In the United States Court of Federal Claims

OFFICE OF SPECIAL MASTERS

Filed: September 22, 2022

JENNIFER GROSS,	*	PUBLISHED
	*	
Petitioner,	*	No. 17-1075V
	*	
v.	*	Special Master Nora Beth Dorsey
	*	
SECRETARY OF HEALTH AND HUMAN SERVICES,	*	Ruling on Entitlement; Pneumococcal Conjugate ("Prevnar 13") Vaccine; Guillain-Barré Syndrome ("GBS"); Chronic Inflammatory Demyelinating Polyneuropathy ("CIDP").
Respondent.	*	

Lawrence R. Cohan, Saltz Mongeluzzi & Bendesky, Philadelphia, PA, for Petitioner.
Colleen C. Hartley, U.S. Department of Justice, Washington, DC, for Respondent.

RULING ON ENTITLEMENT[1]

On August 8, 2017, Jennifer Gross ("Petitioner") filed a petition for compensation under the National Vaccine Injury Compensation Program ("Vaccine Act" or "the Program"), 42 U.S.C. § 300aa-10 et seq. (2012),[2] alleging that she suffered Guillain-Barré Syndrome ("GBS") and chronic inflammatory demyelinating polyneuropathy ("CIDP") as the result of a pneumococcal conjugate ("Prevnar 13") vaccination she received on September 22, 2016. Petition at Preamble (ECF No. 1). Respondent argued against compensation, stating "this case [was] not appropriate for compensation under the terms of the Act." Respondent's Report ("Resp. Rept.") at 1 (ECF No. 18).

[1] Because this Ruling contains a reasoned explanation for the action in this case, the undersigned is required to post it on the United States Court of Federal Claims' website in accordance with the E-Government Act of 2002. 44 U.S.C. § 3501 note (2012) (Federal Management and Promotion of Electronic Government Services). **This means the Ruling will be available to anyone with access to the Internet.** In accordance with Vaccine Rule 18(b), Petitioner has 14 days to identify and move to redact medical or other information, the disclosure of which would constitute an unwarranted invasion of privacy. If, upon review, the undersigned agrees that the identified material fits within this definition, the undersigned will redact such material from public access.

[2] The National Vaccine Injury Compensation Program is set forth in Part 2 of the National Childhood Vaccine Injury Act of 1986, Pub. L. No. 99-660, 100 Stat. 3755, codified as amended, 42 U.S.C. §§ 300aa-10 to -34 (2012). All citations in this Ruling to individual sections of the Vaccine Act are to 42 U.S.C. § 300aa.

After carefully analyzing and weighing the evidence presented in this case in accordance with the applicable legal standards, the undersigned finds that Petitioner has provided preponderant evidence that her proper diagnosis was GBS, which subsequently was diagnosed as CIDP, and that the Prevnar 13 vaccine she received caused her GBS and CIDP, satisfying her burden of proof under Althen v. Secretary of Health & Human Services, 418 F.3d 1274, 1280 (Fed. Cir. 2005). Accordingly, Petitioner is entitled to compensation.

I. ISSUES TO BE DECIDED

Diagnosis is at issue. Petitioner's experts, Dr. Daniel Stein and Dr. Lawrence Steinman, opined that Petitioner's correct diagnosis was an inflammatory neuropathy initially labeled as GBS that became chronic with a diagnosis of CIDP, whereas Respondent's expert, Dr. Vinay Chaudhry, disagreed. Petitioner's Exhibit ("Pet. Ex.") 15 at 11; Pet. Ex. 23 at 26; Resp. Ex. A at 8-9. Dr. Chaudhry opined that Petitioner's clinical presentation and diagnostic studies were not consistent with GBS. Resp. Ex. A at 9-10; Resp. Ex. E at 5.

The parties also dispute causation. Petitioner does not allege a Table injury, and thus, she must prove causation-in-fact by preponderant evidence. Petitioner contended that she provided preponderant evidence of the Althen criteria, and respondent disagreed. Pet. Pre-Hearing Submission, filed May 24, 2021, at 11-37 (ECF No. 88); Resp. Pre-Hearing Submission, filed May 24, 2021, at 13-6 (ECF No. 86). Respondent argued that even if Petitioner had GBS, which subsequently evolved into CIDP, she failed to (1) provide a reliable scientific or medical theory establishing that the Prevnar 13 vaccine can cause GBS or CIDP, (2) provide evidence of a logical sequence of cause and effect between Petitioner's Prevnar 13 vaccine and her alleged GBS or CIDP, or (3) establish a medically appropriate temporal relationship between Petitioner's Prevnar 13 vaccine and her alleged GBS or CIDP. Resp. Pre-Hearing Submission at 13-16.

