

# Search autism immigration and vitamin D

1987 – Oct. 2015

Cathy Breedon

(in reverse order by year)

## 2015

Eur Child Adolesc Psychiatry. 2015 Aug;24(8):941-8

### Parental migration and Asperger's syndrome.

Lehti V<sup>1</sup>, Cheslack-Postava K, Gissler M,

Parental immigration has been suggested as a possible risk factor for autism spectrum disorders (ASD), but findings have been inconsistent. Very few studies have focused specifically on Asperger's syndrome. The aim of this study was to examine the association between maternal and paternal immigration and the diagnosis of Asperger's syndrome in offspring. The study was a nested case-control study based on a national birth cohort in Finland. Children born in 1987-2005 and diagnosed with Asperger's syndrome by the year 2007 were identified from the Finnish Hospital Discharge Register (N = 1,783). Four matched controls for each case were selected from the Finnish Medical Birth Register (N = 7,106). Information on maternal and paternal country of birth and mother tongue was collected from the Finnish Central Population Register. The study showed that children whose parents are both immigrants have a significantly lower likelihood of being diagnosed with Asperger's syndrome than those with two Finnish parents [adjusted odds ratio (aOR) 0.2, 95 % confidence interval (CI) 0.1-0.4]. No significant associations were found between having only one immigrant parent and the diagnosis of Asperger's syndrome. **A regional analysis showed a significantly decreased likelihood of the diagnosis of Asperger's syndrome in children whose mother (aOR 0.1, 95 % CI 0.01-0.5) or father (aOR 0.2, 95 % CI 0.05-0.5) was born in Sub-Saharan Africa. The findings may help in identifying risk factors for different ASD subtypes. On the other hand, they might reflect service use of immigrant families in Finland.**

Mol Autism. 2015 Jan 14;6:3.

### Autism spectrum disorder and low vitamin D at birth: a sibling control study. Fernell E<sup>1</sup>, Bejerot S<sup>2</sup>, Westerlund J<sup>3</sup>,

Insufficient vitamin D activity has attracted increasing interest as a possible underlying risk factor in disorders of the central nervous system, including autism. METHODS: In this study, 25-hydroxyvitamin D (25(OH)D) was analysed in 58 Sweden-born sibling pairs, in which one

child had autism spectrum disorder (ASD) and the other did not. The study group consisted of two representative samples; 47 Gothenburg sibling pairs with mixed ethnicities and 11 Stockholm sibling pairs with Somali background. 25(OH)D levels were analysed in the stored dried blood spots taken in the neonatal period for metabolic screening. **RESULTS:** The collapsed group of children with ASD had significantly lower vitamin D levels ( $M = 24.0$  nM,  $SD = 19.6$ ) as compared with their siblings ( $M = 31.9$  nM,  $SD = 27.7$ ), according to a paired samples t-test ( $P = 0.013$ ). The difference was - most likely - not only accounted for by a difference in season of birth between ASD and non-ASD siblings since the mean 25(OH)D levels differed with similar effect size between the sibling pairs born during winter and summer, respectively. All children with African/Middle East background, both the children with ASD and their non-ASD siblings, had vitamin D deficiency. **CONCLUSIONS: The findings suggest that low prenatal vitamin D may act as a risk factor for ASD, however, there is a need for replication with larger samples. Future research should study whether or not adequate supplementation of vitamin D to pregnant women might lower the risk for ASD in the offspring.**

Nutrients. 2015 Feb 27;7(3):1538-64..

## **Emphasizing the health benefits of vitamin D for those with neurodevelopmental disorders and intellectual disabilities.** Grant WB<sup>1</sup>, Wimalawansa SJ<sup>2</sup>, Holick MF<sup>3</sup>, Cannell JJ<sup>4</sup>,

People with neurodevelopmental disorders and intellectual disabilities have much greater health care needs. Mainly staying indoors, such people generally have low 25-hydroxyvitamin D (25(OH)D) concentrations. The Vitamin D Task Force of the American Academy of Developmental Medicine and Dentistry (AADMD) reviewed the evidence of 25(OH)D concentrations that benefit the health of persons with developmental disabilities. **Maintaining recommended optimal serum 25(OH)D concentrations year long will benefit skeletal development in infants, children, and adolescents, and benefit musculoskeletal health and neuromuscular coordination in adult patients, and decrease risk of falls. Maintaining optimal concentrations decreases risks and severities of autoimmune diseases, cardiovascular disease, many types of cancer, dementia, types 1 and 2 diabetes mellitus, and respiratory tract infections. Other benefits include improved dental and oral health and improved physical performance. The Task Force recommends that 25(OH)D concentrations for optimal health to be in the range of 75 to 125 nmol/L, which can be achieved using between 800 and 4000 IU/day vitamin D3 and sensible exposure to solar UVB radiation.** The paper also discusses the potential risks of higher 25(OH)D concentrations, the evidence from and limitations of randomized controlled trials, and the recommendations by various groups and agencies.

