

# Long-Term Outcomes in Children with Acute Flaccid Myelitis

Megan Henley, MOT/S, Lindie Hill, MOT/S, Sydney Inman, MOT/S, Molly Grace King, MOT/S, Sam Lopez, MOT/S, Carley Mahaffey, MOT/S

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Clinical Mentor: Heather Clabo, OTR/L, BCP, C/NDT

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## Narrative Description

Our final CAT portfolio contains 8 research articles from national and international journals. Study designs include a retrospective cohort study, two retrospective non-randomized studies without a control group, a retrospective review, a nationwide follow-up questionnaire analysis study, a case report, a case series, and a multiple quantitative case study. All studies directly relate to our PICO question and will be shared with our practitioner-mentor upon completion.

Six of our eight articles specifically state that there was varied improvement in function for patients who received some form of therapy. However, underlying evidence from all eight articles suggests that further research and studies are needed on patients with acute flaccid myelitis to understand the etiology and prognosis of the disease. These themes will be discussed in greater detail throughout this portfolio.

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**Table 10-4 Critically Appraised Topic**

<p><b>Evidence-Based Practice Question</b>                  In children with a diagnosis of acute flaccid myelitis, what are the long-term outcomes regarding posture and movement, gross and fine motor control, and ADL performance?</p>																	
<p><b>Clinical Scenario</b>                  After speaking with Heather Clabo OTR/L, there is little known about the effects, causes, outcomes, and/or prognosis of children with this diagnosis. She has found that several of her clients have not fully recovered after this diagnosis. This has brought to light a gap in the literature that shows how important it is to learn more about AFM. She was curious if others who have treated AFM have published their interventions and treatment options so that she may use best-evidence to plan interventions for these clients in the future.</p>																	
<p><b>Search Methodology and Terms</b></p> <table border="1"> <thead> <tr> <th>PICO Question Categories</th> <th colspan="2">Search Terms Used</th> </tr> </thead> <tbody> <tr> <td> <b>Population</b>                      Children with Acute Flaccid Myelitis                 </td> <td colspan="2">(Child* OR pediatric) AND ("acute flaccid myelitis"))</td> </tr> <tr> <td> <b>Intervention</b>                      N/A                 </td> <td colspan="2">N/A</td> </tr> <tr> <td> <b>Comparison</b>                      N/A                 </td> <td colspan="2">N/A</td> </tr> <tr> <td> <b>Outcomes</b>                      Long-term outcomes regarding posture and movement, gross/fine motor control, and ADL performance                 </td> <td colspan="2">                     AND outcome* AND (posture OR movement OR "gross motor" OR "fine motor" OR "motor function" OR "ADL" OR "activities of daily living" OR "functional activities" OR dressing OR feeding OR bathing OR "functional mobility")                 </td> </tr> </tbody> </table>			PICO Question Categories	Search Terms Used		<b>Population</b> Children with Acute Flaccid Myelitis	(Child* OR pediatric) AND ("acute flaccid myelitis"))		<b>Intervention</b> N/A	N/A		<b>Comparison</b> N/A	N/A		<b>Outcomes</b> Long-term outcomes regarding posture and movement, gross/fine motor control, and ADL performance	AND outcome* AND (posture OR movement OR "gross motor" OR "fine motor" OR "motor function" OR "ADL" OR "activities of daily living" OR "functional activities" OR dressing OR feeding OR bathing OR "functional mobility")	
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**Inclusion Criteria for Articles**

- Published in English
- Diagnosis of AFM
- Population under the age of 18

**Exclusion Criteria for Articles**

- Literature review
- Population ages 18+
- Studies more than 10 years ago

**Review Process**

We worked with a clinical mentor to determine what question she wanted answered. As a group we developed a search strategy with inclusion and exclusion criteria. Database selection was made from the UTHSC database page. Results were scanned by title, abstracts, and relevance to the PICO question. Our mentor reviewed our analyses and search strategies. Each CAP form was peer reviewed, and reviewed by Dr. Mitchell.

See **Appendix B.** for our Modified Prisma Form showing the breakdown in numbers of our records searched and reviewed.

**Search Results by Level of Evidence**

Level of Evidence	Study Design	Number of Articles Included
III	Retrospective Cohort Study, Retrospective Non-randomized Study Without a Control Group (2)	3
IV	Retrospective Review, Nationwide Follow-up Questionnaire Analysis Study, Case Report, Case Series, Multiple quantitative case study	5

**TOTAL ARTICLES REVIEWED: 8**

**Main Findings**

Level III

- Can make clinically significant neurologic and functional progress from rehab (\*77%, Melicosta, 2019)
- Future AFM studies will benefit clinical and pathogenic understanding (\*68%, Kane, 2019)
- Significant change in all areas of the WeeFIM, including self-care, mobility, and cognition after receiving Activity Based Restorative Therapy (\*60.8%, Hagen, 2020; \*77%, Melicosta, 2019)

Level IV

- Some functional improvement was seen in most individuals, varied from complete to incomplete recovery, some persistent motor/functional deficits (\*71.4%, Martin, 2017)
- Significant improvements in Barthel Index from 6 months to 3 years (\*86%, Chong, 2021)
- 1 year client had small improvements in lower extremities, achieved a functional right-hand grasp and pinch, PROM worsened with contractures in shoulders and hamstrings (\*75%, Kornafel, 2017), No full recovery after 1 year (\*82%, Matensanz, 2019), improved to some degree or full recovery after 1 year (\*83.33%, Downey, 2020)

**Limitations**

Level III

- AFM not defined until 2014, respiratory failure made it difficult to provide treatment. AFM cases could have been missed due to misdiagnosis due to rarity (\*68%, Kane, 2019; \*77%, Melicosta, 2019)
- No way to measure the delivery of ABRT other than looking at the time that rehabilitation interventions were supervised, difficult to determine whether improvements were made due to natural recovery or ABRT (\*60.8%, Hagen, 2020)

