ACUTE FLACCID MYELITIS

LISA SALAZAR ARNP

LEARNING OBJECTIVES

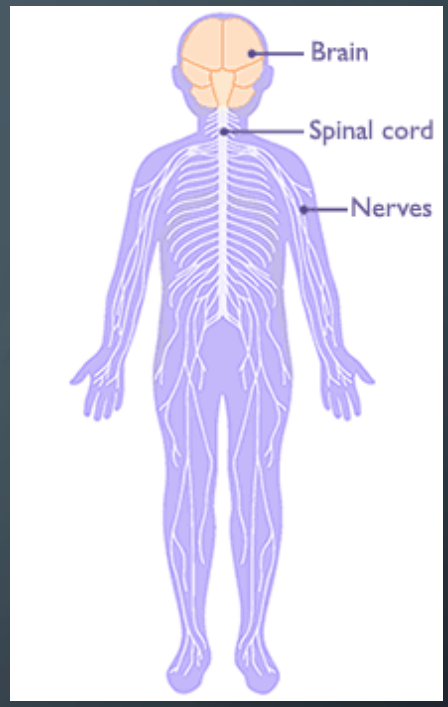
- Describe clinical presentation & diagnostic workup for Acute Flaccid Myelitis (AFM).
- Name essential considerations in supporting patient and families affected by AFM.
- Explain how and why to report a suspected AFM case to the health department.
- Describe resources that are available for healthcare providers about AFM

