Thomas, S., Hovinga, M., Rai, D., & Lee, B. K. (2017). Brief Report: Prevalence of Co-occurring Epilepsy and Autism Spectrum Disorder: The U.S. National Survey of Children's Health 2011–2012. *Journal of Autism and Developmental Disorders*, 47(1), 224–229.
<https://doi.org/10.1007/s10803-016-2938-7>

Peer reviewed version

Link to published version (if available):
[10.1007/s10803-016-2938-7](https://doi.org/10.1007/s10803-016-2938-7)

[Link to publication record in Explore Bristol Research](#)
PDF-document

This is the author accepted manuscript (AAM). The final published version (version of record) is available online via Springer at <http://link.springer.com/article/10.1007/s10803-016-2938-7>. Please refer to any applicable terms of use of the publisher.

University of Bristol - Explore Bristol Research

General rights

This document is made available in accordance with publisher policies. Please cite only the published version using the reference above. Full terms of use are available:
<http://www.bristol.ac.uk/red/research-policy/pure/user-guides/ebr-terms/>

Brief Report: Prevalence of co-occurring epilepsy and autism spectrum disorder: the U.S. National Survey of Children's Health 2011-12

Authors: ¹Shiny Thomas, ¹Mary E. Hovinga, ^{2,3}Dheeraj Rai, ^{1,4}Brian K. Lee

¹Department of Epidemiology and Biostatistics, Drexel University School of Public Health

²Centre for Academic Mental Health, School of Social and Community Medicine, University of Bristol

³Avon and Wiltshire Partnership NHS Mental Health Trust

⁴A.J. Drexel Autism Institute, Drexel University

Correspondence concerning this article should be addressed to: Brian Lee, Drexel University School of Public Health, 3215 Market St., Philadelphia, PA, USA. Phone: 267-359-6052. E-mail: bklee@drexel.edu

Funding: This study was unfunded.

Conflict of interest: All authors declare no conflicts of interest.

Keywords: autism, epilepsy, comorbid, epidemiology

Abstract

Epilepsy is reported to co-occur in individuals with autism spectrum disorder (ASD). Previous studies across the world have found prevalence estimates ranging from 4-38%. We examined parent-reported prevalence of co-occurring epilepsy and ASD in the most recent U.S. National Survey of Children's Health, 2011-2012. All analyses accounted for survey weights to account for the complex sampling design. In the overall analytic sample of 85,248 children ages 2-17, there were 1,604 children with ASD (prevalence of 1.8%) and 1,083 children with epilepsy (prevalence of 1.2%). Epilepsy was reported to co-occur in 8.6% of ASD cases. In children with ASD, the co-occurrence of epilepsy was associated with increasing child age, female gender, intellectual disability, speech problems and lower socioeconomic status.

An overlap between autism spectrum disorders (ASD) and epilepsy has been noted for decades, especially with co-occurrence of both conditions (Tuchman et al. 2010). The prevalence of this co-occurrence is not reliably known. Because epilepsy is associated with increased mortality (Gillberg et al. 2010; Schendel et al. 2016), the prevalence of co-occurring ASD and epilepsy deserves further scrutiny.

In studies with at least 100 ASD cases, previous estimates of the prevalence of epilepsy in ASD range from 4-38% (Supplementary Table 1). The wide range may be attributable to sample heterogeneity. For example, one of the more recent estimates of prevalence of epilepsy in 918 children with ASD in the age group 2-17 years based on the 2007 National Survey of Children's Health (NSCH) was 12.5% (Viscidi et al. 2013). In comparison, the prevalence of epilepsy in a population-based sample of 150 individuals with autism in UK with a mean age of 32.6 years at follow up was 22% (Bolton et al. 2011). Another sample characteristic that may contribute to the heterogeneity in prevalence is sex of study participants. A prevalence estimate of the co-occurrence in a study based on medical records of 100 males with Asperger's syndrome in the age group 5-12 years in Sweden was 4% (Cederlund and Gillberg 2004) while the estimate was 38% for a study on 108 individuals (77 males, 31 females) in the age group 17-40 years in Sweden (Danielsson et al. 2005).

In light of better recognition of ASD in recent years and to quantify the overlap of epilepsy with autism, it is important to update the estimates of the co-occurrence from a recent nationally representative study. This study had two aims. First, we conducted a literature review of previous studies of the co-occurrence of epilepsy and ASD. Second, we examined the co-occurrence of epilepsy and ASD in a large nationally representative sample of the most recent

survey of the NSCH 2011-2012 and examined child characteristics that are associated with this co-occurrence.