Level IV

- Small cohort size and lack of follow-up, especially with participants who made complete recoveries during the study (\*71.4%, Martin, 2017)
- Case series used a small sample size that was also a retrospective study, timing of etiological testing was inconsistent across the fourteen participants (\*82%, Matensanz, 2019), study was retrospective and observational in design including a small number of cases without a control group, but the timing of follow-up varied (\*83.33%, Downey, 2020).
- Case study only followed one participant that had a rehabilitation approach that was tailored to his specific case (\*75%, Kornafel, 2017)
- Study only looked at two time points of assessment, there was potential for selection bias, a large attrition rate and a small sample size (\*86%, Chong, 2021)

**BOTTOM LINE AND RECOMMENDATIONS**

Children who went through rehabilitation while recovering from AFM, showed significant improvements in strength, ADL performance, gross and fine motor skills. However, long-term outcomes regarding functional performance varied from multiple to no deficits. Activity based restorative therapy done by occupational therapists could be a contributing factor to recovery from AFM. More research is needed on AFM and the long-term outcomes of this diagnosis.

**REFERENCES**

See **Appendix C.** for References

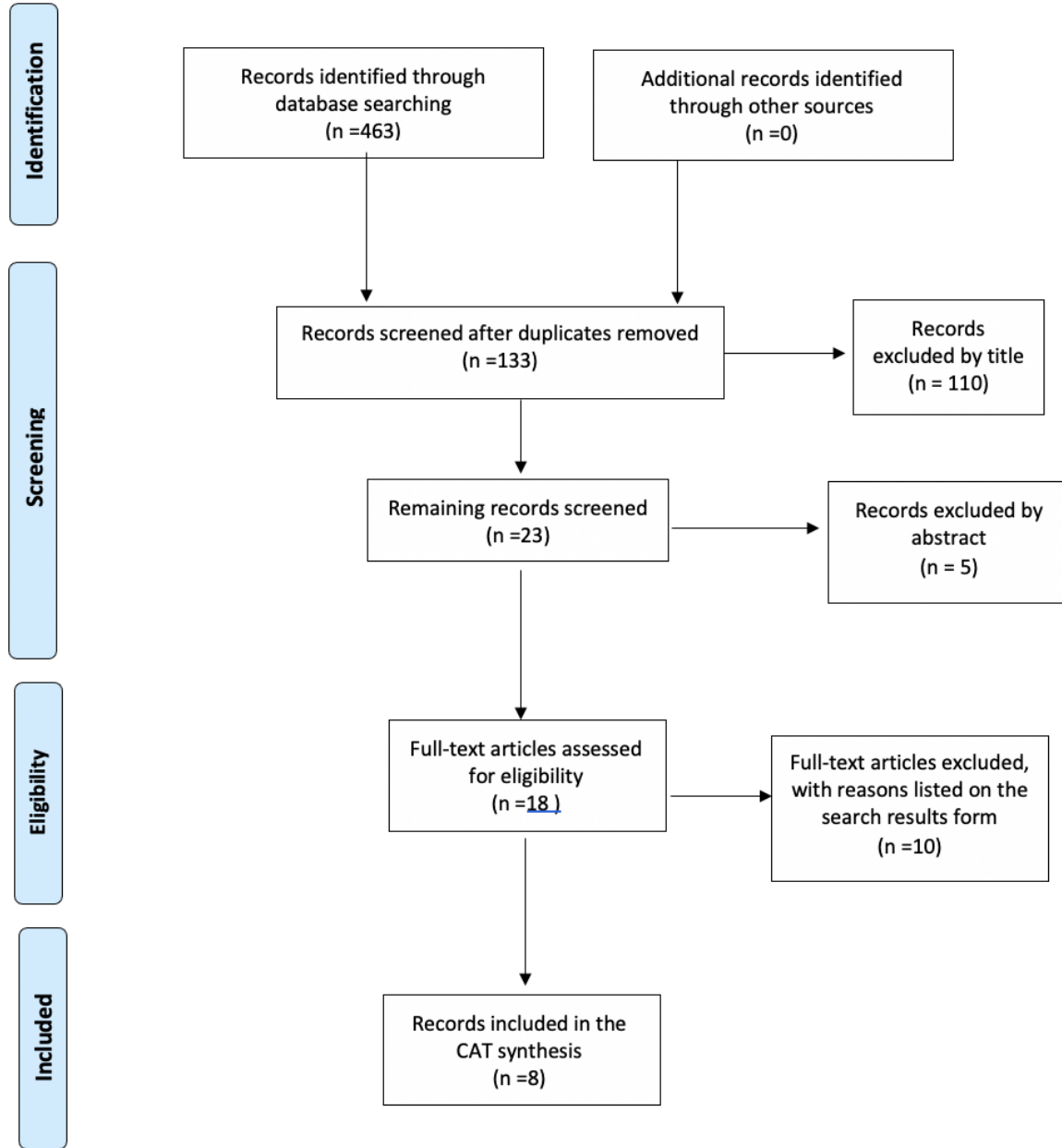
**Name of Appraiser(s):** Megan Henley, MOT/S, Lindie Hill, MOT/S, Sydney Inman, MOT/S, Molly Grace King, MOT/S, Sam Lopez, MOT/S, Carley Mahaffey, MOT/S

**Date Completed:** 4/27/2021

\* percentages are quality score percentages



## Modified PRISMA 2009 Flow Diagram (awm 2018)



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit [www.prisma-statement.org](http://www.prisma-statement.org).



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### PICO QUESTION

In children with a diagnosis of acute flaccid myelitis, what are the long-term outcomes regarding posture and movement, gross and fine motor control, and ADL performance?

