

**Investigation of Neurologic Symptoms among Le Roy Jr/Sr High School Students,
October 2011 – January 2012
Interim Report
January 31, 2012**

Summary

This report summarizes an on-going investigation (as of January 31, 2012) of neurologic tic symptoms in 12 female students at Le Roy Jr/Sr High School in Le Roy, New York (Genesee County) during October 2011 to January 2012.

Tics are repeated involuntary twitches, movements, or sounds. Isolated and transient tics are common among children, affecting up to 20% of the school-age population.

A collaborative investigation by New York State Department of Health (NYSDOH), New York State Office of Mental Health (NYSOMH), Genesee County Health Department (GCHD), Le Roy Central School District (LRCS), and its medical contractor, Work Fit Medical (WFM), found no infectious or environmental etiologies.

Eight of the twelve students were diagnosed with conversion disorder and have been evaluated by a pediatric neurologist. Three students had illness associated with tic symptoms predating their attendance at the school.

In an effort to obtain best-in-nation evaluation and care for impacted students, NYSDOH has secured an agreement from the National Institutes of Health (NIH) to provide each student with a no-cost specialized medical consultation.

On January 11, 2012, Le Roy Jr/Sr High School hosted a public meeting, which included NYSDOH and NYSOMH officials, to share the results of the investigation and address questions from the community. The primary findings were that there were no infectious or environmental public health concerns related to this cluster of students.

While preparing this report, NYSDOH learned of three additional students with possible tic symptoms; they are currently under investigation.

Introduction

On October 21, 2011, the NYSDOH Western Regional Office (WRO) was notified by the GCHD that eight Le Roy Jr/Sr High School students had recently developed neurologic tic symptoms. WRO staff reached out to multiple programs within the NYSDOH including chronic disease, environmental health, and communicable disease for their expertise and guidance related to the information received. In addition, WRO staff reached out to LRCS health staff for additional information on the students. A conference call was held on Friday, November 4, 2011 between NYSDOH, GCHD, LRCS, WFM, and the New York State Education Department (NYSED) to review the situation and determine next steps. Subsequent to the call, NYSDOH WRO learned that four additional students

developed tic symptoms in December 2011. Medical diagnoses, epidemiologic, clinical, and environmental factors were reviewed to determine if there was a possible infectious or environmental cause of the tic symptoms.

School Description

Le Roy Jr/Sr High School, a combined building, is located at 9300 South Street in Le Roy, New York. The school was first occupied in 2003 and is 129,190 square feet in size. The construction type is primarily slab on grade masonry construction. The boiler room and auditorium are partially below grade. It is served by municipal water and sewer. There are 32 teaching classrooms and the student population is approximately 630.

Medical Evaluation

All 12 students were evaluated by Work Fit Medical and eight of the 12 were evaluated by DENT Neurologic Institute.

Epidemiologic Methods

Le Roy Jr/Sr High School obtained parental consents allowing WFM to review individual patient medical records and interview the affected students and families. Information such as, past medical history, family medical history, significant life stressors, past and current medications, recent illness, drug use and laboratory testing was collected during the interviews and medical record review. Possible common exposures were evaluated (where they live, work, volunteer, play sports, etc.). In addition, WFM consulted with the treating pediatric neurologist who evaluated eight of the 12 cases as of the date of this report.