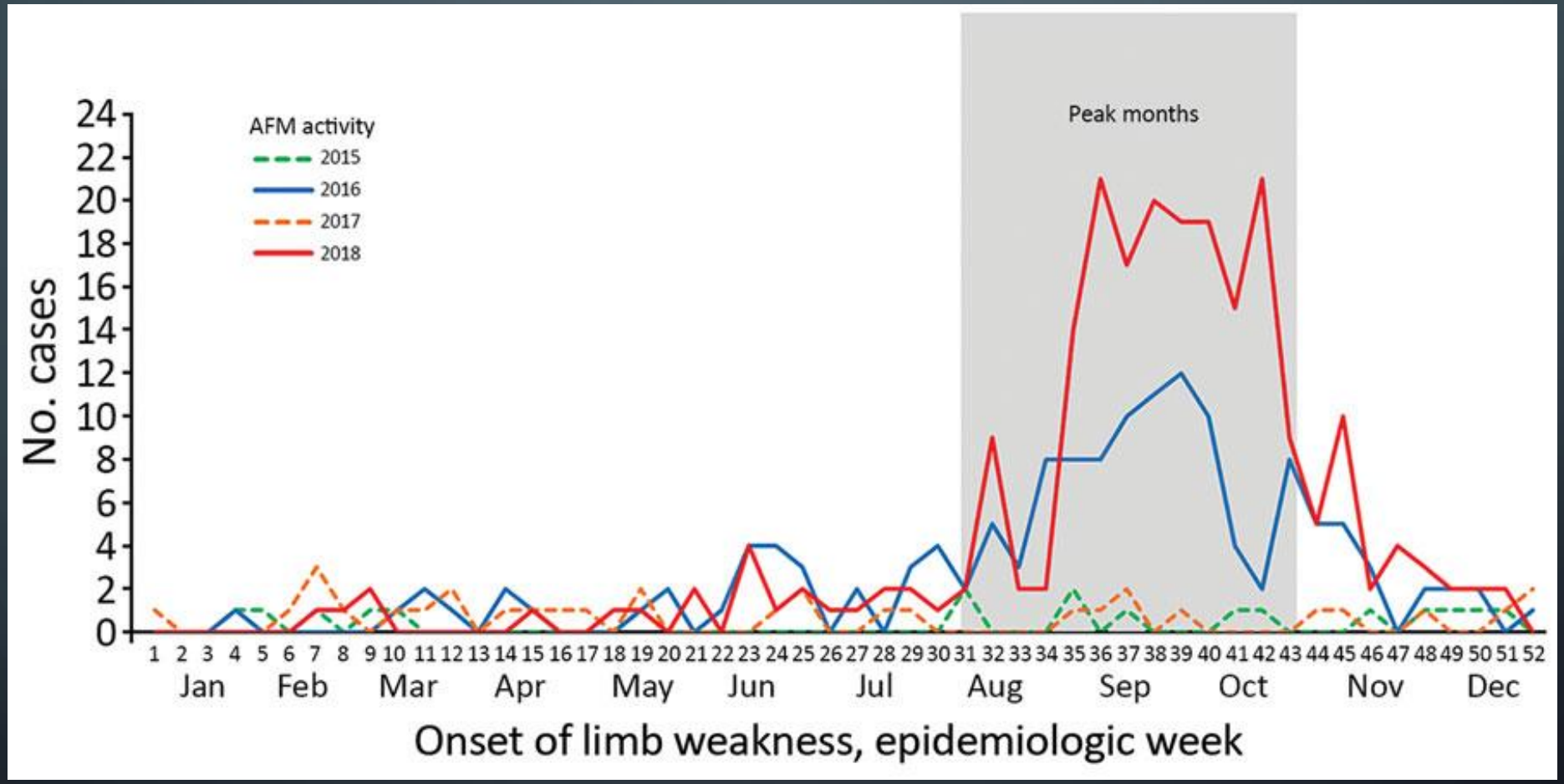

acute flaccid myelitis
Recognize. Hospitalize. Report.
CDC

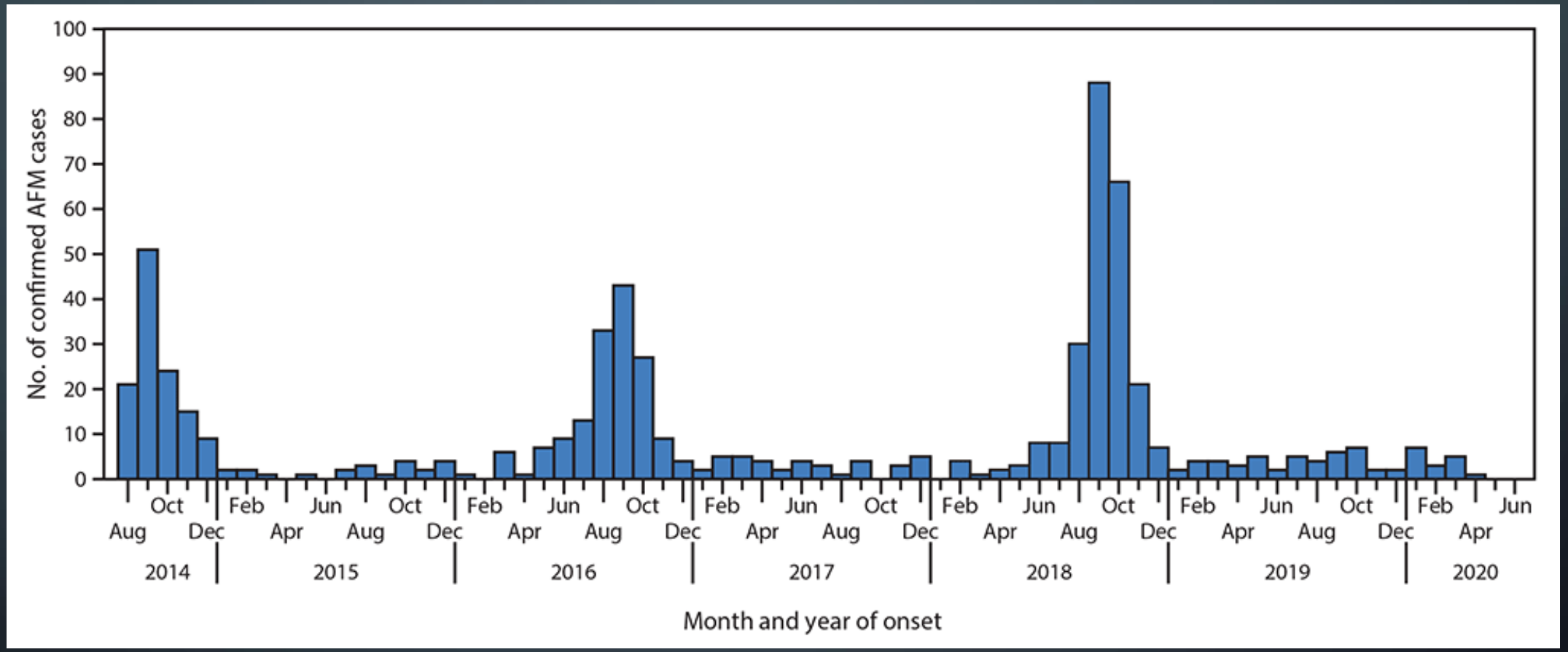
ACUTE FLACCID **PARALYSIS** (AFP)

- Covers many clinical entities including myelitis, peripheral neuropathy, myopathy, Guillain-Barré syndrome (GBS), toxic neuropathy, Reyes Syndrome, and muscle disorders.
- Patients presenting with AFP have lesions that can appear anywhere along the axis of the central nervous system from the lower motor neuron (anterior horn cell), out to the nerve root, peripheral motor nerve, the neuromuscular junction, or the muscle itself.

- Acute flaccid Myelitis (AFM) is an uncommon but serious neurologic condition. It affects the nervous system, specifically the area of the spinal cord called gray matter, which **causes the muscles and reflexes in the body to become weak**.
- We have seen increases in AFM cases in the U.S. every other year starting in 2014.
- Most AFM cases (more than 90%) have been in young children.
- You may hear AFM referred to as a "polio-like" condition, but all the specimens from AFM patients received **tested negative for poliovirus**. The cases of AFM since 2014 are not caused by poliovirus.



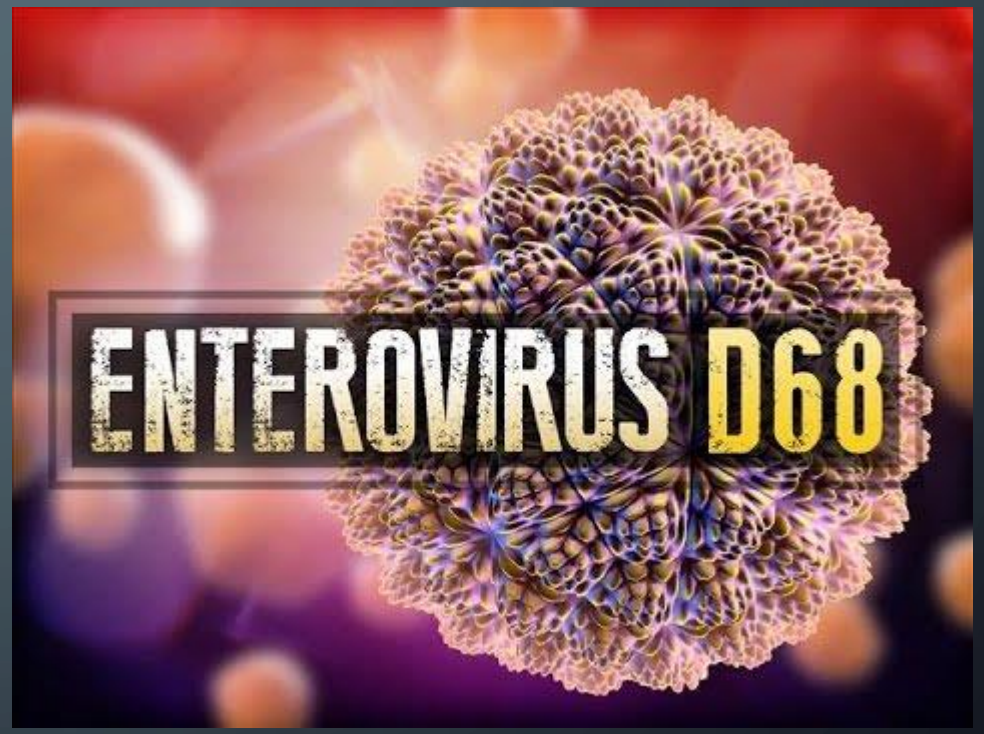

AFM activity
2015
2016
2017
2018
Peak months
No. cases
0
2
4
6
8
10
12
14
16
18
20
22
24
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Onset of limb weakness, epidemiologic week


No. of confirmed AFM cases
100
90
80
70
60
50
40
30
20
10
0
Aug
Oct
Dec
Feb
Apr
Jun
Aug
Oct
Dec
Feb
Apr
Jun
Aug
Oct
Dec
Feb
Apr
Jun
Aug
Oct
Dec
Feb
Apr
Jun
Aug
Oct
Dec
Feb
Apr
Jun
2014
2015
2016
2017
2018
2019
2020
Month and year of onset

RECOGNIZE

- AFM is defined by sudden onset of limb weakness with inflammation of the spinal cord seen on MRI (magnetic resonance imaging).
- Symptoms of AFM vary in severity and type – from mild weakness of a limb to complete inability to move legs and arms.
- At the onset in 2014, medical information from suspected cases were sent to expert neurologists at the CDC who do a case analysis and decide if the person has AFM or not. If not, the suspected case is “ruled out” and not counted as an official case.

A large number of cases of respiratory illness due to EV-D68 were happening at the same time Because of the severity of the clinical presentation of the early cases, and presumed rarity of this syndrome, CDC was invited to assist with case investigations along with local clinicians and the Colorado Department of Public Health and Environment



CLINICAL PRESENTATION

Parents and providers should suspect AFM in patients with sudden limb weakness, especially during August through November. Recent respiratory illness or fever and the presence of neck or back pain or any neurologic symptom should heighten their concern.