### RATIONALE

- Acute flaccid myelitis (AFM) is a neurological condition that affects the gray matter of the spinal cord and causes weakness of muscles and decreased reflexes
- April 2021: 652 confirmed cases since 2014
- Increase in cases in the U.S. in 2014, 2016, and 2018
- According to mentor, there has not been many cases with a full recovery
- Little known about long-term outcomes and prognosis of AFM

### REVIEW PROCESS



### SEARCH METHODOLOGY

<b>Databases Searched</b>	CINAHL, Google Scholar, PubMed, Scopus, PMC
<b>Search Terms</b>	Child, pediatric, acute flaccid myelitis, outcome, posture, movement, gross motor, fine motor, motor function, ADL, activities of daily living, functional activities, dressing, feeding, bathing, functional mobility <i>*Terms searched individually and in combination</i>

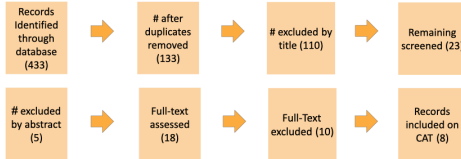
### Inclusion Criteria

- Published in English
- Diagnosis of AFM
- Population under age 18

### Exclusion Criteria

- Literature reviews
- Population ages 18+
- Studies published 10+ years ago

### SEARCH RESULTS



### MAIN FINDINGS

Citation (Quality Score %)	Long-Term Outcomes	
	ADL Performance	Fine/Gross Motor Control, Posture & Movement
Level III Evidence		
Hagen et al., 2020 (61%)	(+) WeeFIM (Self-care) scores	(+) Strength in all muscle groups maintained or improved using manual muscle testing (+) Increase in WeeFIM (Mobility) and Physical Ability and Mobility Scale (PAMS) scores
Kane et al., 2019 (68%)		(-) 38/42 persistent muscle weakness (+) 1/3 mounted a full recovery
Melicosta et al., 2019 (77%)	(+) WeeFIM Self-Care Developmental Quotient overall mean score	(+) Spinal Cord Injury Measure and WeeFIM Mobility Developmental Quotient overall mean score
Level IV Evidence		
Chong et al., 2021 (86%)	(+) Barthel Index after 3 years	(-) 25/33 persistent motor deficits
Downey et al., 2020 (83%)	(-) 5/21 cases needed mod to total assist (+) 10/16 cases without full recovery can perform ADLs	(+) 20/21 cases improved to some degree (-) 16/21 with persistent weakness after two years
Kornafel et al., 2017 (75%)	(-) Total assistance for self-care skills and transfers	(+) Remained limited, but improved from admission (+) Can sit unsupported in wheelchair for up to four minutes
Martin et al., 2017 (71%)		(-) 2/8 improvement at one year with Assisting Hand Assessment (+) 6/8 had persistent motor or functional deficits at 12 months
Matensanz et al., 2019 (82%)		(-) 2/14 full recovery

(+) Positive outcomes seen in > 50% of participants  
(-) Positive outcomes not seen in > 50% of participants

### ACTIVITY BASED RESTORATIVE THERAPY (ABRT)

- ABRT is a therapeutic approach that uses repeated, patterned and non-patterned movement to recover function that is lost due to neurological injury.
- Key components: functional electrical stimulation, locomotor gait training, massed and task specific practice, and weight loading
- 3-5 hours per day of OT/PT, 5x/week

### LIMITATIONS

- Due to the variable progression of the disease and individualized rehabilitation, outcomes may not be consistent
- Difficult to measure whether ABRT was successful or if natural recovery occurred
- Lack of follow-up
- High attrition rates

### BOTTOM LINE

- Children with AFM who received some form of rehabilitation showed improvements in strength, activities of daily living (ADL) performance, gross and fine motor skills.
- All studies showed at least minimal improvement in functional performance from diagnosis up to three years.
- ABRT could have been a contributing factor to the improvements seen in children with AFM in two of our articles.

### RECOMMENDATIONS

- 3-5 hours of OT/PT, 5x/week using the 5 components of ABRT
- Consistent assessments
- More research on the outcomes of specific interventions
- Individualized rehabilitation according to stage of progression

### REFERENCES



### EXAMPLE METHOD FOR MONITORING CLINICAL APPLICATION



## CAP Forms

### CRITICALLY APPRAISED PAPER #1

**PICO Question:** In children with a diagnosis of Acute flaccid myelitis, what are the long-term outcomes regarding posture and movement, gross and fine motor control, and ADL performance?

Chong, P. F., Kira, R., Torisu, H., Yasumoto, S., Okumura, A., Mori, H., & Tanaka-Taya, K. (2021). Three-year longitudinal motor function and disability level of acute flaccid myelitis. *Pediatric Neurology*, 116(2021), 14-19.  
<https://doi.org/10.1016/j.pediatrneurol.2020.11.019>

<b>Purpose of the Study</b>	- Evaluate the long-term motor outcomes and disability levels of patients with AFM 3 years after the onset of the disease
<b>Setting</b>	- Based on a cohort associated with the Japanese outbreak of enterovirus D68 (EV-D68) in 2015

**Participants or Sample** - 33 patients (age range 2.5-6.6 years at onset) - 3 years after onset the age range is 6.0-9.8 years

- 20 males and 13 females
- 7 patients had nerve transfer surgery
- At acute stage, all 33 patients had flaccid limb weakness 13/33 had 2 limb lower limb paralysis, 3/33 had 3 limb paralysis, 13/33 had 1 limb weakness, 4/33 had all 4 limb paralysis.
- 5 cases had cranial neuropathy, 5/33 had some sensory involvement, 10/33 had neurogenic bladder or bowel, 4/33 had impaired consciousness, and 2/33 needed a ventilator
- Treatments: 25/33 received pulse methylprednisolone, and 25/33 received intravenous immunoglobulin.