Pediatrics. 2015 Jan;135(1):e196-8.

## **Core symptoms of autism improved after vitamin D supplementation.** Jia F<sup>1</sup>, Wang B<sup>1</sup>, Shan L<sup>1</sup>,

Autism spectrum disorder (ASD) is a common neurodevelopmental disorder caused by a complex interaction between genetic and environmental risk factors. Among the environmental factors, vitamin D3 (cholecalciferol) seems to play a significant role in the etiology of ASD because this vitamin is important for brain development. Lower concentrations of vitamin D3 may lead to increased brain size, altered brain shape, and enlarged ventricles, which have been observed in patients with ASD. Vitamin D3 is converted into 25-hydroxyvitamin D3 in the liver. Higher serum concentrations of this steroid may reduce the risk of autism. Importantly, children with ASD are at an increased risk of vitamin D deficiency, possibly due to environmental factors. **It has also been suggested that vitamin D3 deficiency may cause ASD symptoms. Here, we report on a 32-month-old boy with ASD and vitamin D3 deficiency. His core symptoms of autism improved significantly after vitamin D3 supplementation. This case suggests that vitamin D3 may play an important role in the etiology of ASD, stressing the importance of clinical assessment of vitamin D3 deficiency and the need for vitamin D3 supplementation in case of deficiency.**

## **2014**

Pediatrics. 2014 Jul;134(1):e63-71.

## **Autism spectrum disorders and race, ethnicity, and nativity: a population-based study.** Becerra TA<sup>1</sup>, von Ehrenstein OS<sup>2</sup>, Heck JE<sup>1</sup>,

Our understanding of the influence of maternal race/ethnicity and nativity and childhood autistic disorder (AD) in African Americans/blacks, Asians, and Hispanics in the United States is limited. Phenotypic differences in the presentation of childhood AD in minority groups may indicate etiologic heterogeneity or different thresholds for diagnosis. We investigated whether the risk of developing AD and AD phenotypes differed according to maternal race/ethnicity and nativity. **METHODS:** Children born in Los Angeles County with a primary AD diagnosis at ages 3 to 5 years during 1998-2009 were identified and linked to 1995-2006 California birth certificates (7540 children with AD from a cohort of 1,626,354 births). We identified a subgroup of children with AD and a secondary diagnosis of mental retardation and investigated heterogeneity in language and behavior. **RESULTS:** We found increased risks of being diagnosed with AD overall and specifically with comorbid mental retardation in children of foreign-born mothers who were black, Central/South American, Filipino, and Vietnamese, as

well as among US-born Hispanic and African American/black mothers, compared with US-born whites. Children of US African American/black and foreign-born black, foreign-born Central/South American, and US-born Hispanic mothers were at higher risk of exhibiting an AD phenotype with both severe emotional outbursts and impaired expressive language than children of US-born whites. **CONCLUSIONS: Maternal race/ethnicity and nativity are associated with offspring's AD diagnosis and severity. Future studies need to examine factors related to nativity and migration that may play a role in the etiology as well as identification and diagnosis of AD in children.**

## 2013

BMC Pediatr. 2013 Oct 19;13:171.

### **The risk of childhood autism among second-generation migrants in Finland: a case-control study.**

Lehti V, Hinkka-Yli-Salomäki S, Cheslack-Postava K,

**BACKGROUND:** Studying second-generation immigrants can help in identifying genetic or environmental risk factors for childhood autism. Most previous studies have focused on maternal region of birth and showed inconsistent results. No previous study has been conducted in Finland. **METHODS:** The study was a nested case-control study based on a national birth cohort. Children born in 1987-2005 and diagnosed with childhood autism by the year 2007 were identified from the Finnish Hospital Discharge Register. Controls were selected from the Finnish Medical Birth Register. Information on maternal and paternal country of birth and mother tongue was collected from the Finnish Central Population Register. There were 1132 cases and 4515 matched controls. The statistical test used was conditional logistic regression analysis.

**RESULTS:** Compared with children with two Finnish parents, the risk of childhood autism was increased for those whose parents are both immigrants (adjusted odds ratio [aOR] 1.8, 95% confidence interval [CI] 1.2-2.7) and for those with only an immigrant mother (aOR 1.8, 95% CI 1.2-2.7), but not for those with only an immigrant father. The risk was increased for those with a mother born in the former Soviet Union or Yugoslavia and for those with a mother or a father born in Asia. Specific parental countries of birth associated with an increased risk were the former Soviet Union, the former Yugoslavia and Vietnam. **CONCLUSIONS: In Finland, children who are born to immigrant mothers with or without an immigrant partner, have an increased risk of childhood autism. The risk varies with immigrant parents' region of birth. The findings may help in identifying possible risk factors, which can be examined in future studies.**

Sante Ment Que. 2013 Spring;38(1):189-205.