Methods

Review of literature

An electronic search for all prevalence studies on the co-occurrence of epilepsy and ASD was performed in PubMed and Google Scholar that were published during 1980-2015. The bibliography section in all relevant studies was examined. Studies of at least 100 individuals with ASD that examined the prevalence of epilepsy or vice versa were included irrespective of study design.

Study Population: the National Survey of Children's Health 2011-2012

The data for this cross-sectional study are taken from the NSCH 2011-2012 which was conducted by the National Center for Health Statistics of the CDC. The NSCH is a nationally representative survey which uses a list-assisted random-digit-dialed (RDD) sample of landline telephone numbers and an independent RDD sample of cell-phone numbers to identify households with one or more children less than 18 years of age. One child was randomly chosen from each household to be the subject of the survey. The respondent was a parent/guardian who had knowledge about the child's health status.

A total of 95,677 surveys were collected for children in the age group of 0-17 years across the United States. The survey results are weighted to represent the population of non-institutionalized children nationwide. We excluded all children less than 2 years of age

(N=10,040), children with missing information on sex (N=102), ASD or epilepsy (N=170) and other characteristics including intellectual disability and speech problems (N=117). The final analytic sample consisted of 85,248 children (Figure 1). The sample was further divided into two groups, children with ASD (N=1,604) and children with epilepsy (N=1,083). The two groups were subdivided into children with ASD without epilepsy (N=1,453), children with epilepsy without ASD (N=932) and children with both ASD and epilepsy (N=151).

ASD Ascertainment

A child with ASD in this study was one whose parent/guardian reported to have ever been told by a doctor or a health care provider that the child had ASD and also reported that the child currently has ASD. This case ascertainment approach is also identical to the one used in prior NSCH studies (Blumberg et al. 2013; Schieve et al. 2012). Although parent report for ASD diagnosis can be misleading, studies have shown the validity of standard questionnaires in the diagnosis of ASD in children. For example, comparison of maternal report of ASD and ASD diagnosis via ADI-R in the Nurses' Health Study II showed high agreement (Lyll et al. 2014).

Epilepsy Ascertainment

Parents in the telephone survey were asked if they had ever been told by their doctor/health care provider that their child had epilepsy or seizure disorder. Children who currently had or were ever diagnosed with epilepsy were considered as having epilepsy. This approach is the same as used in a prior study to estimate prevalence of epilepsy in ASD based on the 2007 NSCH survey (Viscidi et al. 2013).

Other Covariates

Other covariates considered for analysis were identified from the literature. Socio-demographic characteristics included sex, age of child (2-4 years, 5-7 years, 8-11 years, 12-14 years and 15-17 years), race (Hispanic, White non-Hispanic, Black non-Hispanic and Other). Income data provided by the National Center for Health Statistics were categorized as: Less than 100% of the federal poverty level (FPL), 100-199% FPL, 200-399% FPL and 400% or more FPL. Clinical characteristics included intellectual disability and speech problems ascertained using the same methodology as ASD and epilepsy.

Statistical Analysis

SAS version 9.3 was used for statistical analysis. Descriptive statistics for sample size were calculated as actual numbers. To account for the complex sampling design, survey weights were incorporated to obtain percent composition of individuals across different categories. Prevalence was also calculated as a weighted estimate. To examine characteristics associated with the co-occurrence of epilepsy in the subset of children with ASD (N=1,604), we used a survey-weighted logistic regression model adjusted for the aforementioned covariates.

Results

Sample characteristics are described in Table 1. All prevalence estimates are weighted. Overall the prevalence of ASD and epilepsy in the analytic sample were 1.8% and 1.2% respectively. The prevalence of epilepsy in children with ASD was 8.6% compared to a 1.2% in children without ASD. The prevalence of ASD in children with epilepsy was 12.5%.

Of the 1,604 children with a diagnosis of ASD, 82% were boys. Girls constituted 18% of the population of ASD cases without epilepsy and 30% of ASD cases with epilepsy. The prevalence of epilepsy in ASD increased with age: ages 2-4 (3.9%); ages 5-7 (5.6%); ages 8-11

(6.7%) ages 12-14 (11.9%); ages 15-17 (13.2%). 61% of the total ASD population in the sample was non-Hispanic White. A similar trend was seen in the population of ASD with epilepsy (64%). The prevalence of epilepsy in the general population was disproportionately higher in non-Hispanic Blacks (19.4%). Intellectual disability was more common in ASD children with epilepsy (59%) vs. without epilepsy (19%). Similarly, speech problems were more common in ASD children with epilepsy (71%) vs. without epilepsy (55%). Almost half (47%) of the children with ASD and epilepsy fell under 199% FPL.