<p><b>Study Design and Methodology</b></p>	<ul style="list-style-type: none"> <li>- Nationwide follow-up questionnaire analysis from Japan</li> <li>- Non-experimental quantitative study done by questionnaire/survey</li> <li>- MMT and other neurological comorbidities were collected at onset, 6 months and 3 years.</li> <li>- Barthel Index to assess disability level</li> </ul>
<p><b>Level of Evidence</b></p>	<ul style="list-style-type: none"> <li>- Level IV</li> </ul>
<p><b>Outcomes and Main Findings</b></p>	<ul style="list-style-type: none"> <li>- 8/33 showed complete recovery</li> <li>- 25/33 showed persistent motor deficits and 9/33 improved in the number of limbs involved from 6 months – 3-year stages</li> <li>- At 3 years, those with tetraplegia or triplegia, 2/7 showed complete recovery.</li> <li>- At 3 years, those with paraplegia, 4/13 showed complete recovery.</li> <li>- At 3 years, those with monoplegia, 2/13 showed complete recovery</li> <li>- Those with more limbs involved showed better improvement than those with only 1 limb involved. - Those with nerve transfer to subscapular nerve, showed satisfactory elbow and hand function at follow up, but not complete recovery.</li> <li>- 1 patient had nerve transfer to femoral nerve showed MMT grade 4 of knee extension</li> <li>- Most patients with complete recovery, had full Barthel Index scores at 3 years</li> <li>- Significant improvements from 6 months to 3 years in Barthel Scores</li> </ul>
<p><b>Intervention Highlighted Through the Research</b></p>	<ul style="list-style-type: none"> <li>- Nerve transfer</li> <li>- Pulse methylprednisolone</li> <li>- Intravenous immunoglobulin.</li> </ul>

<b>Limitations</b>	<ul style="list-style-type: none"> <li>- Only looked at 2 time points of assessment</li> <li>- Potential for selection bias</li> <li>- Large attrition rate</li> <li>- Small sample size</li> </ul>
<b>This Study Was Identified as the “Best” Evidence and Selected for the Portfolio for the Following Reasons:</b>	<ul style="list-style-type: none"> <li>- Accurately helps us answer our PICO question - Provides information at the onset of disease, 6 months after onset and 3 years after disease onset</li> <li>Uses the Barthel Index to assess disability level which looks at ADLs and mobility</li> </ul>
<b>Quality Score</b>	- 86%

## CRITICALLY APPRAISED PAPER #2

**PICO Question:** In children with a diagnosis of Acute flaccid myelitis, what are the long-term outcomes regarding posture and movement, gross and fine motor control, and ADL performance?

Downey, R., McElvain, D., Murphey, D.K., Bailey, A., Patel, B., Fernandez, M., Loftis, L., Carreno, C.G., Eger, L., Aguilera, E.A., Wootton, S., Castagnini, L.A., & Hauger, S.B. (2020). Acute flaccid myelitis among hospitalized children in Texas, 2016. *Pediatric Neurology*, 106, 50-55. <https://doi.org/10.1016/j.pediatrneurol.2020.01.007>

<b>Purpose of the Study</b>	- Acute Flaccid Myelitis cases during an outbreak to look at presentation/causes of the disease, treatment responses, and function outcomes to up to 2 years from the onset of symptoms
<b>Setting</b>	- 6 Texas hospitals in 2016 (Austin, Dallas/Fort Worth, San Antonio)

<p><b>Participants or Sample</b></p>	<ul style="list-style-type: none"> <li>- 21 participants (age range 7 months – 15 years with median age of 5 years)</li> <li>- 9 males and 12 females</li> <li>- 90% had no underlying disease (1 patient had transverse myelitis 2 months before)</li> <li>- 4 weeks before onset: 18 had respiratory, gastrointestinal or febrile illness, 16 had UE weakness, 13 had LE weakness, 18 had asymmetric weakness, and 8 had weakness in all 4 extremities.</li> </ul>
<p><b>Study Design and Methodology</b></p>	<ul style="list-style-type: none"> <li>- Retrospective review</li> <li>- Each site collected its own data to put into the system</li> <li>- Data included: preceding illnesses, medical history, pathogen testing, MRIs, a neurological exam at the most severe point of illness, lab testing, medical treatments and response to treatment, and degree of recovery at discharge and up to 2 years from onset of symptoms</li> <li>- Follow up visits: overall function rated as “fully functional”, “somewhat functionally impaired”, or “complete dependence on caretakers”. Strength was recorded as “weak”, “some improvement”, “more weak”, or “full recovery”.</li> <li>- Last follow up: participants' ability to perform ADLs was rated “no functional deficit”, “mild functional deficit”, “moderate functional deficit”, “total deficit” or “no chart information”.</li> </ul>
<p><b>Level of Evidence</b></p>	<ul style="list-style-type: none"> <li>- Level IV</li> </ul>



<p><b>This Study Was Identified as the “Best” Evidence and Selected for the Portfolio for the Following Reasons:</b></p>	<ul style="list-style-type: none"> <li>- Provides evidence to answer our PICO question</li> <li>- Provides information during the duration of the disease (2 years) to look at long-term outcomes</li> <li>- Looked at ADLs</li> </ul>
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<p><b>Quality Score</b></p>	<p>- 83%</p>
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**CRITICALLY APPRAISED PAPER #3**

**PICO Question:** In children with a diagnosis of Acute flaccid myelitis, what are the long-term outcomes regarding posture and movement, gross and fine motor control, and ADL performance?