## **Autism and social support in recently immigrated families : experience of parents from Maghreb.**

Ben-Cheikh I<sup>1</sup>, Rousseau C<sup>2</sup>.

This qualitative exploratory study examines the impact of an **autism diagnosis** on the social support networks of **North African's parents recently immigrated to Quebec** and having a child diagnosed with pervasive developmental disorder. Semi-structured interviews were conducted with ten parents and participant observation took place during support meetings for the mothers. Our results highlight how the autism diagnosis transforms the parents' family and community networks, creating tensions and losses while also generating new links, sources of support. Group meetings between mothers of the same community experiencing the same problem are perceived particularly beneficial. The analysis of the relationship between professional service providers and families underlines how the development of a therapeutic alliance is threatened by major problems caused by administrative obstacles and intercultural communication difficulties. A greater awareness by health and social professionals of the interaction between the migratory context and the social network challenges associated with autism diagnostic for immigrant families would help ease these parents' loneliness and suffering.

Public Health Rep. 2013 Nov-Dec;128(6):463-79.

## **Health, chronic conditions, and behavioral risk disparities among U.S. immigrant children and adolescents.** Singh GK<sup>1</sup>, Yu SM, Kogan MD.

We examined differentials in the prevalence of 23 parent-reported health, chronic condition, and behavioral indicators among 91,532 children of immigrant and U.S.-born parents. **METHODS:** We used the 2007 National Survey of Children's Health to estimate health differentials among 10 ethnic-nativity groups. Logistic regression yielded adjusted differentials. **RESULTS:** Immigrant children in each racial/ethnic group had a lower prevalence of depression and behavioral problems than native-born children. The prevalence of autism varied from 0.3% among immigrant Asian children to 1.3%-1.4% among native-born non-Hispanic white and Hispanic children. Immigrant children had a lower prevalence of asthma, attention deficit disorder/attention deficit hyperactivity disorder; developmental delay; learning disability; speech, hearing, and sleep problems; school absence; and  $\geq 1$  chronic condition than native-born children, with health risks increasing markedly in relation to mother's duration of residence in the U.S. Immigrant children had a substantially lower exposure to environmental tobacco smoke, with the odds of exposure being 60%-95% lower among immigrant non-Hispanic black, Asian, and Hispanic children compared with native non-Hispanic white children. Obesity prevalence ranged from 7.7% for native-born Asian children to 24.9%-25.1% for immigrant Hispanic and native-born non-Hispanic black children. Immigrant children had higher physical inactivity

levels than native-born children; however, inactivity rates declined with each successive generation of immigrants. Immigrant Hispanic children were at increased risk of obesity and sedentary behaviors. Ethnic-nativity differentials in health and behavioral indicators remained marked after covariate adjustment. **CONCLUSIONS: Immigrant patterns in child health and health-risk behaviors vary substantially by ethnicity, generational status, and length of time since immigration. Public health programs must target at-risk children of both immigrant and U.S.-born parents.**

Acta Psychiatr Scand. 2013 Jul;128(1):54-60.

## **An incidence study of diagnosed autism-spectrum disorders among immigrants to the Netherlands.**

van der Ven E<sup>1</sup>, Termorshuizen F, Laan W.

To estimate the risk of developing autism-spectrum disorder (ASD) in children born to immigrants as compared with children of Dutch-born parents. **METHOD:** Retrospective, population-based cohort study of all live births (n = 106 953) between 1998 and 2007 in a circumscribed geographical region in the Netherlands. Cohort members were linked to the Psychiatric Case Register to identify diagnosed cases. **RESULTS:** A total of 518 cases of ASD were identified, including 150 children with autism and 368 children with Asperger syndrome or Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS). Children born to migrants from developing countries were at significantly lower risk of ASD [rate ratio (RR) = 0.6, 95% confidence interval (CI) 0.5-0.9] than children of Dutch-born parents. Within the ASD group, the risk for the subgroup with Asperger syndrome and PDD-NOS was reduced (RR = 0.4, 95% CI 0.3-0.6), whereas that for narrowly defined autism was non-significantly increased (RR = 1.4, 95% CI 0.9-2.4). Migrant groups did not differ in age at diagnosis. **CONCLUSION: The results echo Swedish findings indicating a reversal of risk gradient in children of parents from developing countries, specifically a decreased risk for high-functioning and increased risk for low-functioning autism.**

Zhongguo Dang Dai Er Ke Za Zhi. 2013 Aug;15(8):698-702.