Environmental Methods

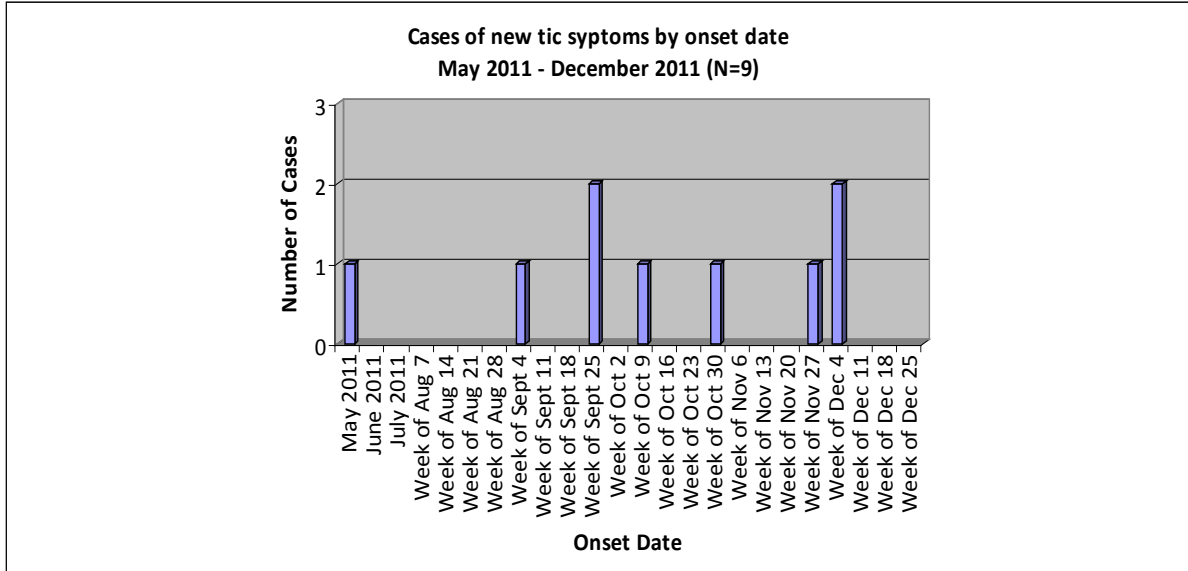
NYSDOH staff provided WFM with questions to be incorporated in the student interviews. NYSDOH staff conducted a literature search to explore possible associations between environmental chemical exposures and development of neurologic tics. Data on the water quality testing conducted by the Monroe County Water Authority (MCWA), including public water provided to the school from MCWA, are reviewed routinely by the GCHD. NYSDOH consulted with the United States Environmental Protection Agency (EPA) regarding the Lehigh Valley Railroad Derailment Superfund Site and reviewed information pertaining to the Lapp Insulator and Target Products Sites to determine the potential for spread of contamination to the school campus. At the request of LRCSD, in December 2011, the Genesee Valley Educational Partnership Office of Health-Safety-Risk Management Services (BOCES) conducted an evaluation of indoor air quality and mold within the Le Roy Jr/Sr High School building. GCHD, working collaboratively with BOCES, collected additional water quality samples from the school on January 25, 2012.

Epidemiologic Results

Between October and December 2011, NYSDOH received reports of twelve students with tic symptoms from LRCSD and WFM. The cases ranged in age from 13 to 19 years.

All cases were female. Three of the 12 cases were identified as having pre-existing medical conditions associated with tic disorders. Two of the three cases, who were tic free for a period of time, experienced an exacerbation of tic symptoms during this time period. The third case was identified as having a previous diagnosis of Tourette’s disorder and did not have a new onset of tic symptoms, but rather an acceleration of on-going tics during this time period. Onsets of tic symptoms ranged from May 2011 to December 2011 for the nine new onsets (Figure 1).

Figure 1 – Epidemiologic curve of outbreak



Interviews of the 12 cases did not reveal any common exposures or evidence of an infectious etiology. The cases are in different grade levels (1-8th; 1-9th; 3-10th; 3-11th; 4-12th). No common in-school or after school activities among the entire group were identified. Four participated in cheerleading and two participated in soccer. Medical testing and screening failed to identify a definitive somatic diagnosis. Antistreptolysin O (ASO) titers were ordered on six of the cases. Four were elevated above the normal range and two were normal. Drug use was ruled out based on interviews with all the cases, and toxicology screens on seven of the cases. Five were negative and two were positive for medication the cases were previously prescribed. Heavy metal testing was ordered on five cases and all were negative. According to the New York State Immunization Information System (NYSIIS), seven of the cases received Gardasil, human papillomavirus (HPV) vaccine. Five cases received the recommended three doses while two cases received two of three doses. Six of seven cases who received Gardasil had onset of tic symptoms greater than one year after their last dose of vaccine. One case received her third dose after her tic symptom onset (Table 1). No temporal relationship between vaccine administration and symptom onset was identified. A post-licensure safety study of HPV vaccine among 189,629 females completed by an independent safety team of experts, identified no association between vaccination with Gardasil and neurologic disorders (1).