Hagen, K., Porter, C., Martin, R., Dean, J., Salorio, C., & Sadowsky, C. (2020). Improvements in function following inpatient activity-based therapy for children with acute flaccid myelitis. *Top Spinal Cord Injury and Rehabilitation, 26*(4), 275-282.

<p><b>Purpose of the Study</b></p>	<ul style="list-style-type: none"> <li>- To examine the functional changes of children with AFM who took part in ABRT in an inpatient setting</li> </ul>
<p><b>Setting</b></p>	<ul style="list-style-type: none"> <li>- Inpatient rehab unit</li> </ul>
<p><b>Participants or Sample</b></p>	<ul style="list-style-type: none"> <li>- 29 participants</li> <li>- Children under the age of 18</li> <li>- Meet CDC criteria for AFM diagnosis</li> <li>- Received care between 2014-2018, who stayed longer than 2 weeks</li> <li>- 90% of the children had tetraplegia, 10% had paraplegia</li> </ul>

<p><b>Study Design and Methodology</b></p>	<ul style="list-style-type: none"> <li>- Retrospective non-randomized study without a control group</li> <li>- A retrospective chart review of all participants was completed to obtain demographics and scores from standardized testing.</li> <li>- The Functional Independence Measure, Spinal Cord Independence Measure, Manual Muscle Testing, and the Physical Abilities and Mobility Scale were used to assess children during routine clinical care.</li> </ul>
<p><b>Level of Evidence</b></p>	<ul style="list-style-type: none"> <li>- Level III</li> </ul>

**Outcomes and Main Findings**

- The findings were statistically significant with significance set at  $p < .05$ . Children with AFM who participated in ABRT showed significant functional gains across all outcome measures from admission to discharge.
- Significant change was seen in all areas of the WeeFIM, including self-care, mobility, and cognition. Large effect sizes were also seen for the SCIM and PAMS testing, indicating significant improvement. ( $p < .001$ ).
- Results from MMT showed that strength

was maintained or improved across all muscle groups for all children. Most muscle groups showed a moderate effect size ( $p < .01$ ).

- At admission, 14 of the 29 children were at a level of complete dependence for mobility and 9 of the 29 were at a level of complete dependence for self-care. By discharge, more than half of the children had improved to partial independence.
- Results were significant and support the role of ABRT inpatient rehabilitation for children with AFM.



**Intervention  
Highlighted Through  
the Research**

- ABRT is an approach that uses repeated, patterned and nonpatterned movement to recover function that was lost in children with neurologic deficits.
- All children received 1 to 2 hours of OT and 2 to 3 hours of PT, 5 days a week and 2 hours of therapy on the weekend. All sessions included the main components of ABRT: functional electrical stimulation, locomotor gait training, massed and task specific practice, and weight loading.
- Twenty out of 29 children in the study participated in FES cycle ergometry for 30-60 minutes per session utilizing lower limbs. While 15 children in the study participated in FES cycle ergometry for 25- 35 minutes per session utilizing upper limbs. One child could not perform standardized cycling, but received reciprocal patterning FES without legs attached to the pedals. For 2 hours a day, participants completed functional tasks with electrical stimulation. Participants engaged in upper and lower limb weight loading activities daily for 30 to 60 minutes. Mobility activities were also included daily. 19 of the 29 children participated in aquatic therapy.
- ABRT was used to increase muscle strength, mobility, and cognition.

<p><b>Limitations</b></p>	<ul style="list-style-type: none"> <li>- There is no way to measure the delivery of ABRT other than looking at the time that rehabilitation interventions were supervised. - It is difficult to determine whether improvements were made due to natural recovery or ABRT - In this study, there is no control group to support the effectiveness of ABRT specifically.</li> <li>- Some of the outcome measures that were used in the study were designed for individuals with SCI and not specifically for children with AFM.</li> </ul>
<p><b>This Study Was Identified as the “Best” Evidence and Selected for the Portfolio for the Following Reasons:</b></p>	<ul style="list-style-type: none"> <li>- This study was selected because of its statistical significance which is identified as strong evidence of an intervention that results in improvements in function of children with AFM. This study examined the long-term outcomes of children with AFM, specifically mobility, muscle strength, and ability to complete self-care tasks, which directly answers our PICO question. - This study can be useful for a therapist because it supports the use of ABRT as an effective intervention useful in making functional changes in children with AFM.</li> </ul>
<p><b>Quality Score</b></p>	<p>- 61%</p>

**CRITICALLY APPRAISED PAPER #4**

**PICO Question:** In children with a diagnosis of Acute flaccid myelitis, what are the long-term outcomes regarding posture and movement, gross and fine motor control, and ADL performance?

Kane, M. S., Sonne, C., Zhu, S., Malhotra, A., Van Haren, K., Messacar, K., & Glaser, C.

A. (2019). Incidence, risk factors and outcomes among children with acute flaccid myelitis: a population-based cohort study in a California network between 2011 and 2016. *The Pediatric Infectious Disease Journal*, 38(7), 667-672.  
doi:10.1097/inf.00000000000002276

<p><b>Purpose of the Study</b></p>	<p>- The goal of this study was to provide a comprehensive, population-based evaluation of AFM incidence data among pediatric patients with retrospective analysis of potential risks factors and outcomes over a 5-year period. This study applies to our pico question in regard to the outcomes in children with AFM over a 5-year period.</p>
<p><b>Setting</b></p>	<p>- Patients in the Kaiser Permanente Northern California pediatric population in Northern California.</p>
<p><b>Participants or Sample</b></p>	<p>- Cases were identified through a comprehensive electronic search of all KPNC members in Northern California 12 months to 18 years of age between January 1, 2011 and December 31, 2016 with spinal magnetic resonance images (MRIs) and at least one of the following diagnosis codes: paralysis/paresis, hemiparalysis/hemiparesis, ataxia, Guillain-Barre syndrome, transverse myelitis, demyelinating disease, neuromyelitis optica, multiple sclerosis, acute disseminated encephalomyelitis (ADEM), AFM or acute flaccid paralysis. A total of 1,052,632 pediatric patient-years were captured in the KPNC database. 302 individuals were identified between 12 and 18 months of age. 272 of those were excluded due to not meeting the criteria. The final cohort included 28 individuals.</p>
<p><b>Study Design and Methodology</b></p>	<p>- The study design implemented was a retrospective cohort study. In this study design, researchers perform the study and begin identifying and enrolling subjects after the outcomes have already occurred.</p>