## **Relationship between vitamin D and autism spectrum disorder.** Duan XY<sup>1</sup>, Jia FY, Jiang HY.

**Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder, with multiple genetic and environmental risk factors. The interplay between genetic and environmental factors has become the subject of intensified research in the last several years. Vitamin D deficiency has recently been proposed as a possible environmental risk factor for ASD. Vitamin D has a unique role in brain homeostasis, embryogenesis and neurodevelopment,**

**immunological modulation (including the brain's immune system), antioxidation, antiapoptosis, neural differentiation and gene regulation. Children with ASD had significantly lower serum levels of 25-hydroxy vitamin D than healthy children. Therefore vitamin D deficiency during pregnancy and early childhood may be an environmental trigger for ASD.**

**2012**

Disabil Health J. 2012 Jan;5(1):18-25

**Association between parental nativity and autism spectrum disorder among US-born non-Hispanic white and Hispanic children, 2007 National Survey of Children's Health.** Schieve LA<sup>1</sup>, Boulet SL, Blumberg SJ,

Limited studies suggest the prevalence of autism spectrum disorders (ASD) varies by whether maternal and child birth country are discordant. **OBJECTIVE/HYPOTHESIS:** We explored associations between ASD and maternal and paternal nativity in a sample of US-born non-Hispanic white (NHW, n = 37,265) and US-born Hispanic (n = 4,690) children in the 2007 National Survey of Children's Health (NSCH). **METHODS:** We assessed ASD prevalence within race-ethnicity and parental nativity subgroups. Prevalence ratios (aPR), comparing each group to NHW children with 2 US-born parents, were adjusted for child age, sex, and receipt of care in a medical home. Estimates were weighted to reflect US noninstitutionalized children. Standard errors were adjusted to account for the complex sample design. **RESULTS:** In NHW children with 2 US-born parents, ASD prevalence was 1.19%; estimates were similar for NHW children with a foreign-born mother or father. There was a striking heterogeneity between Hispanic children with 2 US-born versus 2 foreign-born parents (ASD prevalence 2.39% versus 0.31%, p = .05). Even after adjustment, PRs comparing ASD prevalence in Hispanic versus NHW children were vastly different for Hispanic subgroups, suggesting a substantially lower prevalence for Hispanic children with both parents foreign-born (aPR 0.2, 95% confidence interval 0.1-0.5) and a higher prevalence for Hispanic children with both parents US-born (aPR 2.0 [0.8-4.6]). **CONCLUSIONS:** Previous studies comparing ASD prevalence between NHW and Hispanic children based on a composite Hispanic grouping without consideration of parental nativity likely missed important differences between these racial-ethnic groups. Continuing efforts toward improving early identification in Hispanic children are needed.

Br J Psychiatry. 2012 Aug;201:109-15.

## **Migration and autism spectrum disorder: population-based study.** Magnusson C<sup>1</sup>, Rai D, Goodman A

Migration has been implicated as a risk factor for autism, but evidence is limited and inconsistent. **AIMS:** To investigate the relationship between parental migration status and risk of autism spectrum disorder, taking into consideration the importance of region of origin, timing of migration and possible discrepancies in associations between autism subtypes. **METHOD:** Record-linkage study within the total child population of Stockholm County between 2001 and 2007. Individuals with high- and low-functioning autism were defined as having autism spectrum disorder with and without comorbid intellectual disability, and ascertained via health and habilitation service registers. **RESULTS:** In total, 4952 individuals with autism spectrum disorder were identified, comprising 2855 children with high-functioning autism and 2097 children with low-functioning autism. **Children of migrant parents were at increased risk of low-functioning autism (odds ratio (OR) = 1.5, 95% CI 1.3-1.7); this risk was highest when parents migrated from regions with a low human development index, and peaked when migration occurred around pregnancy (OR = 2.3, 95% CI 1.7-3.0).** A decreased risk of high-functioning autism was observed in children of migrant parents, regardless of area of origin or timing of migration. Parental age, income or obstetric complications did not fully explain any of these associations. **CONCLUSIONS:** Environmental factors associated with migration may contribute to the development of autism presenting with comorbid intellectual disability, especially when acting in utero. High- and low-functioning autism may have partly different aetiologies, and should be studied separately.

Pediatrics. 2012 Nov;130 Suppl 2:S191-7.

## **Autism spectrum disorders and developmental disabilities in children from immigrant families in the United States.** Lin SC<sup>1</sup>, Yu SM, Harwood RL.

Recent census data show that nearly one-quarter of US children have at least 1 immigrant parent; moreover, there has been a dramatic increase in children diagnosed with autism spectrum disorders (ASDs) and select developmental disabilities (DDs). However, little is known about access to medical home and adequacy of insurance coverage for children with ASDs and select DDs from immigrant families. **METHODS:** By using the 2007 National Survey of Children's Health, we compared children with ASDs and select DDs from immigrant (n = 413, foreign born or reside with at least 1 immigrant parent) and nonimmigrant (n = 5411) families on various measures of medical home and insurance coverage. We used weighted logistic regression to examine the association between immigrant family and selected outcome measures while controlling for confounding factors. **RESULTS:** Compared with nonimmigrant families, children



with ASD and select DD from immigrant families were more than twice as likely to lack usual source of care and report physicians not spending enough time with family. Furthermore, multivariable analyses indicate that insurance coverage is an important factor in mitigating health care barriers for immigrant families. **CONCLUSIONS:** The study demonstrates important areas of deficits in the health care experiences of children with ASD and select DD from immigrant households. Public policy implications include increasing access to existing insurance programs, augmenting public awareness resources for ASD and select DD, and offering assistance to immigrant families that are struggling with the medical needs of their children.