II. BACKGROUND

A. Procedural History

On August 8, 2017, Petitioner filed her petition for compensation in the Vaccine Program. Petition. From August 2017 to May 2018, Petitioner filed medical records. Pet. Exs. 1-14. Respondent filed Respondent's Rule 4(c) Report on June 29, 2018, arguing against compensation. Resp. Rept. at 1.

Petitioner filed an expert report from Dr. Daniel Stein and medical literature on September 27, 2018. Pet. Exs. 15-18. Respondent filed responsive expert reports from Dr. Vinay Chaudhry and Dr. Noel Rose on March 12, 2019. Resp. Exs. A-D. The parties agreed to alternative dispute resolution ("ADR") in May 2019 and began ADR proceedings in September 2019. P-100 Initial Order dated Sept. 24, 2019 (ECF No. 22).

On October 3, 2019, this case was reassigned to the undersigned. Notice of Reassignment dated Oct. 3, 2019 (ECF No. 24). From October 2019 to January 2020, the parties filed medical literature and medical records. Pet. Exs. 19-22; Resp. Ex. A, Tabs 1-15; Resp. Ex.

C, Tabs 1-22. The case was removed from the ADR process on February 13, 2020. Order Removing Case from ADR dated Feb. 13, 2020 (ECF No. 44).

A pre-hearing order was issued, setting an entitlement hearing to begin on June 9, 2021. Pre-Hearing Order dated Mar. 24, 2020 (ECF No. 49). The parties filed multiple expert reports from Drs. Steinman, Chaudhry, and Whitton, with supporting medical literature from December 2020 to June 2021. Pet. Exs. 23-34; Resp. Exs. E-K.

An entitlement hearing was held on June 9 and 10, 2021. Order dated June 10, 2021 (ECF No. 96). Petitioner filed updated medical records on August 9, 2021, and a post-hearing brief on September 21, 2021. Pet. Exs. 35-36; Pet. Post-Hearing Brief ("Br."), filed Sept. 21, 2021 (ECF No. 109). Respondent filed a post-hearing brief on January 27, 2022. Resp. Post-Hearing Br., filed Jan. 27, 2022 (ECF No. 125). Petitioner filed a reply on March 31, 2022. Pet. Reply to Resp. Post-Hearing Br. ("Pet. Reply"), filed Mar. 31, 2022 (ECF No. 133). Petitioner filed additional medical records throughout 2022. Pet. Exs. 37-38.

This matter is now ripe for adjudication.

B. Medical Terminology

GBS is "an acute paralytic disorder of the peripheral nervous system, usually characterized by 'ascending' paralysis (i.e., beginning in the lower limbs, and spreading upwards)." Resp. Ex. F at 7. The condition is relatively rare, with a reported incidence of 0.89-1.89 cases per 100,000 person-years in Western countries, affecting all ages, with an increased risk in older adults. Pet. Ex. 17o at 1.[3] Weakness is the prominent manifestation. Id. Other symptoms may include sensory disturbances, cranial nerve palsies, and dysautonomia.[4] Id. at 9. Generally, weakness is progressive, but it may be acute with "rapid neurological deterioration over 2-6 weeks during which time a nadir is reached, followed by a plateau of relative clinical stability and then a period of improvement." Pet. Ex. 15 at 7; see also Transcript ("Tr.") 154.

[3] Nobuhiro Yuki & Hans-Peter Hartung, Guillain-Barré Syndrome, 366 New Eng. J. Med. 2294 (2012).

[4] Dysautonomia is a "malfunction of the autonomic nervous system." Dysautonomia, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=15146 (last visited Sept. 12, 2022). Autonomic nervous system is "the portion of the nervous system concerned with regulation of the activity of cardiac muscle, smooth muscle, and glandular epithelium; usually restricted to the two visceral efferent peripheral components, the sympathetic nervous system, and the parasympathetic nervous system." Autonomic Nervous System, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=111779 (last visited Sept. 12, 2022).