<b>Level of Evidence</b>	- Level III
<b>Outcomes and Main Findings</b>	- The majority of the patients manifested persistent muscle weakness at a 1-year follow-up, but more than

	one-third mounted a full recovery. Future AFM investigations will benefit from improved clinical and pathogenic heterogeneity of affected individuals. These markers will ultimately be necessary to advance clinical care and therapeutics.
<b>Intervention Highlighted Through the Research</b>	- No interventions were talked about in this study. It was mainly focused on the incidence and outcomes of children diagnosed with AFM after a 5-year period. However, some of the participants received intravenous immunoglobulin and steroids with the more severe patients also receiving plasmapheresis and/or fluoxetine during their times at the hospital before this study was conducted.
<b>Limitations</b>	- Since it was a retrospective cohort study, AFM cases could have been missed due to misdiagnosis by treating physicians given that AFM is a rare entity. The study only had one neuroradiologist for core inclusion criteria and could have biased the results.
<b>This Study Was Identified as the “Best” Evidence and Selected for the Portfolio for the Following Reasons:</b>	- This study was included because it discussed the incidence, prevalence, and outcomes of AFM in children from 2011 to 2016. It looked at over 1 million pediatric patient-years in the KPNC database and selected 28 individuals over that time and looked at their outcomes after a 5-year period. Since there is little information on AFM in children due to limited research and AFM being a new and rare disease, we felt this was a great study to include in

	our research.
<b>Quality Score</b>	- 68%

### CRITICALLY APPRAISED PAPER #5

**PICO Question:** In children with a diagnosis of Acute flaccid myelitis, what are the long-term outcomes regarding posture and movement, gross and fine motor control, and ADL performance?

Kornafel, T., Tsao, E., Sabelhaus, E., Surges, L., & Apkon, S.D. (2017). Physical and occupational therapy for a teenager with acute flaccid myelitis: A case report. *Physical & Occupational Therapy In Pediatrics*, 37(5), 485-595.  
<https://doi.org/10.1080/01942638.2016.1255289>

<b>Purpose of the Study</b>	- To describe the inpatient rehabilitation program of a 13-year-old boy with acute flaccid myelitis (AFM) that answers aspects of our PICO question.
<b>Setting</b>	- Inpatient Rehabilitation (Seattle Children's Hospital)
<b>Participants or Sample</b>	- One 13-year-old male with acute flaccid myelitis (AFM) who was previously healthy, left-hand dominant
<b>Study Design and Methodology</b>	- Case Report.

<b>Level of Evidence</b>	- Level IV
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<b>Outcomes and Main Findings</b>	<ul style="list-style-type: none"> <li>- Upper extremity and lower extremity passive range of motion and strength impairments remained limited but improved from admission into the inpatient rehabilitation unit</li> <li>- Presented with active cervical strength with the ability to maintain midline and have an unsupported head position while in his wheelchair for up to four minutes</li> <li>- Could control and navigate his power chair with great success</li> <li>- Required supervision during outings due to his tracheostomy and ventilator needs.</li> <li>- WeeFIM scores at discharge for self-care, transfers remained at 1 or total assistance</li> <li>- Locomotion score changed to a 6 or modified independence</li> <li>- Follow-Up: By 11 months after his initial presentation, the individual developed a 27-degree thoracolumbar scoliosis in supine position</li> <li>- One year after discharge from inpatient rehabilitation, he had small improvements in right knee extension strength to full anti-gravity movement.</li> <li>- Achieved a functional right-hand grasp and pinch. - PROM worsened with contractures in his shoulders and hamstrings despite stretching daily. He is attending school and outpatient therapy.</li> </ul>
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performance?

Martin, J. A., Messacar, K., Yang, M. L., Maloney, J. A., Lindwall, J., Carry, T., & Schreiner, T. L. (2017). Outcomes of colorado children with acute flaccid myelitis at 1 year. *American Academy of Neurology*, 89(2), 129-137.

<https://doi.org/10.1212/WNL.0000000000004081>

<b>Purpose of the Study</b>	<ul style="list-style-type: none"><li>- To look at and describe long-term outcomes in children with acute flaccid myelitis (AFM), specifically functional, neurodiagnostic, and psychosocial outcomes</li></ul>
<b>Setting</b>	<ul style="list-style-type: none"><li>- Children's Hospital Colorado in Aurora, Colorado with follow-up taking place at a multidisciplinary clinic</li></ul>
<b>Participants or Sample</b>	<ul style="list-style-type: none"><li>- Twelve children who were diagnosed with AFM in 2014 with acute onset limb weakness or cranial nerve dysfunction, eight of which consented for follow-up studies and reached the 1-year study end point</li></ul>
<b>Study Design and Methodology</b>	<ul style="list-style-type: none"><li>- Multiple quantitative case study design – participants were followed every three months for one year or until complete clinical resolution of deficits. Results were reported individually. Follow-up was provided. At each visit, participants underwent physical exams such as MRI, EMG, functional measurements, etc. and also answered questionnaires.</li><li>- Assessments used:<ul style="list-style-type: none"><li>- Assisting Hand Assessment – used to measure functional outcomes of the upper extremities</li><li>- Hammer-smith Functional Motor Scale used to measure functional outcomes of the lower extremities</li></ul></li></ul>
<b>Level of Evidence</b>	<ul style="list-style-type: none"><li>- Level IV</li></ul>