Table 1.

Case	# of Gardasil Doses	Date of last dose	Onset of Symptoms	Time from last dose to onset
1	3	2008	2011	3 yrs, 4 mos
2	3	2010	2011	1 yr, 6 mos
3	3	2008	2011	3 yrs, 4 mos
4	3	2011	2011	Onset prior to last dose
5	3	2010	2011	1 yr, 5 mos
6	2	2008	2011	3 yrs
7	2	2007	2011	4 yrs, 4 mos

Significant life stressors were identified in 11 of the cases. Eight of the cases were diagnosed as conversion disorder by the primary treating physicians and pediatric neurologist; three cases had preceding medical illness associated with tics, and one case did not seek medical attention.

Environmental Results

Interviews of the 12 cases did not reveal any common environmental exposures, other than attendance at the same school. The occurrence of symptoms in only female students and the range of time of symptom onset are not consistent with an environmental cause.

A comprehensive search of the biomedical and life sciences literature using the National Library of Medicine database found a single case report of a 5-year-old Chinese boy who developed transient tics after using large amounts of a mercury-containing herbal mouth spray and a single case report of a 12-year-old Turkish boy who developed transient tics after carbon monoxide poisoning. Additional searches failed to identify other articles demonstrating associations between environmental chemical exposures, including trichloroethene (TCE), and the development of neurologic tics.

Water quality provided by the MCWA is in compliance with current state and federal drinking water standards. NYSDOH analyzed three drinking water samples taken on January 25, 2012 by GCHD from Le Roy Jr/Sr High School. Two samples were taken from within the campus (a student science laboratory and cafeteria kitchen). The third sample was taken where public water enters the building and is representative of water quality in the distribution system that supplies the school and the surrounding area. The analyses of these samples were completed on January 30, 2012.

The results show nothing out of the ordinary. All three samples meet state and federal drinking water standards. The water quality in the school was no different from the water quality in the community. In addition, all three samples were consistent with the normally expected water quality for the entire MCWA service area. The only chemical detections to note were disinfection by-products, the earth metal barium, and fluoride.

All of these detected chemicals were at levels well below drinking water standards. The disinfection by-products were found at levels consistent with the entire MCWA service area. Disinfection by-products occur at all drinking water systems that chlorinate surface water and result from the reaction of the primary disinfectant (chlorine) with naturally occurring organic material found in all surface waters of the State. The detected barium comes from Lake Ontario and is consistent with the level normally present in MCWA's water. Fluoride is added by MCWA for dental protection purposes and the level detected is MCWA's optimal target level for fluoride. The detected chemical levels are shown in Table 2.

The laboratory analyses looked for 58 volatile organic chemicals (including TCE), 63 separate pesticides and herbicides, 11 metals, cyanide, polychlorinated biphenyl's (PCBs) and ketones.

Table 2. Disinfection by-products, Barium, and Fluoride Levels

Detected Chemical	Range of Levels Detected	Maximum Contaminant Level
Disinfection Byproducts: (DBP)		
Chloroform	27 - 28 (ug/L or ppb)	N/A
Bromodichloromethane	10 - 10 (ug/L or ppb)	N/A
Dibromochloromethane	2.8 - 2.8 (ug/L or ppb)	N/A
Total DBP	39.8 - 40.8 (ug/L or ppb)	80 (ug/L or ppb)
Barium	0.018 - 0.019 (mg/L or ppm)	2 (mg/L or ppm)
Fluoride	0.7 - 0.7 (mg/L or ppm))	2.2 (mg/L or ppm)
Key		
ug/l=micrograms per liter; mg/l=milligrams per liter; ppm=parts per million; ppb=parts per billion		