CLINICAL PRESENTATION

- Febrile illness 1-2 weeks before onset limb weakness
  - Rhinorrhea, fever, cough, vomiting, diarrhea
- Rapid weakness, proximal >> distal, symmetric motor loss and arreflexia
- Cranial nerve abnormalities
- Neck/shoulder, back right before onset weakness
- Severe complications: respiratory failure, autonomic dysfunction

CLINICAL PRESENTATION

- Most patients had preceding febrile illness 1–2 weeks before **onset of acute flaccid limb weakness.**
  - Frequently respiratory or gastrointestinal illness (GI) with symptoms of fever, rhinorrhea, cough, vomiting or diarrhea
  - Onset of weakness is rapid, within hours to a few days.
  - Weakness is in one or more limbs and is more proximal than distal.
- Loss of muscle tone and reflexes in the affected limb(s).
- Cranial nerve abnormalities may be present:
  - Facial or eyelid droop
  - Difficulty swallowing or speaking
  - Hoarse or weak cry
- Some patients may complain about stiff neck, headache, or pain in the affected limb(s).
- In uncommon cases, people may also have numbness or tingling.
- The most severe symptoms of AFM are:
  - **Respiratory failure**, requiring mechanical ventilation
  - **Serious neurologic complications** such as body temperature changes and blood pressure instability that could be life threatening

DIFFERENTIAL DIAGNOSES

- Transient synovitis
- Neuritis
- Limb injury
- GBS
- Transverse myelitis
- Stroke, spinal stroke
- Tumor, spinal cord
- Acute cord compression
- Conversion Disorder

Polio virus was eliminated in the US in 1979 by routinely vaccinating children to prevent the disease. Nevertheless, testing for polio is done because in some other parts of the world, outbreaks of polio still happen among unvaccinated people.

HOSPITALIZE

Timing is critical at each step—prompt AFM recognition leads to optimal medical management and early specimen collection. When health care providers recognize symptoms as soon as possible, there is a better chance of detecting the cause of AFM, which might help predict the outcome. Other laboratory tests and an MRI of the brain and spinal cord can distinguish AFM from other conditions with limb weakness.

MEDICAL HISTORY

- Collect information on any illness in the past 4 weeks
- Note respiratory and GI symptoms, with or without fever
- Ask about hand, foot, and mouth lesions (possible EV-A71 or coxsackie viral infections)

FOCUSED, AGE-APPROPRIATE ASSESSMENT TO EVALUATE LIMB FUNCTION IMPAIRMENT(S)

- Difficulty holding their head up?
- Can they feed themselves?
- Are they suddenly using one limb less or refusing to use one limb?
- Can they put on or take off a T-shirt?
- Can they throw a ball overhead?
- Are they limping or dragging a leg?
- Are they falling often while walking?
- Can they put on or take off pants?
- Can they get out of bathtub unassisted?

ADDITIONAL SIGNS/SYMPTOMS

- Ask about additional signs and symptoms, including:
- Decreased appetite or difficulty swallowing
- Increased sleepiness or inactivity*
- Headache or neck, shoulder, or back pain (Patients often complain of this prior or concurrent to weakness)

PHYSICAL EXAM WITH AGE-APPROPRIATE NEUROLOGICAL EXAM

- Neurological examination should include documentation of:
  - **Muscle tone** (flaccid/loose vs spastic/tight and firm)
  - Muscle strength (full strength, move against gravity with some resistance/pressure, move against gravity but with no resistance/pressure, or little limb movement but not against gravity, no muscle movement at all)
  - **Reflexes in each extremity** (hypo-, hyper, or absent)
  - Any cranial nerve deficiencies such as for facial, palatal and shoulder asymmetry, hoarseness or hypophonia and dysphagia (if possible)
  - **Note: Sensory exam is often normal in patients with AFM.**
- Assess the patient's ability to protect their airway:
  - Document respiratory sufficiency
  - Negative inspiratory force may be used if the child is old enough and able to cooperate
- Check for autonomic manifestations:
  - Blood pressure lability
  - Body temperature instability

DIAGNOSTIC STUDIES

- Lumbar Puncture ASAP in the ED if possible to identify pathogens
- CSF, Serum, Stool/Rectal, Naso/Oropharyngeal swabs
- Neuroimaging

LABORATORY TESTS

- **Cerebrospinal fluid (CSF):** cell count with differential, protein and glucose; oligoclonal bands; meningitis/encephalitis PCR panel
- **Serum:** EV PCR, anti-MOG (myelin oligodendrocyte glycoprotein) and anti-aquaporin antibodies, HSV, EBV, WNV
- **Stool/Rectal swab:** EV PCR
- **Naso/oropharyngeal swabs:** Respiratory multiplex testing and enterovirus (EV) PCR
- Consider additional pathogen-specific testing (e.g., Lyme) based on seasonality, exposures, and geography.

