syndrome) in the 22q11.2 region of chromosome 22. Those syndromes may occur in at least about 1 out of every 2000-4000 children and may involve disruptions in as many as 30-40 genes. Among the genes that may be affected is RANBP1, an mGluR network gene. Children with a deletion or duplication at 22q11.2 have a higher than average rate of psychiatric disorders including ADHD, autism spectrum (ASD), and anxiety disorder, and a significant percentage may develop psychoses such as schizophrenia later in life. Children with a deletion or duplication of that region may also suffer from various intellectual disabilities.

[008] Treatment of psychiatric symptoms in 22q syndrome patients may be complicated due to the physical abnormalities of these patients, including cardiac anomalies. For example, it may be necessary to avoid use of otherwise widely- prescribed stimulant drugs due to their negative side effects in the 22q syndrome population. Thus, improved therapeutic treatments are particularly needed for patients with ADHD, ASD, anxiety disorder or other conditions who have an underlying 22q genetic syndrome.

SUMMARY

[009] Provided herein are methods of treating attention deficit hyperactivity disorder (ADHD) in a subject comprising administering a therapeutically effective amount of a nonselective metabotropic glutamate receptor (mGluR) activator to a subject, thereby treating ADHD.

[009a] In one aspect of the disclosure, there is provided a use of fasoracetam in the preparation of a medicament for treating attention deficit hyperactivity disorder (ADHD) in a subject, wherein fasoracetam is to be administered in an amount from 100 to 400mg to the subject, thereby treating ADHD.

[0010] Also provided are methods of treating attention deficit hyperactivity disorder (ADHD) in a subject comprising administering a therapeutically effective amount of a nonselective metabotropic glutamate receptor (mGluR) activator to a subject having at least one genetic alteration in an mGluR network gene, thereby treating ADHD.

[0010a] In another aspect of the disclosure, there is provided a use of fasoracetam in the preparation of a medicament for treating ADHD and 22q deletion/duplication syndrome or ADHD and oppositional defiant disorder (ODD) in a subject.

What is claimed is :

1. Use of fasoracetam in the preparation of a medicament for treating attention deficit hyperactivity disorder (ADHD) in a subject, wherein fasoracetam is to be administered in an amount from 100 to 400mg to the subject, thereby treating ADHD.

2. Use of fasoracetam in the preparation of a medicament for treating ADHD and 22q deletion/duplication syndrome or ADHD and oppositional defiant disorder (ODD) in a subject.

3. The use according to claim 1 or claim 2, wherein the subject has at least one copy number variation (CNV) in a metabotropic glutamate receptor (mGluR) network gene.

4. The use according to claim 2 or claim 3, wherein 100 to 400mg fasoracetam is to be administered.

5. The use according to any one of claims 1-4, wherein the CNV is a deletion or a duplication.

6. The use according to any one of claims 1-5, wherein the subject has a CNV in at least two mGluR network genes.

7. The use according to any one of claims 1-6, wherein the subject is a pediatric or adolescent subject, such as a subject between the ages of 5 and 17, 8 and 17, 5 and 12, 5 and 8, 8 and 12, or 12 and 17.

8. The use according to any one of claims 1-7, wherein the fasoracetam is to be administered once, twice, or three times daily.

9. The use of any one of claims 1, 3, or 5-8, wherein the subject has at least one of oppositional defiant disorder (ODD), 22q deletion/duplication syndrome, anxiety disorder, a mood disorder, a phobia, conduct disorder, Tourette's syndrome, autism, difficulty controlling anger, disruptive behavior, obsessive compulsive disorder

(OCD), dermatillomania, a developmental disorder, or a movement disorder, in addition to ADHD.

10. The use of any one of claims 1, 3, or 5-8, wherein the subject does not have at least one of oppositional defiant disorder (ODD), 22q deletion/duplication syndrome, anxiety disorder, conduct disorder, Tourette's syndrome, autism, difficulty controlling anger, disruptive behavior, a mood disorder, a phobia, obsessive compulsive disorder (OCD), dermatillomania, a developmental disorder, or a movement disorder.

11. The use of claim 10, wherein the subject does not have any of ODD, 22q deletion/ duplication syndrome, anxiety disorder, a mood disorder, a phobia, conduct disorder, Tourette's syndrome, autism, difficulty controlling anger, disruptive behavior, obsessive compulsive disorder (OCD), dermatillomama, a developmental disorder, or a movement disorder.

12. The use of claim 9, wherein the subject has ODD.

13. The use of claim 12, wherein the treatment reduces symptoms of anger and irritability, argumentation and defiance, and/or vindictiveness in the subject.

14. The use of any one of claims 3-13, wherein the CNV is detected by a process comprising a genetic test comprising obtaining a sample from the subject, optionally isolating nucleic acid from the sample, optionally amplifying the nucleic acid, and analyzing the nucleic acid for a CNV in at least one mGluR network gene, and wherein the treatment comprises obtaining results of the genetic test prior to initial administration of fasoracetam.

15. The use of claim 14, wherein the genetic test comprises analyzing the nucleic acid for a CNV in at least 5, 6, 7, 8, 9, 10, 15, 20, 30, 40, 50, 60, 70, or all Tier 1 mGluR network genes.

16. The use of claim 14 or 15, wherein the genetic test comprises analyzing the nucleic acid for a CNV in at least 5, 10, 20, 30, 50, 100, 150, 175, or all Tier 2 mGluR network genes.

17. The use of claim 14, 15, or 16, wherein the genetic test comprises analyzing the nucleic acid for a CNV in at least 5, 10, 20, 50, 100, 200, 300, 400, 500, or all Tier 3 mGluR network genes.

18. The use of any one of claims 14-17, wherein the genetic test does not assess CNVs in one or more of GRM1, GRM2, GRM3, GRM4, GRM5, GRM6, GRM7 or GRM8.

19. The use of any one of claims 1-18, wherein treating ADHD in the subject comprises reducing at least one ADHD symptom in the subject, such as inattentiveness, hyperactivity, or impulsiveness.

20. The use of claim 19, wherein the subject has one or more of the following changes in symptoms after at least one, two, three, or four weeks of treatment with fasoracetam:

a. the subject has symptoms of difficulty controlling anger and the anger control symptoms are reduced;

b. the subject has symptoms of disruptive behavior and the disruptive behavior symptoms are reduced;

c. the subject's CGI-I is reduced by at least 1 or by at least 2;

d. the subject's CGI-I score after one, two, three, or four weeks of treatment is 1 or 2;

e. the subject's CGI-S score after one, two, three, or four weeks of treatment is 1;

f. the subject's ADHD Rating Scale score is reduced by at least 25%, such as at least 30%, at least 35%, or at least 40%;

g. the subject has symptoms of inattentiveness and the inattentiveness symptoms are reduced;

h. the subject has symptoms of hyperactivity and the hyperactivity symptoms are reduced;

i. the subject has symptoms of impulsiveness and the impulsiveness symptoms are reduced;

j. the subject has symptoms of ODD such as anger and irritability, argumentation

and defiance, and/or vindictiveness and the ODD symptoms are reduced;

k. the subject has symptoms of conduct disorder and the conduct disorder symptoms are reduced;

l. the subject has symptoms of anxiety and the anxiety symptoms are reduced;

m. the subject has symptoms of Tourette's syndrome, and the Tourette's syndrome symptoms are reduced;

n. the subject has symptoms of autism, and the autism symptoms are reduced; and

o. the subject has symptoms of movement disorder and the movement disorder symptoms are reduced.