CIDP "is a symmetric sensorimotor weakness of [greater than] 8 weeks[] duration and is associated with absent/reduced reflexes, albuminocytological dissociation,[5] demyelinating electrophysiology, response to [intravenous immune globulin ("IVIG")] treatment, and relapsing or slowly progressive course." Resp. Ex. A at 6 (citing Resp. Ex. A, Tab 1 at 1).[6] CIDP is closely related to GBS and it is considered the chronic counterpart of the acute disease. Resp. Ex. E, Tab 5 at 1.[7] "CIDP is a neurological disorder characterized by progressive weakness and impaired sensory function in the legs and arms. The disorder, which is sometimes called chronic relapsing polyneuropathy, is caused by damage to the myelin sheath of the peripheral nerves." Id.

"The clinical course of CIDP may be described as relapsing-remitting, steady progressive[,] or stepwise progressive." Resp. Ex. A, Tab 10 at 8.[8] The clinical features are similar to GBS, however, "respiratory dysfunction, cranial nerve deficits[,] and dysautonomia [are] less commonly observed." Id. EMG studies in CIDP show "evidence of peripheral nerve demyelination such as prolonged distal latencies, reduced conduction velocities, conduction block[,] and temporal dispersion in at least two motor nerves; however, with disease restricted to the nerve roots prolonged F-wave responses may be the only evidence of dysfunction." Id. at 8-9. Analysis of cerebrospinal fluid ("CSF") generally shows the same abnormalities that are seen in GBS, albuminocytologic dissociation. Id. at 9. The neuropathological features of CIDP are similar to GBS, with both conditions characterized by "mononuclear cell infiltration of predominantly monocytes/macrophages and less commonly T lymphocytes into peripheral nerve and nerve root endoneurium with macrophage-mediated demyelination." Id.

The cause of GBS is not known, but it "is thought to be an autoimmune process that is triggered by antigenic stimulation, resulting in demyelination and destruction of peripheral nerves." Resp. Ex. A, Tab 6 at 1.[9] GBS is thought to be triggered by infections or

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[5] Albuminocytologic dissociation is the "increase of protein with otherwise normal cell count in the spinal fluid." Albuminocytologic Dissociation, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=71273 (last visited Sept. 12, 2022).

[6] Jean-Michel Vallat et al., Chronic Inflammatory Demyelinating Polyradiculoneuropathy: Diagnostic and Therapeutic Challenges for a Treatable Condition, 9 Lancet Neurology 402 (2010).

[7] Nat'l Inst. Neurological Disorders & Stroke, Chronic Inflammatory Demyelinating Polyneuropathy (CIDP) Information Page, https://www.ninds.nih.gov/health-information/disorders/chronic-inflammatory-demyelinating-polyneuropathy-cidp (last updated Mar. 27, 2019).

[8] Eroboghene E. Ubogu, Inflammatory Neuropathies: Pathology, Molecular Marker and Targets for Specific Therapeutic Intervention, 130 Acta Neruopathol 445 (2015).

[9] Roger Baxter et al., Lack of Association of Guillain-Barré Syndrome with Vaccinations, 57 Clinical Infectious Diseases 197 (2013).

immunizations. Pet. Ex. 15 at 3, 5. "[A]proximately two-thirds of all cases are preceded by a gastrointestinal or respiratory infection within the prior 3 months." Resp. Ex. A, Tab 6 at 1.

"Molecular mimicry has been proposed to be a pathogenic mechanism . . . based on epidemiological, clinical, and experimental evidence of the association of infectious agents with autoimmune diseases and an observed cross-reactivity of antibodies raised by microbial components with host 'self' antigens." Pet. Ex. 17a at 1.[10] The underlying etiology of GBS, although not known, "is considered to be an immune-mediated disorder resulting from generation of autoimmune antibodies and/or inflammatory cells which cross-react with epitopes on peripheral nerves and roots, leading to demyelination or axonal damage or both." Resp. Ex. E, Tab 3 at 2.[11] In an article filed by Respondent, the way infection and vaccines may cause GBS is described below:

> Antigenic challenge by an antecedent infection or immunization leads to antigen-specific humoral and/or cellular immunity, and as such, this immune stimulation could theoretically result in GBS through a number of possible mechanisms. The concept of "molecular mimicry" involves a situation in which epitopes of a pathogen or vaccine protein could initiate development of antibodies and/or T-cells that could cross-react with epitopes on peripheral nerve myelin or axonal glycoproteins or ganglioside moieties. Activated macrophages could potentially be targeted to antigens on the myelin sheath and subsequently invade the basement membrane resulting in demyelination or, alternatively, invade at the nodes of Ranvier[12] to result in axonal damage.