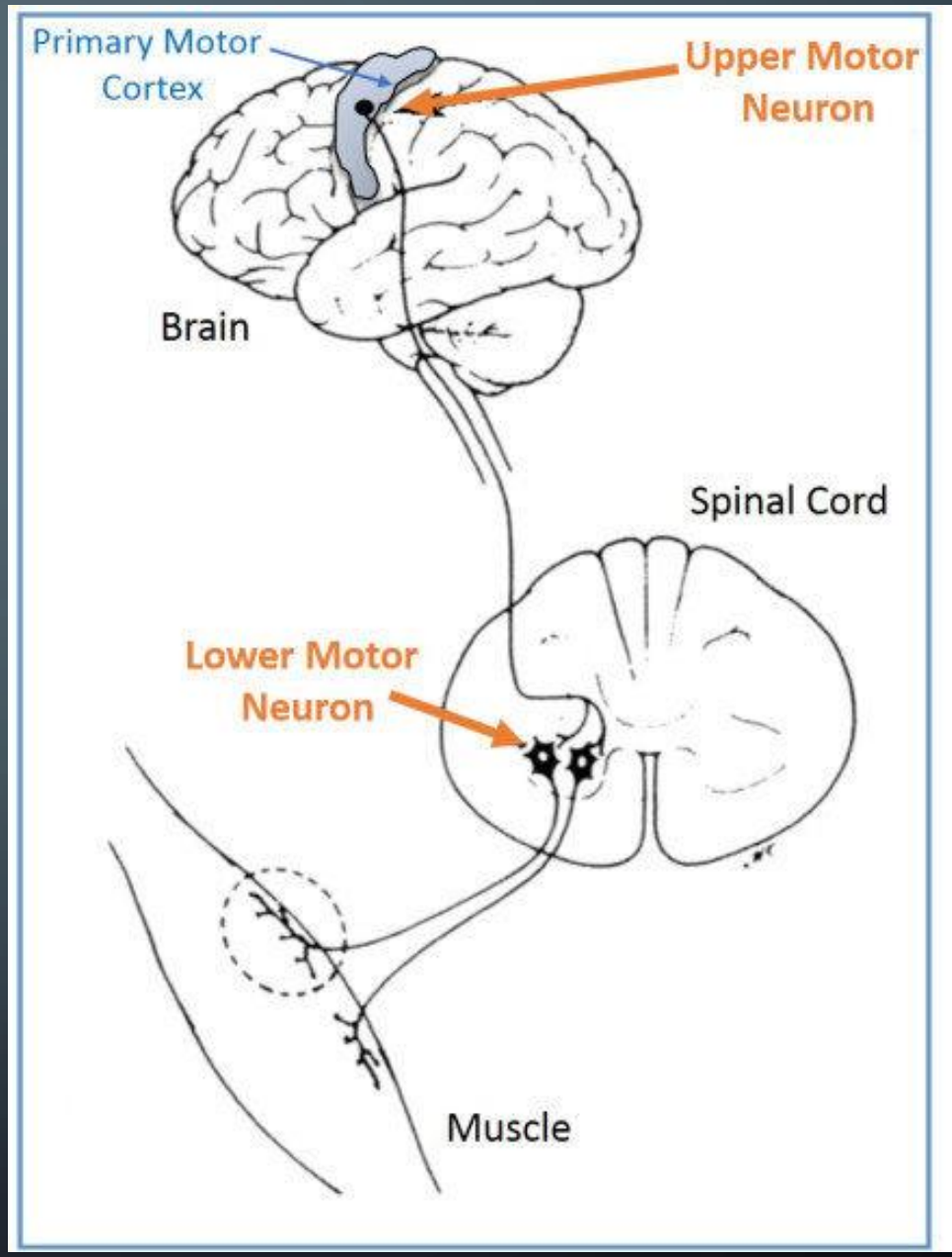
SPECIMEN COLLECTION

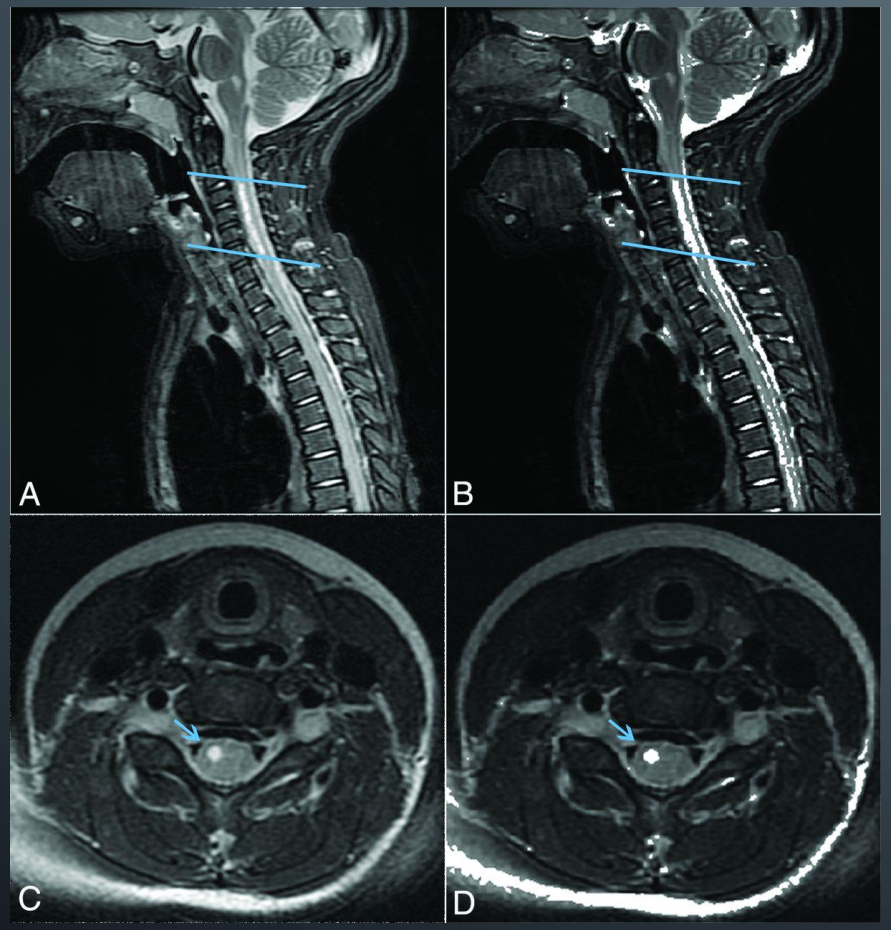
- **CDC continues to search for potential causes of acute flaccid myelitis (AFM)** by broadening laboratory approaches that test for potential infectious, including immune-mediated mechanisms and host responses to AFM.

NEUROIMAGING (HIGH RESOLUTION MRI)

If the patient is able to tolerate imaging of the entire spinal cord, that would be a reasonable approach as often multiple levels of the spinal cord are involved. High cuts of brainstem should be considered in patients with cranial nerve deficits. Axial and sagittal images are most helpful in identifying lesions

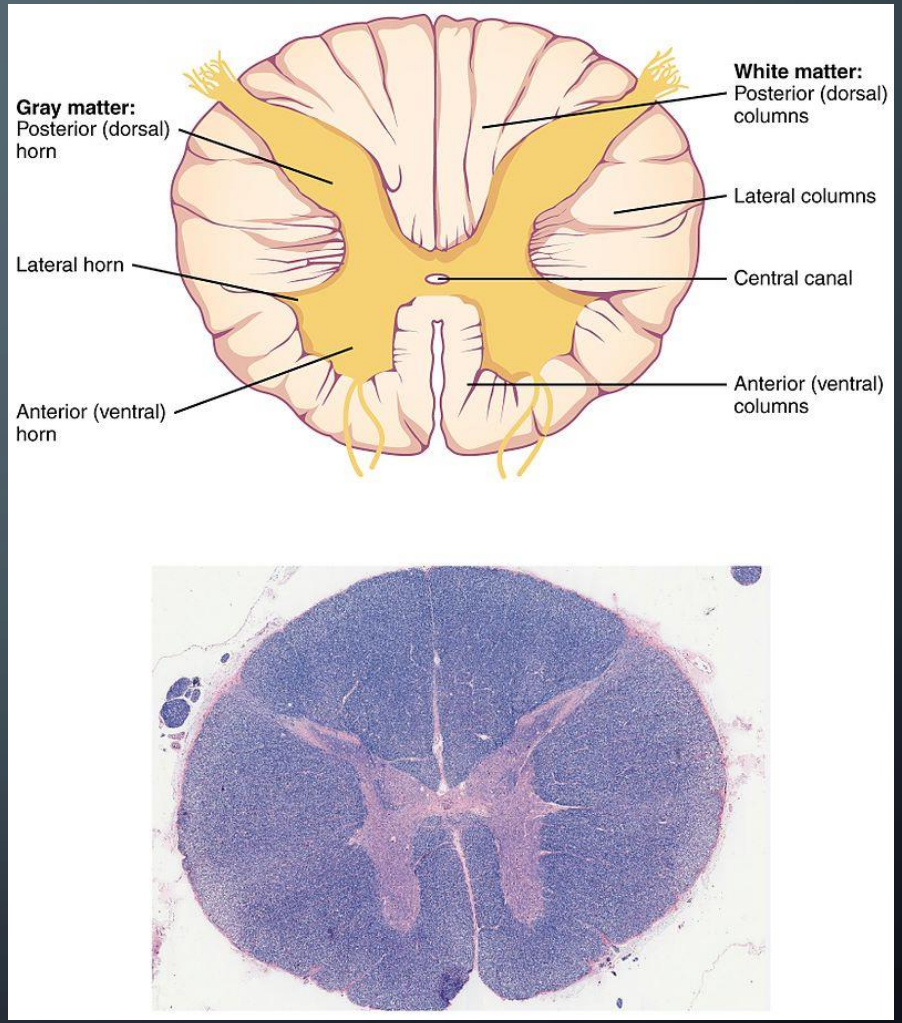
- Anterior Horn Cells/Lower Motor Neuron