The Lehigh Valley Railroad Derailment Superfund Site, the Lapp Insulator Site and Target Products Site do not represent a source of contamination or exposure for the school property for the following reasons:

- According to EPA records, the Lehigh Valley Railroad Derailment Superfund Site is located approximately 3.5 miles east of the school. Contamination is limited to the site of the spill and areas to the east.
- Water in an adjacent dolomite quarry has very low level of TCE (median value of five micrograms per liter, which is NYS drinking water standard for TCE). School officials reported that crushed stone from the quarry was used at the school in a road construction project and for subsurface drainage at a playing field. Residual TCE that might be present in stone from the quarry would be reduced or eliminated through evaporation during stone crushing and handling operations.

- The Lapp Insulator Site, located near Oatka Creek, is approximately 4700 feet west of the school, and has been evaluated in the past. Private drinking water wells near the site were tested and it has been established by New York State Department of Environmental Conservation (NYSDEC) that the site is not contaminating drinking water wells. Surface water and sediment in the Oatka Creek are not contaminated at levels of concern.
- Chemicals associated with the Target Products Site have not been detected in nearby groundwater monitoring wells.

The reports prepared by BOCES specific to indoor air quality and mold within the Le Roy Jr/Sr High School building identified no environmental concerns (Attachments I & II).

Discussion

Twelve cases of tic-like behaviors were identified among Le Roy Jr/Sr High School students with onsets or recurrence/exacerbation over a seven month period. Two of the cases had preceding illnesses associated with tics and one case has a pre-existing Tourette's diagnosis.

The wide dispersion of cases over time, lack of affected faculty/staff, and the involvement of only female students argue heavily against a common environmental or infectious source for the cases.

Review of clinical history, medical diagnoses, epidemiologic and environmental exposure information on the cases, as well as information from environmental assessments and case interviews revealed no common infectious etiology or environmental exposure.

The American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR) is used by health professionals to help diagnose tic disorders. Tics are repeated involuntary twitches, movements, or sounds. Four tic disorders described in the DSM-IV-TR are differentiated by the type of tic present and duration of symptoms. These include Tourette's disorder, chronic motor or vocal tic disorder, transient tic disorder, and tic disorder not otherwise specified (2). Isolated and transient tics are common among children, affecting up to 20 % of the school-age population (3).

The clinical diagnosis for the eight cases seen by the pediatric neurologist was conversion disorder. These eight cases all had significant life stressors, a common factor with conversion disorder. Conversion disorder is a separate DSM category and is characterized by physical symptoms without an identified cause other than psychological stress (4). Tic-like symptoms may be a sign of conversion disorder. Conversion disorder is more prevalent in females. Symptoms can be severe (4,5).

The term Pediatric Autoimmune Neuropsychiatric Disorders Associated with Streptococci, commonly referred to as PANDAS, has been used for a group of neuro-psychiatric disorders that are proposed to have an autoimmune basis and to be related to infection with group A beta-hemolytic streptococci (GAS) (6). PANDAS as the cause of tic symptoms in this cluster has been considered and rejected by medical professionals. The diagnosis of PANDAS is a clinical diagnosis in which five diagnostic criteria must be met (7). None of the cases meet the PANDAS criteria. In addition, the ASO titer elevations found on the four cases were not significant (>400 IU/ML) enough to meet diagnostic criteria as per consultation with NIH (8). In most studies, there was no association between levels of ASO titers and clinical symptoms (9). Leckman et.al found no evidence for a temporal association between GAS and tic symptom exacerbations in children who meet the published PANDAS diagnostic criteria (10).

Based on the treating physicians' diagnoses of conversion disorder and the epidemiologic and environmental investigation, it was concluded that the cases did not have common infectious or environmental causes.

The healthcare providers and public health agencies involved in this investigation consider this cluster of cases to be the result of conversion disorder/mass psychogenic illness. Mass psychogenic illness has been defined as a group of symptoms suggestive of organic disease but without an identified cause in a group of individuals with shared beliefs about the cause of symptoms. Outbreaks of mass psychogenic illness affect females more often than males (11).