Res Dev Disabil. 2012 Sep-Oct;33(5):1541-50.

## **Vitamin D and autism: clinical review.**

Kočovská E<sup>1</sup>, Fernell E, Billstedt E,

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder with multiple genetic and environmental risk factors. The interplay between genetic and environmental factors has become the subject of intensified research in the last several years. Vitamin D deficiency has recently been proposed as a possible environmental risk factor for ASD. **OBJECTIVE:** The aim of the current paper is to systematically review the research regarding the possible connection between ASD and vitamin D, and to provide a narrative review of the literature regarding the role of vitamin D in various biological processes in order to generate hypotheses for future research. **RESULTS:** Systematic data obtained by different research groups provide some, albeit very limited, support for the possible role of vitamin D deficiency in the pathogenesis of ASD. There are two main areas of involvement of vitamin D in the human body that could potentially have direct impact on the development of ASD: (1) the brain (its homeostasis, immune system and neurodevelopment) and (2) gene regulation. **CONCLUSION: Vitamin D deficiency--either during pregnancy or early childhood--may be an environmental trigger for ASD in individuals genetically predisposed for the broad phenotype of autism. On the basis of the results of the present review, we argue for the recognition of this possibly important role of vitamin D in ASD, and for urgent research in the field.**

J Neuroinflammation. 2012 Aug 17;9:201.

## **Reduced serum concentrations of 25-hydroxy vitamin D in children with autism: relation to autoimmunity.**

Mostafa GA<sup>1</sup>, Al-Ayadhi LY.

**BACKGROUND:** Aside from the skeletal health affection, vitamin D deficiency has been implicated as a potential environmental factor triggering for some autoimmune disorders. Vitamin D might play a role in the regulation of the production of auto-antibodies.

Immunomodulatory effects of vitamin D may act not only through modulation of T-helper cell function, but also through induction of CD4(+)CD25(high) regulatory T-cells. We are the first to investigate the relationship between serum levels of 25-hydroxy vitamin D and anti-myelin-associated glycoprotein (anti-MAG) auto-antibodies in autistic children. **METHODS:** Serum levels of 25-hydroxy vitamin D and anti-MAG auto-antibodies were measured in 50 autistic children, aged between 5 and 12 years, and 30 healthy-matched children. Serum 25-hydroxy vitamin D levels 10-30 ng/mL and < 10 ng/mL were defined as vitamin D insufficiency and deficiency, respectively. **RESULTS:** Autistic children had significantly lower serum levels of 25-hydroxy vitamin D than healthy children ( $P < 0.001$ ) with 40% and 48% being vitamin D deficient and insufficient, respectively. Serum 25-hydroxy vitamin D had significant negative correlations with Childhood Autism Rating Scale ( $P < 0.001$ ). Increased levels of serum anti-MAG auto-antibodies were found in 70% of autistic patients. Serum 25-hydroxy vitamin D levels had significant negative correlations with serum levels of anti-MAG auto-antibodies ( $P < 0.001$ ). **CONCLUSIONS:** Vitamin D deficiency was found in some autistic children and this deficiency may contribute to the induction of the production of serum anti-MAG auto-antibodies in these children. However, future studies looking at a potential role of vitamin D in the pathophysiology and treatment of autism are warranted.

## 2011

Acta Psychiatr Scand. 2011 May;123(5):339-48.

### **Prevalence of autism according to maternal immigrant status and ethnic origin.** Dealberto MJ<sup>1</sup>.

**OBJECTIVE:** To examine the rates of autism separately according to maternal immigrant status and ethnic origin in respect to the vitamin D insufficiency hypothesis. **METHOD:** Articles were identified by electronic searches. Studies were selected when they analysed autism rates according to maternal immigrant status and/or ethnic origin using multivariate techniques. **RESULTS:** This review gave further support to the association between maternal immigrant status and an increased risk of autism. The relationship with ethnic origin was more complex. Although the crude rates did not differ, multivariate analyses taking into account confounding factors found that black ethnicity was associated with an increased risk for autism. The risk was highly significant when considering the strict definition of autistic disorders as opposed to the large definition of other pervasive developmental disorders. The risk was also very significant for autism associated with mental retardation. **CONCLUSION:** **These results are consistent with the maternal vitamin D insufficiency hypothesis. Neurobiological studies are warranted to document the effect of maternal vitamin D insufficiency during pregnancy on the foetal brain and the window of vulnerability. This review stresses the importance of monitoring vitamin D levels in pregnant women, especially those who are immigrant, dark-skinned or veiled, and the urgency of randomized controlled trials.**

Acta Psychiatr Scand. 2011 Jul;124(1):74; author reply 74-5.