- Spinal cord lesions largely restricted to gray matter
- Ventral (anterior horn) cells most commonly involved
- Ventral and dorsal nerve roots may demonstrate signal abnormality
- Cord lesions often involve multiple vertebral levels, spanning multiple cervical/thoracic levels
- Conus medullaris and cauda equina involvement frequently noted

- Some cases have entire central gray matter involved, producing characteristic “H” pattern on axial images.
- Generalized cord edema often localizes to the grey matter in 10-14 days; this is an area of CDC study to help project outcome



	UMN (UP)	LMN (LOW)
Muscle Tone		
Reflexes		
Babinski		
Atrophy	Disuse	Denervation
Muscle Contraction	Spastic	Flaccid

DIAGNOSIS: AFM

An illness with onset of acute flaccid* limb weakness.

- ** Low muscle tone, limp, hanging loosely, not spastic or contracted.*

A magnetic resonance image (MRI) showing a spinal cord lesion in at least some gray matter† and spanning one or more vertebral segments, AND

Excluding persons with gray matter lesions in the spinal cord resulting from provider diagnosed malignancy, vascular disease, or anatomic abnormalities.

CLINICAL MANAGEMENT

- Respiratory surveillance and management
- Respiratory function can deteriorate rapidly with 25% patients requiring ventilator support
- SRNA Portal for providers to contact AFM experts staffed by academic medical providers
- CDC clinical considerations for providers

TREATMENT

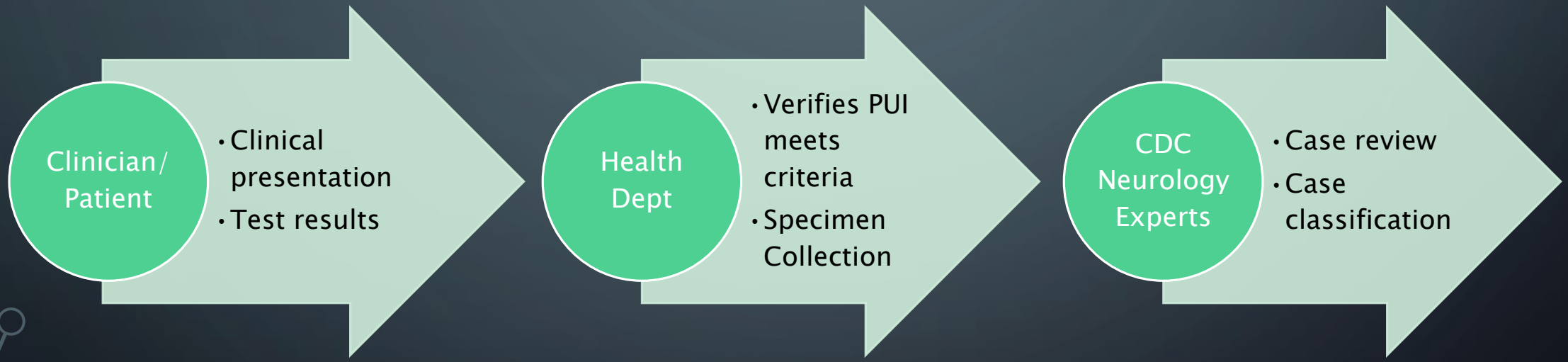
- Currently, there is **no specific treatment for AFM**, but providers may recommend different interventions based on each patient.
- Commonly used in acute phase:
  - IVIG
  - Corticosteroids
  - Plasmaphoresis
- At this time, no compelling evidence for Fluoxetine, antivirals, or other immunosuppressants for AFM

REPORT

- All clinicians involved in the patient care of persons with AFM are critical to the success of AFM surveillance activities.

- If you believe your patient has symptoms of AFM, contact your state or local health department as soon as possible for instructions on how to report. You can direct urgent questions to the CDC Emergency Operations Center (770-488-7100). Email non-urgent questions to the AFM team at AFMinfo@cdc.gov

AFM SURVEILLANCE PROCESS



CONFIRMED

- Clinically compatible case (acute onset of flaccid limb weakness) WITH
- Confirmatory laboratory/imaging evidence: MRI showing spinal cord lesion with predominant gray matter involvement* and spanning one or more vertebral segments, AND
- Excluding persons with gray matter lesions in the spinal cord resulting from physician diagnosed malignancy, vascular disease, or anatomic abnormalities, AND
- Absence of a clear alternative diagnosis attributable to a nationally notifiable condition.