Table 2 shows covariates for the occurrence of seizure in children with ASD (n=1,604). A dose response trend was present with increasing age as children with ASD grew into young adults (2-4 years: OR=0.4, 95% CI: 0.1, 1.5; 15-17 years: OR=2.3, 95% CI: 0.9, 6.1). Male gender was associated with lower risk for occurrence of epilepsy in ASD (OR=0.4, 95% CI: 0.2, 0.7). Odds of having epilepsy were lower in Hispanic children with ASD (OR=0.3, 95% CI: 0.1, 1.4). Odds of having epilepsy were higher in ASD children under 100% FPL (OR=2.8, 95% CI: 1.2, 6.6), with intellectual disability (OR=4.8, 95% CI: 2.1, 11.2) and speech problems (OR=2.1, 95% CI: 0.8, 5.1).

Discussion

In this cross sectional study, we examined the co-occurrence of epilepsy with ASD in the most recent, nationally representative population-based survey of child health in the US. We found significant population level differences in demographic and clinical features in the various sub-groups of ASD and epilepsy. We observed that there was a seven-fold increased risk of epilepsy in ASD when compared to the general population (8.6% vs. 1.2%). Although the

prevalence of ASD was higher in boys, male gender was associated with lower risk for ASD and co-morbid epilepsy. Finally, children with ASD and epilepsy had higher rates of co-occurring intellectual disability and speech problems.

The prevalence estimates reported here are similar in magnitude to other population based studies measuring the co-occurrence. For example, prevalence of the co-occurrence of ASD and epilepsy in a population based study in Finland was 6.6% (Jokiranta et al. 2014) while the largest study to date in Denmark reported a figure of 6.3% (Schendel et al. 2016). Of note, these estimates are considerably smaller than those typically reported in clinical samples, such as the 28.2% reported in an Italian study (Valvo et al. 2013) and the 37.0% in a Japanese study (Yasuhara 2010). This may be because cases seen in clinics tend to be more severe and in greater need of clinical attention.

The key strength of the present study is that it is population based and designed to represent the entire US population. The sample of ASD children is comparatively large which increases confidence in the ability to better understand socio-demographic and clinical characteristics. Our results represent some of the most contemporaneous estimates of epilepsy and its correlates in individuals with ASD. One key limitation is that the NSCH estimates are based on parent report and have not been verified by clinical evaluation or medical records. There may be subjectivity in the way caregivers report the presence and severity of autism based on race, ethnicity, socioeconomic status and access to services (Liptak et al. 2008). However, NSCH estimates of ASD prevalence have been similar in magnitude to estimates obtained from the Autism and Developmental Disabilities Monitoring Network (ADDM). According to the 2011-2012 NSCH, the current prevalence of caregiver reported ASD was 2% among children in the age group 6-17 years (Blumberg et al., 2013). This is similar to the ADDM's most recent

estimate of the 2012 prevalence of ASD of 1.46% in children aged 8 years (Christensen, Baio, & Braun et al., 2016).

Our findings indicate that epilepsy is a common co-occurring condition in individuals with ASD. The associated factors include increasing age, female gender, intellectual disability, speech problems and poverty. These findings may help alert policy makers regarding the compelling need to identify barriers in access to care in autistic individuals which cause delays in diagnosis and increased co-occurrence with other comorbidities and a poor quality of life.

Compliance with Ethical Standards:

Funding: This study was unfunded.

Conflict of interest: The authors declare no conflicts of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The National Survey of Children's Health study protocol was approved by the National Center for Health Statistics Research Ethics Review Board and the Abt Associates Institutional Review Board.