While outbreaks of psychiatric or neurologic disease without clear explanation are unusual, similar cases have been documented (11-14). The conversion disorder/mass psychogenic illness conclusion is based on individual medical evaluations, the presence of significant life stressors, and demographic characteristics of the cases. It is uncertain what role conversion disorder played in the recurrence/acceleration of symptoms in the three cases with pre-existing medical conditions.

This issue has generated significant concern by families of the impacted students, students, faculty and staff at Le Roy Jr/Sr High School, and the community. It has also attracted national media attention. In an effort to allay community concerns, a public meeting was held on January 11, 2012. The meeting was organized by the LRCSD. Participants, in addition to the school district, included leadership of the NYSDOH and NYSOMH Regional Offices. Participants assured the community that there was no public health concern associated with the cases or the school. Stress was identified as a major contributing factor which can cause and/or exacerbate symptoms. NYSDOH recommends that the affected children continue individualized care with their treating physician.

The findings in this report do not identify a need for the LRCSD to restrict school-related activities or take special health-related precautions because of this situation.

NYSDOH will continue to work with NIH to provide interested families with best-in-nation medical care. Our primary concern continues to be the well-being of the affected students and their families.

References

1. Velicer, C. (October 25, 2011). Post-licensure safety study of quadrivalent human papillomavirus vaccine among 189,629 females.
<http://www.cdc.gov/vaccines/recs/acip/downloads/mtg-slides-oct11/03-HPV-CVelicer.pdf>.
2. Centers for Disease Control and Prevention. Diagnosing tic disorders.
<http://www.cdc.gov/ncbddd/tourette/diagnosis.html/>. January 2012.
3. Centers for Disease Control and Prevention. Bridging the gap between tourette syndrome and public health.
<http://www.cdc.gov/NCBDDD/tourette/documents/BridgingTheGapTSandPH.pdf>. January 2012.
4. U.S. National Library of Medicine *NIH* National Institutes of Health. Conversion disorder. <http://www.nlm.nih.gov/medlineplus/ency/article/000954.htm/>. January 2012.
5. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders*: DSM-IV-TR. 4th ed. Washington, DC; 2000
6. Shulman, ST. Pediatric autoimmune neuropsychiatric disorders associated with streptococci (PANDAS): update. *Curr Opin Pediatr* 21: 127-130.
7. National Institutes of Mental Health. Intramural research program.
<http://intramural.nimh.nih.gov/pdn/web>. January 2012.
8. Johnson DR, Kurlan, R, Leckman, J, Kaplan, EL. The human immune response to streptococcal extracellular antigens: clinical, diagnostic, and potential pathogenetic implications. *Clinical Infectious Diseases*, 2010; 50: 481-90.
9. Singer HS, Gilbert DL, Wolf DS, Mink JW, et al. Moving from PANDAS to CANS. *The Journal of Pediatrics* - 26 December 2011 (10.1016/j.jpeds.2011.11.040).
10. Leckman JF, King RA, Gilbert DL, Coffey BJ, et al. Streptococcal upper respiratory tract infections and exacerbations of tic and obsessive-compulsive symptoms: a prospective longitudinal study. *J Am Acad Child Adolesc Psychiatry*. 2011 Feb;50(2):108-118.
11. Jones TF, Allen CS, Hoy D, Gunter, EW, et al. Mass psychogenic illness attributed to toxic exposure at a high school. *N Engl J Med* 2000; 342: 96-100.
12. Cassidy JD, Kirschke DL, Jones TF, Allen CS, et al. Case series: outbreak of conversion disorder among amish adolescent girls. *J Am Acad Child Adolesc Psychiatry*, 2005; 44(3): 291-297.
13. Roach ED, Langley, RL. Episodic neurological dysfunction due to mass hysteria. *Arch Neurol*. 2004;61:1269-1272.
14. Harrison, D. (2007, November 18). Expert: mystery illness is stress. *The Roanoke times*. Retrieved January 26, 2012, from
<http://www.roanoke.com/news/roanoke/wb/140221>.