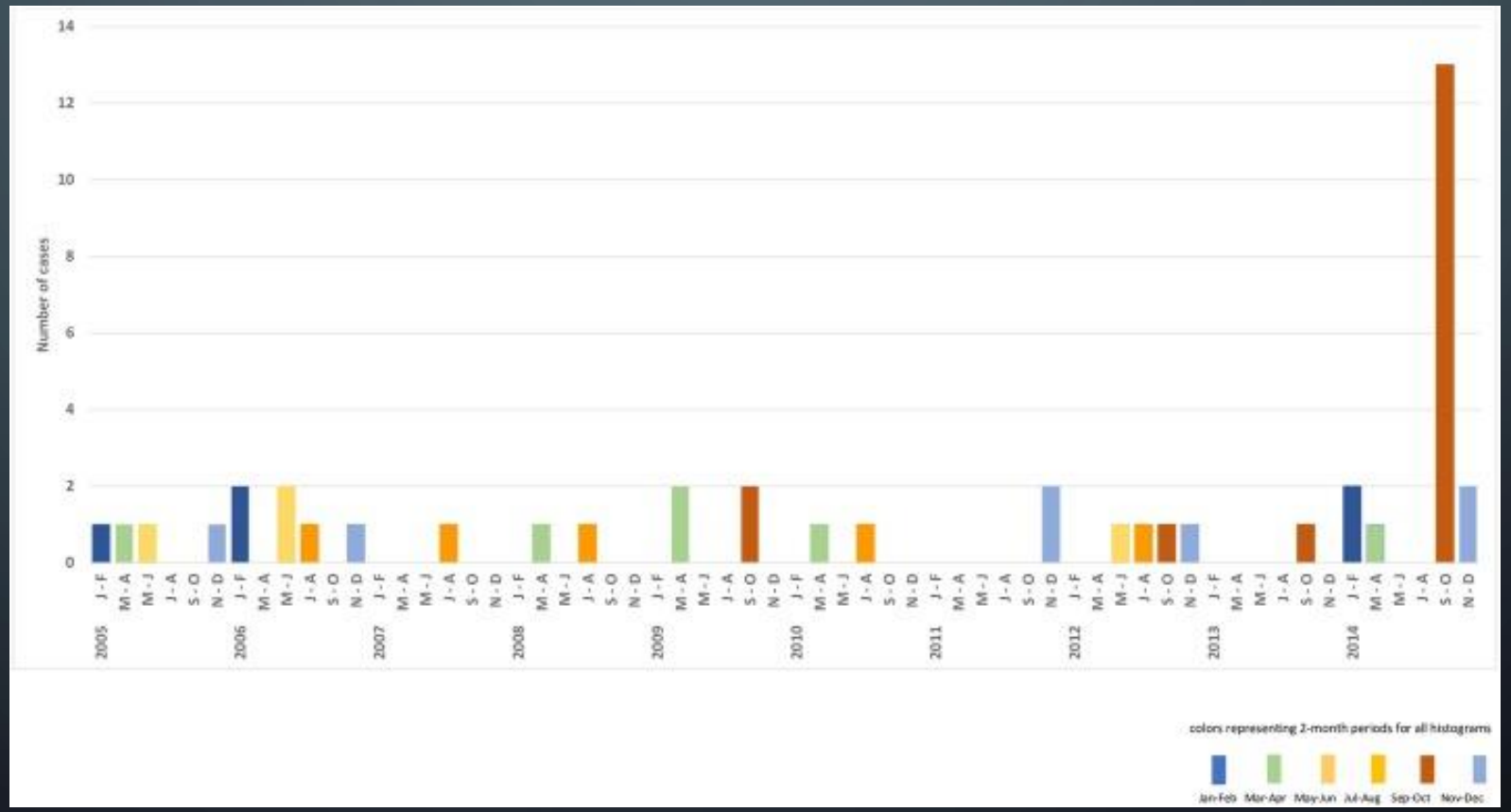
PROBABLE

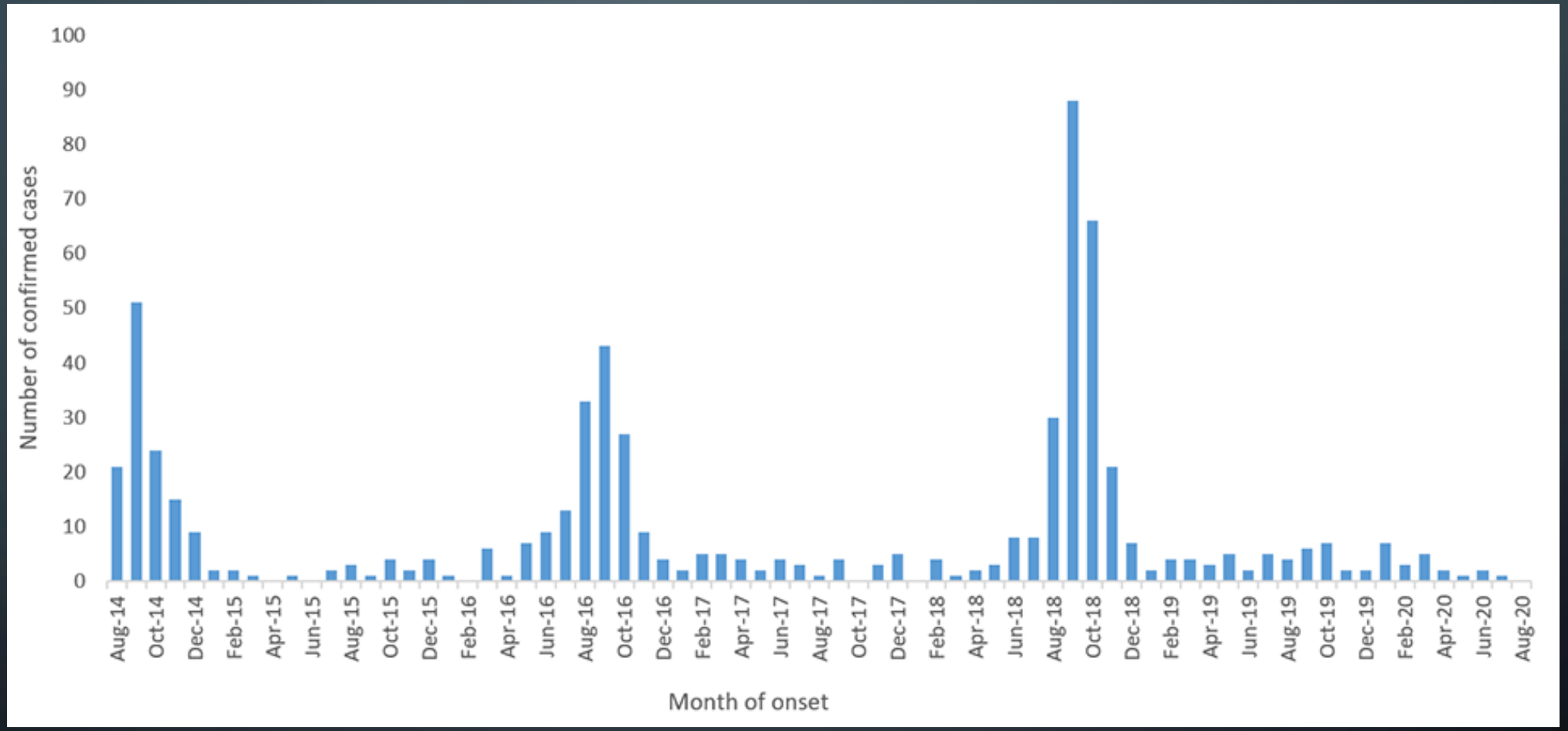
- Clinically compatible case WITH
- Presumptive laboratory/imaging evidence: MRI showing spinal cord lesion where gray matter involvement* is present but predominance cannot be determined, AND
- Excluding persons with gray matter lesions in the spinal cord resulting from physician diagnosed malignancy, vascular disease, or anatomic abnormalities, AND
- Absence of a clear alternative diagnosis attributable to a nationally notifiable condition.

SUSPECTED

- Clinically compatible case WITH
- Available information is insufficient to classify case as probable or confirmed.
  The intent of the case definition is that the criteria for suspect cases should also include laboratory/imaging evidence as follows:
  - MRI showing a spinal cord lesion in at least some gray matter* and spanning one or more vertebral segments, AND
  - Excluding persons with gray matter lesions in the spinal cord resulting from physician diagnosed malignancy, vascular disease, or anatomic abnormalities, AND
  - Absence of a clear alternative diagnosis attributable to a nationally notifiable condition.