References

- Blumberg, S.J., M.D. Bramlett, M.D. Kogan, L.A. Schieve, J.R. Jones, M.C. Lu (2013). Changes in prevalence of parent-reported autism spectrum disorder in school-aged US children: 2007 to 2011–2012. *National health statistics reports* 65, 1-12
- Bolton, P.F., I. Carcani-Rathwell, J. Hutton, S. Goode, P. Howlin, M. Rutter (2011). Epilepsy in autism: features and correlates. *The British Journal of Psychiatry* 198, 289-294
- Cederlund, M., C. Gillberg (2004). One hundred males with Asperger syndrome: a clinical study of background and associated factors. *Developmental Medicine & Child Neurology* 46, 652-660
- Danielsson, S., I.C. Gillberg, E. Billstedt, C. Gillberg, I. Olsson (2005). Epilepsy in Young Adults with Autism: A Prospective Population-based Follow-up Study of 120 Individuals Diagnosed in Childhood. *Epilepsia* 46, 918-923
- Gillberg, C., E. Billstedt, V. Sundh, I.C. Gillberg (2010). Mortality in autism: a prospective longitudinal community-based study. *Journal of Autism and Developmental Disorders* 40, 352-357
- Jokiranta, E., A. Sourander, A. Suominen, L. Timonen-Soivio, A.S. Brown, M. Sillanpää (2014). Epilepsy among children and adolescents with autism spectrum disorders: a population-based study. *Journal of autism and developmental disorders* 44, 2547-2557
- Liptak, G.S., et al. (2008). Disparities in diagnosis and access to health services for children with autism: data from the National Survey of Children's Health. *Journal of Developmental & Behavioral Pediatrics* 29, 152-160
- Lyall, K., J.N. Constantino, M.G. Weisskopf, A.L. Roberts, A. Ascherio, S.L. Santangelo (2014). Parental social responsiveness and risk of autism spectrum disorder in offspring. *JAMA psychiatry* 71, 936-942
- Schendel, D.E., et al. (2016). Association of Psychiatric and Neurologic Comorbidity With Mortality Among Persons With Autism Spectrum Disorder in a Danish Population. *JAMA pediatrics* 170, 243-50 doi:10.1001/jamapediatrics.2015.3935
- Schieve, L.A., et al. (2012). Parent-reported prevalence of autism spectrum disorders in US-born children: An assessment of changes within birth cohorts from the 2003 to the 2007 National Survey of Children's Health. *Maternal and child health journal* 16, 151-157
- Tuchman, R., M. Cuccaro, M. Alessandri (2010). Autism and epilepsy: historical perspective. *Brain & development* 32, 709-18 doi:10.1016/j.braindev.2010.04.008
- Valvo, G., et al. (2013). Somatic overgrowth predisposes to seizures in autism spectrum disorders. *PLoS One* 8, e75015 doi:10.1371/journal.pone.0075015
- Viscidi, E.W., et al. (2013). Clinical characteristics of children with autism spectrum disorder and co-occurring epilepsy. *PloS one* 8, e67797 doi:10.1371/journal.pone.0067797
- Yasuhara, A. (2010). Correlation between EEG abnormalities and symptoms of autism spectrum disorder (ASD). *Brain & development* 32, 791-8 doi:10.1016/j.braindev.2010.08.010

Table 1: Demographic and Clinical characteristics of individuals with Autism Spectrum Disorder and Epilepsy in National Survey of Children's Health (NSCH) 2011-2012 in participants 2-17 years old

Characteristic	Total (n=85,248)	Total ASD (n=1,604)	ASD with epilepsy (n=151)	ASD without epilepsy (n=1,453)	Epilepsy without ASD (n=932)
	No. (Wt. %)	No. (Wt. %)	No. (Wt. %)	No. (Wt. %)	No. (Wt. %)
Gender					
Male	43,991 (51.2)	1,300 (82.1)	105 (69.5)	1,195 (82.2)	482 (51.7)
Female	41,257 (48.8)	304 (17.9)	46 (30.5)	258 (17.8)	450 (48.3)
Age(years)					
2-4	14,644 (17.9)	120 (7.6)	6 (3.5)	114 (8.0)	105 (9.5)
5-7	15,298 (19.0)	296 (19.5)	16 (12.8)	280 (20.1)	139 (15.8)
8-11	20,864 (24.8)	522 (33.2)	47 (25.8)	475 (33.8)	236 (30.9)
12-14	16,088 (18.9)	334 (21.8)	39 (30.2)	295 (21.0)	207 (19.3)
15-17	18,354 (19.4)	332 (18.0)	43 (27.7)	289 (17.0)	245 (24.6)
Race					
Hispanic	11,107 (22.6)	146 (18.6)	10 (9.8)	136 (19.4)	106 (22.8)
White, non-Hispanic	54,998 (51.5)	1,126 (60.6)	104 (64.1)	1,022 (60.3)	589 (44.9)
Black, non-Hispanic	7,993 (13.4)	121 (10.5)	14 (14.8)	107 (10.1)	112 (19.4)
Other	11,150 (12.6)	211 (10.4)	23 (11.4)	188 (10.3)	125 (12.9)
Clinical Characteristics					
Intellectual Disability	998 (1.1)	330 (22.3)	77 (58.9)	253 (18.9)	142 (14.6)
Speech Issues	3,802 (4.7)	817 (56.3)	105 (70.5)	712 (55.0)	226 (25.3)
Epilepsy	1,083 (1.2)	151 (8.6)	151 (100)	-	932 (100)
Poverty level					
Less than 100% FPL	12,808 (21.9)	274 (16.4)	33 (33.1)	241 (14.9)	200 (31.7)
100-199% FPL	15,285 (21.6)	337 (21.5)	37 (13.8)	300 (22.2)	208 (20.1)
200-399% FPL	26,045 (28.5)	500 (35.2)	41 (28.1)	459 (35.9)	258 (24.0)
400% or more FPL	31,110 (28.0)	493 (27.0)	40 (25.0)	453 (27.1)	266 (24.2)

