | Mechanical complication of nervous system device, implant, and graft  |