EPIDEMIOLOGY



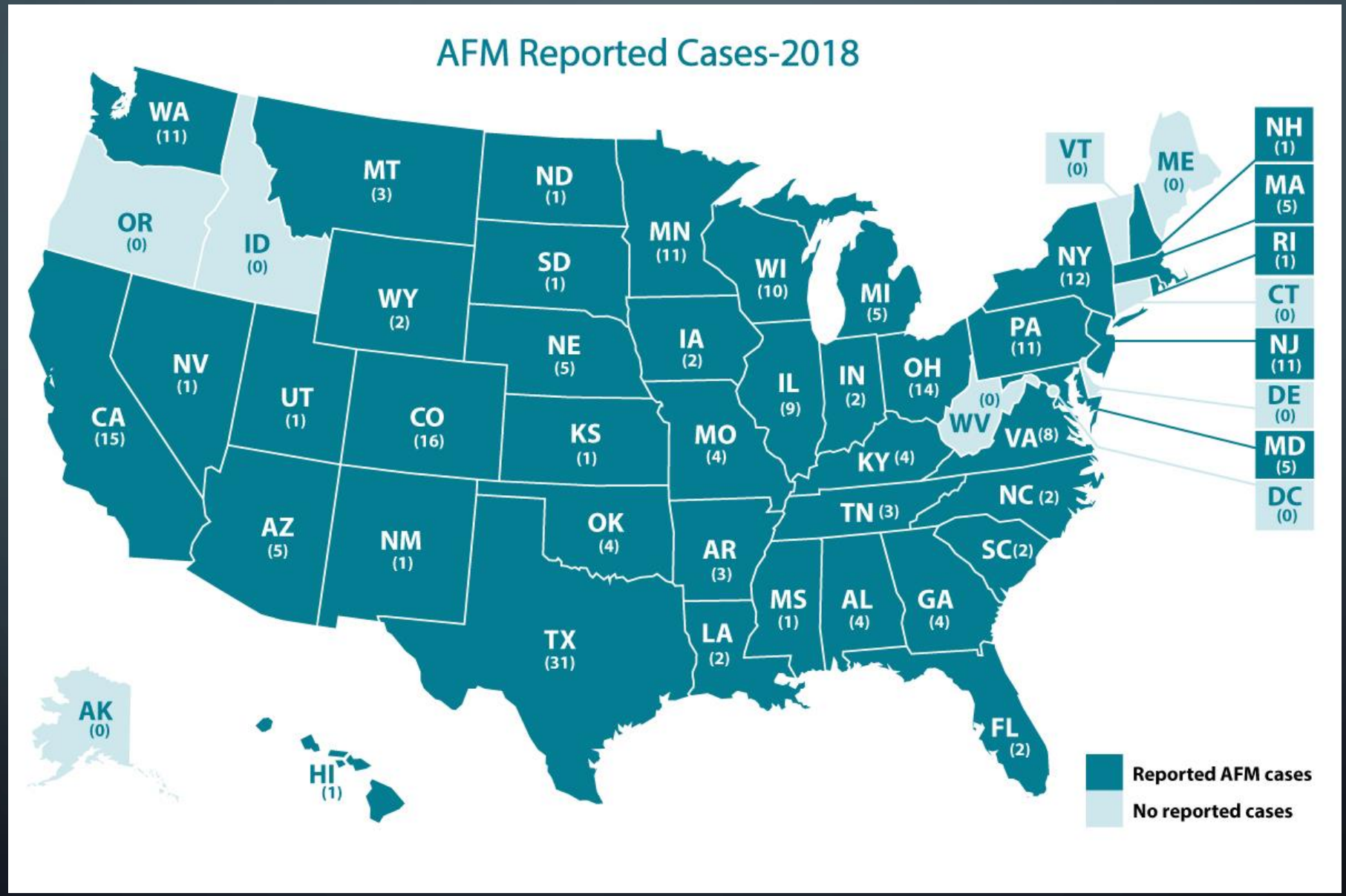

Number of confirmed cases
100
90
80
70
60
50
40
30
20
10
0
Aug-14
Oct-14
Dec-14
Feb-15
Apr-15
Jun-15
Aug-15
Oct-15
Dec-15
Feb-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
Apr-17
Jun-17
Aug-17
Oct-17
Dec-17
Feb-18
Apr-18
Jun-18
Aug-18
Oct-18
Dec-18
Feb-19
Apr-19
Jun-19
Aug-19
Oct-19
Dec-19
Feb-20
Apr-20
Jun-20
Aug-20
Month of onset

LABORATORY FINDINGS

- EV-D68 was identified in 18% of respiratory specimens.
- EV-D68 was not identified in any serum or stool specimens.
- No arboviruses were identified in any specimens.
- Although some serum specimens tested positive for other viruses, no single virus or virus family was consistently identified.

2018 DATA ANALYSIS

- CDC released a new CDC Vital Signs report to alert health care providers to a possible outbreak this year. This Vital Signs report reveals a **delay in care for some patients** in 2018: 35% of patients were not hospitalized until two or more days after limb weakness. AFM can progress rapidly over the course of hours or days, leading to permanent paralysis and/or the life-threatening complication of respiratory failure in previously healthy patients, so delays in care can be serious.


AFM Reported Cases-2018
WA (11)
OR (0)
CA (15)
ID (0)
NV (1)
MT (3)
WY (2)
UT (1)
AZ (5)
CO (16)
NM (1)
ND (1)
SD (1)
NE (5)
KS (1)
OK (4)
TX (31)
MN (11)
IA (2)
MO (4)
AR (3)
LA (2)
WI (10)
IL (9)
MS (1)
MI (5)
IN (2)
KY (4)
TN (3)
AL (4)
OH (14)
WV (0)
GA (4)
FL (2)
SC (2)
NC (2)
VA (8)
PA (11)
NY (12)
VT (0)
ME (0)
NH (1)
MA (5)
RI (1)
CT (0)
NJ (11)
DE (0)
MD (5)
DC (0)
AK (0)
HI (1)
Reported AFM cases
No reported cases

2018 AFM CHARACTERISTICS

- 238 cases
- 42 states
- Median age 5.3 years (94%< 18 years)
- 58% male
- Race: White (53%); Hispanic (20%); Black (9%); Asian (3%)
- No geographic clusters

2018 CLINICAL CHARACTERISTICS

- Hospitalize 98%; ICU 54%
- CSF Pleocytosis 87% (WBC Count 94 cells/mm3 (lymphocyte predominance)
- # Limbs affected: 1 (37%); 2 (30%); 3 (6%); 4 (27%)
- Limbs affected: Upper only 47%; Lower only 16%

2018 PRODROMAL PERIOD

Almost all cases had some viral prodrome (97%)

- Fever **or** URI 92%
  - URI 80%
  - Fever 77%
- Neck/Back pain 46%
- Headache 37%
- GI Illness 22%
- Rash 10%