Table 2: Adjusted odds ratios (OR) and 95% confidence intervals from a survey weighted logistic regression of the associations of child characteristics with co-occurrence of epilepsy in children ages 2-17 years old with ASD (n=1,604) in the National Survey of Children's Health (NSCH) 2011-2012

<u>Characteristic</u>	<u>OR (95% CI)</u>
Age (Years)	
2-4	0.4 (0.1-1.5)
5-7	0.9 (0.30-2.6)
8-11	Reference
12-14	1.9 (0.8-4.3)
15-17	2.3(0.9-6.1)
Sex	
Male	0.4 (0.2-0.7)
Female	Reference
Race	
Hispanic	0.3 (0.1-1.4)
White, non-Hispanic	Reference
Black, non-Hispanic	1.1 (0.5-2.8)
Other	1.1 (0.5-2.5)
Poverty Level	
Less than 100% FPL	2.8 (1.2-6.6)
100-199% FPL	0.8 (0.3-1.7)
200-399% FPL	Reference

400% or more FPL	1.2 (0.4-3.3)
Intellectual disability (Present)	4.8 (2.1-11.2)
Speech problems (Present)	2.1 (0.8-5.1)

Supplementary Table 1: Published estimates of the prevalence of co-occurrence of epilepsy in ASD in studies with at least 100 ASD cases

Author, year	N (ASD)	Age range or mean (years)	Country	ASD diagnosis	Epilepsy diagnosis	Prevalence of epilepsy in ASD
Schendel et al., 2016	20,492	3-23	Denmark	ICD-8, 10	ICD-8, 10	6.3%
Jokiranta et al., 2014	4,705	ns	Finland	ICD-9, 10	ICD-9, 10	6.6%
Takano et al., 2014	274	1-17	Japan	DSM-IV	ILAE	14.6%
van Eeghen et al., 2013	210	4-22	USA	DSM-IV/ADI-R	ILAE	7.0%
Valvo et al., 2013	206	2-21	Italy	DSM-IV	ILAE	28.2%
Viscidi et al., 2013	5,815	2-17	USA	ADI-R, Parent report	Parent report	12.5%
Cuccaro et al., 2012	577	4-21	USA	DSM-IV, ADI-R	Informant report	11.0%
Kohane et al., 2012	14,381	below 35	USA	ICD-9	ICD-9	19.4%
Bolton et al., 2011	150	32.61	UK	ICD-10	ILAE	22.0%
Mouridsen et al., 2011	118	2-15	Denmark	ICD-9, 10	ICD-8, 10	24.6%
Yasuhara, 2010	1,014	3-20	Japan	DSM-IV	EEG	37.0%
Giannotti et al., 2008	104	2.5-8	Italy	DSM-IV-TR	ILAE	19.4%
Ming et al., 2008	160	2-18	USA	DSM-IV	History, EEG	14.0%
Hara, 2007	130	1-14	Japan	DSM-IV	ILAE	25.0%
Danielsson et al., 2005	108	17-40	Sweden	DSM-IV	ILAE	38.0%
Cederlund and Gillberg, 2004	100	5-12	Sweden	Asperger (ICD-10, DSM-IV)	ns	4.0%
Fombonne et al., 2001	126	up to 16	France	PDD (ICD-10)	ns	7.9%
Rossi et al., 1995	106	3-32	Italy	DSM-III-R	ILAE	23.6%
Tuchman et al., 1991	302	6.33	USA	DSM-III-R	ILAE	14.0%
Volkmar & Nelson, 1990	192	2-33	USA	DSM-III, DSM-III-R	EEG	21.0%