## **Autism, immune dysfunction and Vitamin D.**

Becker KG. Comment on Prevalence of autism according to maternal immigrant status and ethnic origin. [Acta Psychiatr Scand. 2011]

## **2010**

Br J Psychiatry. 2010 Apr;196(4):274-81.

## **Autism, ethnicity and maternal immigration.**

Keen DV<sup>1</sup>, Reid FD, Arnone D.

A growing number of European studies, particularly from Nordic countries, suggest an increased frequency of autism in children of immigrant parents. In contrast, North American studies tend to conclude that neither maternal ethnicity nor immigrant status are related to the rate of autism-spectrum disorders. **AIMS:** To examine the hypotheses that maternal ethnicity and/or immigration are linked to the rate of childhood autism-spectrum disorders. **METHOD:** Retrospective case-note analysis of all 428 children diagnosed with autism-spectrum disorders presenting to the child development services in two centres during a 6-year period. **RESULTS:** **Mothers born outside Europe had a significantly higher risk of having a child with an autism-spectrum disorder compared with those born in the UK, with the highest risk observed for the Caribbean group (relative risks (RRs) in the two centres: RR = 10.01, 95% CI 5.53-18.1 and RR = 8.89, 95% CI 5.08-15.5). Mothers of Black ethnicity had a significantly higher risk compared with White mothers (RR = 8.28, 95% CI 5.41-12.7 and RR = 3.84, 95% CI 2.93-5.02). Analysis of ethnicity and immigration factors together suggests the increased risk is predominately related to immigration. CONCLUSIONS:** **Maternal immigration is associated with substantial increased risk of autism-spectrum disorders with differential risk according to different region of birth and possibly ethnicity.**

Acta Paediatr. 2010 May;99(5):743-7.

## **Serum levels of 25-hydroxyvitamin D in mothers of Swedish and of Somali origin who have children with and without autism.** Fernell E<sup>1</sup>, Barnevik-Olsson M, Bågenholm G,

To analyse serum levels of 25-hydroxyvitamin D in mothers of Somali origin and those of Swedish origin who have children with and without autism as there is a growing evidence that low vitamin D impacts adversely on brain development. **METHOD:** Four groups of mothers were invited to participate; 20 with Somali origin with at least one child with autism, 20 with Somali origin without a child with autism, 20 of Swedish origin with at least one child with autism and 20 with Swedish origin without a child with autism. Two blood samples were collected from each individual; during autumn and spring. **RESULTS:** Between 12 and 17 mothers from the different groups accepted to participate, both groups of mothers of Somali origin had significantly lower values of 25-hydroxyvitamin D compared with Swedish mothers. The difference of 25-hydroxyvitamin D between mothers of Somali origin with and without a child with autism was not significant. **CONCLUSION: Our findings of low vitamin D levels in Somali women entail considerable consequences in a public health perspective. The observed tendency, i.e. the lowest values in mothers of Somali origin with a child with autism was in the predicted direction, supporting the need for further research of vitamin D levels in larger samples of Somali mothers of children with and without autism.**

Dev Med Child Neurol. 2010 Dec;52(12):1167-8.

## **Prevalence of autism in children of Somali origin living in Stockholm: brief report of an at-risk population.** Barnevik-Olsson M, Gillberg C, Fernell E.

This work was a follow-up study (birth years 1999-2003) of the prevalence of autism in children of Somali background living in the county of Stockholm, Sweden. In a previous study (birth years 1988-98), the prevalence of autism associated with learning disability\* was found to be three to four times higher among Somali children compared with other ethnicities in Stockholm. We examined all records of children of Somali background, born from 1999 to 2003, registered at the centre for schoolchildren with autism and learning disability. The census day was 31 December 2009. The prevalence of autism and PDDNOS (with learning disability) was 0.98% (18/1836) in the Somali group and 0.21% (232/111555) in the group of children of non-Somali origin ( $p < 0.001$ ). The increased prevalence remained and was now between four and five times higher in children of Somali background. A clinical observation was that more than 80%, in addition to autism and learning disability, had a profound hyperactivity. The findings accord with many other

studies reporting higher prevalence rates of autism in children of immigrant mothers. We discuss the need for further research of underlying mechanisms.

Acta Paediatr. 2010 May;99(5):743-7.

## **Serum levels of 25-hydroxyvitamin D in mothers of Swedish and of Somali origin who have children with and without autism.** Fernell E<sup>1</sup>, Barnevik-Olsson M, Bågenholm G.