2018 CDC TEST RESULTS

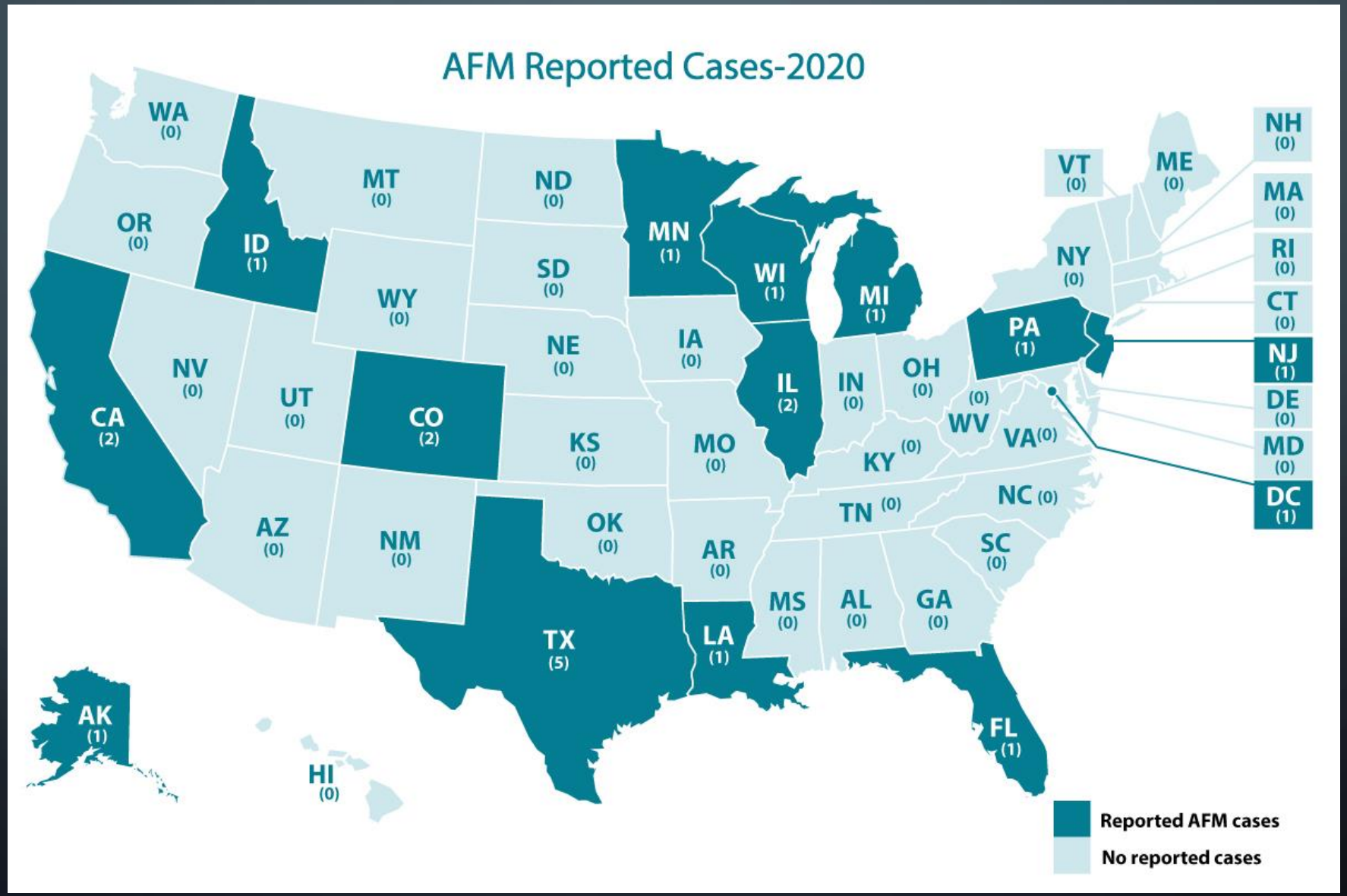
	n	EV/RV positive
CSF	74	2 (3%)
Stool	100	13 (13%)
Resp	123	54 (44%)
Total	151	71 (47%)

LEADING HYPOTHESIS

- Two studies recently published implicate enterovirus with viral antibodies found in CSF of patients following AFM. Non-polio enterovirus, specifically EV D68 is the prominent single virus detected. EV A71 was also identified and contributed to AFM in 2018. Other less frequent included coxsacckie virus in the EV/RV group.

WHAT'S COMING IN 2020?

- As of August 31, 2020, there have been 21 confirmed cases in 2020. There are 44 reports of patients under investigation (PUIs) for 2020. Two patients with confirmed AFM died in the acute phase of their illness, one in 2017 and one in 2020. We have also learned of deaths in cases confirmed in previous years.
- There were **46 confirmed cases in 2019** out of 142 PUIs. CDC, state, and local health departments are still investigating some of the PUIs.
- There have been **638 confirmed cases** since CDC began tracking AFM in August of 2014. CDC has been thoroughly investigating cases since that time. We have seen increases in AFM cases, mostly in young children, every two years.


AFM Reported Cases-2020
WA (0)
OR (0)
CA (2)
ID (1)
NV (0)
MT (0)
WY (0)
UT (0)
AZ (0)
CO (2)
NM (0)
ND (0)
SD (0)
NE (0)
KS (0)
OK (0)
TX (5)
MN (1)
IA (0)
MO (0)
AR (0)
LA (1)
WI (1)
IL (2)
MI (1)
IN (0)
OH (0)
KY (0)
TN (0)
MS (0)
AL (0)
GA (0)
FL (1)
SC (0)
NC (0)
VA (0)
WV (0)
PA (1)
NY (0)
VT (0)
ME (0)
NH (0)
MA (0)
RI (0)
CT (0)
NJ (1)
DE (0)
MD (0)
DC (1)
AK (1)
HI (0)
Reported AFM cases
No reported cases

AFM CASES IN WA AND THE U.S. REPORTED SINCE AUGUST 2014 AND CONFIRMED BY CDC

	WA	U.S.
2014	0	120
2015	0	22
2016	10	153
2017	3	37
2018	11	238
2019	0	22
2020,ytd	0	21

KEY REMINDERS…

- Patients with AFM can deteriorate quickly and rapidly progress to respiratory compromise
- “Most” patients have a preceding febrile illness 1-2 weeks before the onset of their limb weakness
- Perform and document thorough medical history and age appropriate neuro exam with motor and reflexes
- Limb weakness is a medical emergency; hospitalize when AFM is suspected

KEY REMINDERS…

- Assess & protect the airway; may require ventilator
- Perform LP ASAP; obtain specimens early to optimize yield for pathogen
- MRI full spine and brain- sedation may be required
- Consult bedside Neurology and ID and SRNA expert academic neurology team to guide treatment and clinical management decisions. CDC case classification may follow working diagnosis.

SUPPORT

RESOURCES: CDC

- Clinician Job Aid, specimen collection, reporting, initial evaluation
- Fact sheets
- Parent Information Sessions
- Inquiries: 770-488-7100/non-urgent AFMquestions@cdc.gov

RESOURCES

- Siegal Rare Neuroimmune Association
- AFM Association
  - July is AFM Awareness Month
  - National Awareness
    - Frontline Providers
    - Parents
    - “Limb Weakness is a Medical Emergency”

BARRIERS

- Acute Phase: “the ED wait”, the “on call tele-medicine Neurologist”, comprehensive evaluation “insurance auth”, diaphragmatic pacers, nerve transfers
- Rehab/Home: Rehab/DME, parents/family caregivers, home & community wavers, costs, positioning/growth & development, access to expert care may require travel (logistics), specialty providers

“OUTCOMES”

- Goals defined
- “There is no “dis” in ABILITY!
- From complete recovery to lasting effects

“AMAZING GRACE”

Debbie Fisher, PT

Gracie Fisher, Berklee School of Music Scholarship Recipient

…Living with AFM since Dec 2014

- Debbie & Grace: If you’d like to send a picture, I’ll place it here. Also, anything you want to add in the Resources, barriers, Outcomes pages, let me know by Sunday and I’ll finalize this. Thank you both! XO

ACUTE FLACCID MYELITIS