ILAE: International League against Epilepsy, ns: not specified, PDD: pervasive developmental disorder, EEG: electroencephalogram

References

- Bolton, P.F., I. Carcani-Rathwell, J. Hutton, S. Goode, P. Howlin, M. Rutter (2011). Epilepsy in autism: features and correlates. *The British Journal of Psychiatry* 198, 289-294
- Cederlund, M., C. Gillberg (2004). One hundred males with Asperger syndrome: a clinical study of background and associated factors. *Developmental Medicine & Child Neurology* 46, 652-660
- Cuccaro, M.L., et al. (2012). Exploring the relationship between autism spectrum disorder and epilepsy using latent class cluster analysis. *J Autism Dev Disord* 42, 1630-1641
- Danielsson, S., I.C. Gillberg, E. Billstedt, C. Gillberg, I. Olsson (2005). Epilepsy in Young Adults with Autism: A Prospective Population-based Follow-up Study of 120 Individuals Diagnosed in Childhood. *Epilepsia* 46, 918-923
- Fombonne, E., H. Simmons, T. Ford, H. Meltzer, R. Goodman (2001). Prevalence of pervasive developmental disorders in the British nationwide survey of child mental health. *Journal of the American Academy of Child & Adolescent Psychiatry* 40, 820-827
- Giannotti, F., et al. (2008). An investigation of sleep characteristics, EEG abnormalities and epilepsy in developmentally regressed and non-regressed children with autism. *J Autism Dev Disord* 38, 1888-1897
- Hara, H. (2007). Autism and epilepsy: a retrospective follow-up study. *Brain and Development* 29, 486-490
- Jokiranta, E., A. Sourander, A. Suominen, L. Timonen-Soivio, A.S. Brown, M. Sillanpää (2014). Epilepsy among children and adolescents with autism spectrum disorders: a population-based study. *J Autism Dev Disord* 44, 2547-2557
- Kohane, I.S., et al. (2012). The co-morbidity burden of children and young adults with autism spectrum disorders. *PloS one* 7, e33224
- Ming, X., M. Brimacombe, J. Chaaban, B. Zimmerman-Bier, G.C. Wagner (2008). Autism spectrum disorders: concurrent clinical disorders. *Journal of Child Neurology* 23, 6-13
- Mouridsen, S.E., B. Rich, T. Isager (2011). A longitudinal study of epilepsy and other central nervous system diseases in individuals with and without a history of infantile autism. *Brain and Development* 33, 361-366
- Rossi, P.G., A. Parmeggiani, V. Bach, M. Santucci, P. Visconti (1995). EEG features and epilepsy in patients with autism. *Brain and Development* 17, 169-174
- Schendel, D.E., et al. (2016). Association of Psychiatric and Neurologic Comorbidity With Mortality Among Persons With Autism Spectrum Disorder in a Danish Population. *JAMA pediatrics* 170, 243-50 doi:10.1001/jamapediatrics.2015.3935
- Takano, T., C. Sawai, Y. Sakaue, K. Matsui, N. Nishikura (2014). Early and Late-Onset Epilepsy in Autism: High Rate of Secondarily Generalized Seizures. *Autism* 4, 2
- Tuchman, R.F., I. Rapin, S. Shinnar (1991). Autistic and dysphasic children. II: Epilepsy. *Pediatrics* 88, 1219-1225
- Valvo, G., et al. (2013). Somatic overgrowth predisposes to seizures in autism spectrum disorders. *PLoS One* 8, e75015 doi:10.1371/journal.pone.0075015
- Van Eeghen, A.M., et al. (2013). Understanding relationships between autism, intelligence, and epilepsy: a cross-disorder approach. *Developmental Medicine & Child Neurology* 55, 146-153
- Viscidi, E.W., et al. (2013). Clinical characteristics of children with autism spectrum disorder and co-occurring epilepsy. *PloS one* 8, e67797 doi:10.1371/journal.pone.0067797
- Volkmar, F.R., D.S. Nelson (1990). Seizure disorders in autism. *Journal of the American Academy of Child & Adolescent Psychiatry* 29, 127-129
- Yasuhara, A. (2010). Correlation between EEG abnormalities and symptoms of autism spectrum disorder (ASD). *Brain and Development* 32, 791-798