<p><b>Outcomes and Main Findings</b></p>	<ul style="list-style-type: none"> <li>- Functional improvement was seen in all participants, but recovery was incomplete, with persistent motor and functional deficits in most.</li> <li>- Proximal upper extremities were most severely impacted while distal extremity deficits were less severe and more likely to completely recover.</li> <li>- Cranial nerve deficits showed some recovery, but motor deficits were persistent.</li> </ul>
<p><b>Intervention Highlighted Through the Research</b></p> <p><b>Limitations</b></p> <p><b>This Study Was Identified as the “Best” Evidence and Selected for the Portfolio for the Following Reasons:</b></p>	<ul style="list-style-type: none"> <li>- Corticosteroids, IV immunoglobulin, and plasmapheresis were administered among the participants, but there were no clear correlations with these interventions with short- or long-term outcomes.</li> <li>- Small cohort size and lack of follow-up</li> <li>- Studied primarily severe cases; patients who recover completely during the study are less likely to follow-up</li> <li>- Lack of standardized schedule for follow-up imaging</li> <li>- Gives evidence to help answer PICO question - Provides insight on equipment that can be used to assess progression and outcomes of AFM</li> <li>- Provides information on short- and long-term outcomes of AFM in children</li> <li>- Discusses motor and functional status over time</li> </ul>
<p><b>Quality Score</b></p>	<p>- 71%</p>

**CRITICALLY APPRAISED PAPER #7**

**PICO Question:** In children with a diagnosis of Acute flaccid myelitis, what are the long-term outcomes regarding posture and movement, gross and fine motor control, and ADL performance?

Matensanz, S., McGuire, J. L., & Hopkins, S. (2019.) Acute flaccid myelitis: Characteristics and outcomes of 2014 and 2016 cases at a single center. *The Journal of Pediatrics*, 215(1), 272-276.  
<https://doi.org/10.1016/j.jpeds.2019.07.015>

<p><b>Purpose of the Study</b></p>	<ul style="list-style-type: none"> <li>- The purpose of this study was to summarize the clinical, infectious, and imaging findings that should help a clinician to consider a diagnosis of AFM at the initial presentation.</li> <li>- The researchers also summarize their experiences with treatments and the outcomes 1 to 15 months after discharge.</li> </ul>
<p><b>Setting</b></p>	<ul style="list-style-type: none"> <li>- Children’s Hospital of Philadelphia</li> </ul>
<p><b>Participants or Sample</b></p>	<ul style="list-style-type: none"> <li>- Each case had onset of focal limb weakness and an MRI that showed a spinal cord lesion that was primarily restricted to the gray matter.</li> <li>- Fourteen children met the case definition for a confirmed case of AFM during the study time period (n = 5 in 2014 and n= 9 in 2016).</li> <li>- All children had weakness initially, which was worse proximally.</li> <li>- Five children had prominent single limb involvement and nine had multiple limb involvement.</li> <li>- Thirteen clients underwent a lumbar puncture.</li> <li>- Twelve clients underwent brain MRI and abnormalities were found in three.</li> <li>- The average age of the participants was 2.6 years.</li> </ul>

<b>Study Design and Methodology</b>	- Case series using a retrospective chart review. Data was analyzed using non-parametric methods in STATA version 14.2
<b>Level of Evidence</b>	- Level IV

<b>Outcomes and Main Findings</b>	<ul style="list-style-type: none"> <li>- Most children didn't fully recover at the median follow-up of 1 year.</li> <li>- Only two children fully recovered.</li> <li>- Two children had persistent flaccid quadriplegia requiring a tracheostomy and gastrostomy tube.</li> <li>- Among the fourteen total cases, six initially received an alternate diagnosis.</li> <li>- Four children were initially discharged from an ER room and were readmitted with worsening symptoms.</li> </ul>
<b>Intervention Highlighted Through the Research</b>  <b>Limitations</b>	<ul style="list-style-type: none"> <li>- The researchers used the modified Rankin Scale (mRS).</li> <li>- Respiratory virus multiplex polymerase chain reaction (PCR) panels</li> <li>- Sample size was small and limited to a single center's experiences</li> <li>- Study was retrospective</li> <li>- Patients were at the institution at different times in their acute illness</li> <li>- Timing of etiological testing was inconsistent - Steroids and plasma exchange were largely given to sicker patients</li> </ul>
<b>This Study Was Identified as the "Best" Evidence and Selected for the Portfolio for the Following Reasons:</b>	- The outcomes show how clients at one hospital presented with AFM at a one year follow up

<b>Quality Score</b>	- 82%
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**CRITICALLY APPRAISED PAPER #8**

**PICO Question:** In children with a diagnosis of Acute flaccid myelitis, what are the long-term outcomes regarding posture and movement, gross and fine motor control, and ADL performance?