AIM: To analyse serum levels of 25-hydroxyvitamin D in mothers of Somali origin and those of Swedish origin who have children with and without autism as there is a growing evidence that **low vitamin D impacts adversely on brain development.** METHOD: Four groups of mothers were invited to participate; 20 with Somali origin with at least one child with autism, 20 with Somali origin without a child with autism, 20 of Swedish origin with at least one child with autism and 20 with Swedish origin without a child with autism. Two blood samples were collected from each individual; **during autumn and spring.** RESULTS: Between 12 and 17 mothers from the different groups accepted to participate, both groups of mothers of Somali origin had significantly lower values of 25-hydroxyvitamin D compared with Swedish mothers. The difference of 25-hydroxyvitamin D between mothers of Somali origin with and without a child with autism was not significant. **CONCLUSION: Our findings of low vitamin D levels in Somali women entail considerable consequences in a public health perspective. The observed tendency, i.e. the lowest values in mothers of Somali origin with a child with autism was in the predicted direction, supporting the need for further research of vitamin D levels in larger samples of Somali mothers of children with and without autism.**

J Photochem Photobiol B. 2010 Nov 3;101(2):142-9.

## **Vitamin D, light and mental health.** Humble MB<sup>1</sup>.

**Vitamin D receptors and vitamin D metabolizing enzymes are present in the central nervous system. Calcitriol (the active vitamin D hormone) affects numerous neurotransmitters and neurotrophic factors, relevant for mental disorders. In the case of depressive disorders, considerable evidence supports a role of suboptimal vitamin D levels. However, the data are not conclusive and further studies are necessary. Especially, the relative importance of the pineal-melatonin system versus the vitamin D-endocrine system for the pathogenesis of seasonal affective disorders is presently unresolved. Two diagnoses, schizophrenia and autism, have been hypothetically linked to developmental (prenatal) vitamin D deficiency, however, also in adult patients, low levels have been reported, supporting the notion that vitamin D deficiency may not only be a predisposing developmental factor but also relate to the adult patients' psychiatric state. Two cases are described, whose psychiatric improvement coincided with effective treatment of vitamin D deficiency.**

## **Reduced serum levels of 25-hydroxy and 1,25-dihydroxy vitamin D in Egyptian children with autism.** Meguid NA<sup>1</sup>, Hashish AF, Anwar M, Sidhom G.

**The aim of this study was to investigate the potential role of vitamin D in autism through serum level assessment.** DESIGN: This was a case-controlled cross-sectional study. SETTING: The study was conducted at the Out-patient Clinic for "Children with Special Needs" at the Medical Services Unit of the National Research Centre in Cairo, Egypt. SUBJECTS: Seventy (70) children with autism diagnosed according to the DSM-IV criteria of the American Psychiatric Association were recruited for this study. The mean age +/- standard deviation (SD) of the patients was 5.3 +/- 2.8 years. Controls included 42 age-matched randomly selected healthy children of the same socioeconomic status (mean age +/- SD, 6.1 +/- 1.8 years). METHODS: Circulating levels of both forms of vitamin D (25(OH)D and 1,25(OH)(2)D) and serum calcium were measured for all subjects. Associations between vitamin D status, birth season, and clinical characteristics of autism were examined. RESULTS: Children with autism had significantly lower 25(OH)D ( $p < 0.00001$ ) and 1,25(OH)(2)D ( $p < 0.005$ ) as well as lower calcium ( $p < 0.0001$ ) serum values than the controls. A significant positive correlation was obtained between 25(OH)D and calcium (correlation coefficient  $r = 0.309$ ,  $p < 0.01$ ) within the children with autism. No significant difference was found on comparison of birth month and season of birth between children with autism and healthy controls. Furthermore, associations linking parental consanguinity or convulsions with vitamin D could not be established. CONCLUSIONS: Serum values of 25(OH)D in the children with autism of this study could classify them as being "vitamin D inadequate," which lends support to the hypothesis that autism is a vitamin D deficiency disorder.

## **2009**

## **Phenotypic expression of autoimmune autistic disorder (AAD): a major subset of autism.**

Singh VK<sup>1</sup>.

BACKGROUND: Autism causes incapacitating neurologic problems in children that last a lifetime. The author of this article previously hypothesized that autism may be caused by autoimmunity to the brain, possibly triggered by a viral infection. This article is a summary of laboratory findings to date plus new data in support of an autoimmune pathogenesis for autism. METHODS: Autoimmune markers were analyzed in the sera of autistic and normal children, but the cerebrospinal fluid (CSF) of some autistic children was also analyzed. Laboratory procedures included enzyme-linked immunosorbent assay and protein immunoblotting assay. RESULTS:

Autoimmunity was demonstrated by the presence of brain autoantibodies, abnormal viral serology, brain and viral antibodies in CSF, a positive correlation between brain autoantibodies and viral serology, elevated levels of proinflammatory cytokines and acute-phase reactants, and a positive response to immunotherapy. Many autistic children harbored brain myelin basic protein autoantibodies and elevated levels of antibodies to measles virus and measles-mumps-rubella (MMR) vaccine. Measles might be etiologically linked to autism because measles and MMR antibodies (a viral marker) correlated positively to brain autoantibodies (an autoimmune marker)--salient features that characterize autoimmune pathology in autism. Autistic children also showed elevated levels of acute-phase reactants--a marker of systemic inflammation.

**CONCLUSIONS: The scientific evidence is quite credible for our autoimmune hypothesis, leading to the identification of autoimmune autistic disorder (AAD) as a major subset of autism. AAD can be identified by immune tests to determine immune problems before administering immunotherapy. The author has advanced a speculative neuroautoimmune (NAI) model for autism, in which virus-induced autoimmunity is a key player. The latter should be targeted by immunotherapy to help children with autism.**

**[CB note: If so, this finding is also consistent with the already well-recognized role of vitamin D inadequacy in allowing the triggering of genetic autoimmune conditions like type 1 diabetes, celiac disease, MS, parkinsonism, lupus scleroderma etc. etc. etc.]**

## 2008

Dev Med Child Neurol. 2008 Aug;50(8):598-601.

### **Prevalence of autism in children born to Somali parents living in Sweden: a brief report.**

Barnevik-Olsson M<sup>1</sup>, Gillberg C, Fernell E.

In a geographical area of Stockholm, with a relatively large Somali immigrant population, parents as well as teachers in special schools and staff at habilitation centres have raised concerns over whether children with a Somali background are over-represented in the total group of children with autism. The aim of the study was, therefore, to investigate the prevalence of autism in children with parents from Somalia, living in Stockholm county, and to compare the prevalence in children of Somali background with that in the non-Somali group. We reviewed the records of 17 children (13 males, four females), born between 1988 and 1998 (age range 7-17y) and with a Somali background, who had a diagnosis of autistic disorder or pervasive developmental disorder not otherwise specified (PDDNOS) and were registered at either of the two autism habilitation centres for school-aged children. **The prevalence of autistic disorder or PDDNOS was found to be three to four times higher than in the non-Somali group (0.7%**

vs 0.19%). All children also had learning disability.\* Our findings warrant further investigations of possible aetiological factors behind the increased prevalence of autistic disorders in children of Somali origin found in this area in Sweden.

Tidsskr Nor Laegeforen. 2008 Sep 11;128(17):1986-7.

## **Increased occurrence of autism among Somali children--does vitamin D deficiency play a role?**

[Article in Swedish] Bejerot S, Humble M. No abstract available; full text available for free but not in English]

## **1990s**

Br J Psychiatry. 1995 Sep;167(3):362-9.

## **Child and adolescent psychiatric presentations of second-generation Afro-Caribbeans in Britain.**

Goodman R<sup>1</sup>, Richards H.

**BACKGROUND:** A clinical sample was used to investigate whether second-generation Afro-Caribbean children differed from other British-born children in their psychiatric presentation or vulnerability to risk factors. **METHOD:** Second-generation Afro-Caribbean patients (n = 292) were compared with a predominantly white group of patients (n = 1311) who lived in the same inner-city area and attended the same child psychiatric clinic between 1973 and 1989. Data on psychiatric presentation and background factors were systematically recorded at the time of the initial clinical assessment. **RESULTS:** Afro-Caribbean patients were exposed to more socio-economic disadvantage but less family dysfunction. The ratio of emotional to conduct disorders was lower among Afro-Caribbean than among the comparison patients--an effect that was not evidently due to demographic factors or diagnostic bias. Most risk factors for emotional or conduct disorders had comparable effects on Afro-Caribbean and comparison patients. **Psychotic and autistic disorders were disproportionately common among the Afro-Caribbean patients.** **CONCLUSIONS:** Second-generation Afro-Caribbean children differ somewhat from other British-born children in their psychiatric presentation--a difference that has persisted over the 1970s and 1980s and that deserves more investigation than it has received to date.



J Intellect Disabil Res. 1995 Apr;39 ( Pt 2):141-4.

## **Autism in immigrants: children born in Sweden to mothers born in Uganda.**

Gillberg C<sup>1</sup>, Schaumann H, Gillberg IC.

Three boys diagnosed as suffering from autistic disorder were born in Sweden to mothers born in Uganda. Two were related but the third boy was unrelated to the others. **The prevalence for autistic disorder in Göteborg children born to mothers who were born in Uganda was 15% which is almost 200 times higher than in the general population of children. The possible reason for the high autism rate in this particular ethnic subgroup is discussed**

## **1980s**

Br J Psychiatry. 1987 Jun;150:856-8.

## **Infantile autism in children of immigrant parents. A population-based study from Göteborg, Sweden.**

Gillberg C<sup>1</sup>, Steffenburg S, Börjesson B,.

A population-based study of infantile autism from western Sweden has been completed. **Urban children with autism more often than age-matched children in the general population had immigrant parents from 'exotic' countries.** No such trend was seen in rural children with infantile autism.