Melicosta, M. E., Dean, J., Hagen, K., Oppenheimer, K., Porter, C., Rybczynski, S., & Sadowsky, C. (2019). Acute flaccid myelitis: Rehabilitation challenges and outcomes in a pediatric cohort. *Journal of Pediatric Rehabilitation Medicine: An Interdisciplinary Approach*, 12(3), 245-253. <https://doi.org/10.3233/PRM-180549>

<b>Purpose of the Study</b>	<ul style="list-style-type: none"> <li>- To describe one institution’s experience in the rehabilitation of children with acute flaccid myelitis (AFM).</li> <li>- This study reviews the medical and rehabilitative course and functional outcomes of a cohort of children who underwent Activity Based Restorative Therapy (ABRT) at a single center.</li> <li>- The purpose of looking at the outcomes of children with AFM directly relates to our PICO question which is looking for more information on specific outcome measures in children with AFM.</li> </ul>
<b>Setting</b>	<ul style="list-style-type: none"> <li>- Mixture of medical charts from Outpatient (14) and Inpatient rehabilitation (17) at an undisclosed rehabilitation center</li> </ul>

<p><b>Participants or Sample</b></p>	<ul style="list-style-type: none"> <li>- Participants: n = 31</li> <li>- Diagnosis: acute flaccid myelitis (AFM)</li> <li>- Year of diagnosis: <ul style="list-style-type: none"> <li>- Prior to 2014: n = 14</li> <li>- 2014: n = 10</li> <li>- 2016: n = 7</li> </ul> </li> <li>- Participants recruited: n = 31</li> <li>- Sample type: purposive</li> <li>- Age range: 7 months – 16 years</li> <li>- Sex: <ul style="list-style-type: none"> <li>- Female: n = 14</li> <li>- Male: n = 17</li> </ul> </li> <li>- Comorbidities <ul style="list-style-type: none"> <li>- Fever (n = 29)</li> <li>- Upper respiratory infection (n = 17)</li> <li>- Gastrointestinal illness (n = 3)</li> <li>- Monoplegia (n = 26)</li> <li>- Complete respiratory failure (n = 15)</li> </ul> </li> </ul>
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<p><b>Study Design and Methodology</b></p>	<ul style="list-style-type: none"> <li>- Research design: retrospective non-randomized study without a control group</li> <li>- Method: <ul style="list-style-type: none"> <li>- A retrospective review of all medical records at the facility of patients aged 0-21 years who attended outpatient and/or inpatient rehabilitation for spinal cord injury rehabilitation between March 15, 2005 to January 30, 2017 and met the CDC guidelines for AFM was conducted.</li> <li>- Records were reviewed for antecedent factors, a description of the illness, physical and neurological status, and functional status during and after rehabilitation treatment.</li> <li>- All participants also received activity based restorative therapy (ABRT).</li> </ul> </li> </ul>
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<b>Level of Evidence</b>	- Level III
<b>Outcomes and Main Findings</b>	<ul style="list-style-type: none"> <li>- Children with AFM that undergo rehabilitation can make clinically significant neurologic and functional progress</li> <li>- Improved mean scores from admission to discharge using the WeeFIM (<math>n = 13</math>), SCIM (<math>n = 11</math>), and PAMS (<math>n = 17</math>). A paired samples <math>t</math>-test of the admissions scores and discharge scores showed that the results were statistically significant as shown by the <math>p</math>-values in Table 4.</li> <li>- A multitude of medical treatments as well as rehabilitation services, so any one of these treatments could have altered the outcomes. Adverse effects, such as respiratory failure and receiving a ventilator, took place for 7 of the participants, which could have altered their outcomes</li> </ul>
<b>Intervention Highlighted Through the Research</b>	<ul style="list-style-type: none"> <li>- The main issue highlighted is that due to the recent recognition of AFM in 2014 by the CDC, there is a gap in the literature about the functional outcomes of children with AFM and the best evidence-based interventions to use throughout the course of their</li> </ul>

	<p>rehabilitation.</p> <ul style="list-style-type: none"> <li>- A retrospective medical records review was used to present the medical and rehabilitative progress on a cohort of children who have already undergone ABRT to help fill the gap and provide evidence highlighting their outcomes.</li> </ul>
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<p><b>Limitations</b></p>	<ul style="list-style-type: none"> <li>- One limitation in the study is that AFM was not defined by the CDC until 2014, meaning prior to and most likely for some time after 2014 cases were not defined as AFM or given an appropriate AFM workup.</li> <li>- No standardized intervention or evaluation tools for it at this time, thus leading to multiple outcomes measures and different therapeutic interventions.</li> <li>- Another limitation was that AFM caused respiratory failure in some of the participants, making it hard to treat for muscle weakness and ambulation while on a ventilator.</li> </ul>
<p><b>This Study Was Identified as the “Best” Evidence and Selected for the Portfolio for the Following Reasons:</b></p>	<ul style="list-style-type: none"> <li>- This article is included in our study in order to provide statistically significant quantitative data on the functional outcomes of children with AFM, specifically posture and movement using PAMS and ADLs using the WeeFIM.</li> <li>- This article is important because it targets the same gap in the literature that has led our clinical advisor to propose this PICO question needing evidence on what outcomes should be expected when working with children with AFM.</li> </ul>
<p><b>Quality Score</b></p>	<p>- 77%</p>

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\*This source was not used to make our appraisal

Below is a handout which shows our poster as well as a Goal Attainment Scale (GAS) and line graph. We are recommending to use these findings in practice to understand the prognosis of acute flaccid myelitis (AFM). From our project, we found that Activity Based Restorative Therapy (ABRT) could be a contributing factor for recovery in children with AFM. We recommend implementing 3-5 hours of ABRT five times per week. However, when recommending this, we must recognize that this level of intensity may not be feasible for all clients and clinical settings; therefore, the outcomes should be monitored. We also need to understand that all clients progress differently and that therapy should be individualized for each client. A way to monitor progress could be using the GAS and making a line graph to show change. In our example we used upper body dressing as the task we are monitoring, but any task can be substituted in both the GAS or line graph.

Method for Monitoring Clinical Application

Goal Attainment Scale

-2 Present Level of Performance	-1 Progress	0 Expected Level of Outcome (Goal)	+1 Somewhat More than Expected	+2 Much Better than Expected
Dependent in completing upper body dressing	Requires max-assist to complete upper body dressing	Requires mod-assist to complete upper body dressing	Requires min-assist to complete upper body dressing	Independent in completing self-care skills