Id. at 3.

Both GBS and CIDP may occur in the setting of "genetic susceptibility factors." Resp. Ex. A, Tab 10 at 11. The "immunopathogenesis of CIDP has yet to be elucidated." Id. at 12. As

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[10] Nobuhiro Yuki, Ganglioside Mimicry and Peripheral Nerve Disease, 35 Muscle & Nerve 691 (2007).

[11] James J. Sejvar et al., Guillain-Barré Syndrome and Fisher Syndrome: Case Definitions and Guidelines for Collection, Analysis, and Presentation of Immunization Safety Data, 29 Vaccine 599 (2011).

[12] The nodes of Ranvier are "constrictions occurring on myelinated nerve fibers at regular intervals of about 1 mm; at these sites the myelin sheath is absent and the axon is enclosed only by Schwann cell processes." Nodes of Ranvier, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=93095 (last visited Sept. 12, 2022). Schwann cells are "any of the large nucleated cells whose cell membrane spirally enwraps the axons of myelinated peripheral neurons and is the source of myelin; a single Schwann cell supplies the myelin sheath between two nodes of Ranvier." Schwann Cell, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=66407 (last visited Sept. 12, 2022).

with acute inflammatory demyelinating polyradiculoneuropathy ("AIDP") (GBS), there are "significant gaps" in the "understanding of the immunopathogenesis of CIDP." Id. at 13.

C. Summary of Medical Records

1. Pre-Vaccination History

Petitioner was born on August 8, 1962, and was fifty-four years old at the time of vaccination. Pet. Ex. 1 at 21. Her past medical history was significant for anxiety, dermatitis, asthma, mixed hyperlipidemia, abnormal liver function, obesity, vitamin D deficiency, and diabetes mellitus without complication. Id. During a routine visit on May 11, 2016, with her primary care provider ("PCP"), Marc G. Boyer, a certified physician assistant ("PA-C"), Petitioner "was sensitive to microfilament testing on both feet." Id. Her diabetes and mixed hyperlipidemia were noted to be in "excellent control." Id. at 22.

Petitioner underwent a bunionectomy on each of her feet on March 8 and September 13, 2016, both performed by Dr. Christopher Dugan. Pet. Ex. 14 at 22 (right foot), 54 (left foot). Petitioner had a successful postoperative course from her surgeries. Id. at 34.

2. Vaccination on September 22, 2016

On September 22, 2016, Petitioner presented to PA-C Boyer for a routine checkup regarding Petitioner's diabetes and bloodwork results. Pet. Ex. 1 at 16. Mr. Boyer noted Petitioner's type II diabetes was controlled and without complication. Id. at 18. The Prevnar 13 vaccine[13] was administered in Petitioner's left deltoid. Id. at 19; Pet. Ex. 8 at 1.

3. Post-Vaccination Care

a. 2016 Records

Petitioner called PA-C Boyer on October 5, 2016, complaining that both her hands were "tingling." Pet. Ex. 9 at 15. She scheduled an appointment and was advised to go to the emergency room ("ER") if her symptoms worsened. Id.

Petitioner presented to the Memorial Hospital ER on October 7, 2016, for progressing numbness in her hands and feet. Pet. Ex. 12 at 9. Petitioner reported that she began to experience numbness in the tip of her right index finger on October 5, 2016, which progressed to numbness in both of her hands on October 6, and finally progressed to numbness in both of her feet that morning. Id. A computerized tomography ("CT") head scan without contrast showed

[13] The Prevnar 13 vaccine protects against *Streptococcus pneumoniae* ("*S. pneumoniae*") and contains the polysaccharides from 13 different strains of pneumococcus and, thereby, protects against those 13 strains. Pet. Ex. 25e (Prevnar 13 package insert). The Prevnar 13 package insert is also cited by Respondent. See Resp. Ex. A, Tab 9.

normal results. Id. at 33. Petitioner was diagnosed with peripheral neuropathy and advised to follow up in three days. Id. at 21.

On October 10, 2016, Petitioner presented to PA-C Boyer for a follow-up from the ER visit and complained of numbness in both her hands and feet. Pet. Ex. 1 at 12. Petitioner reported that the numbness had now spread up to her knees. Id. Petitioner was prescribed Neurontin, and PA-C Boyer ordered several studies including cervical spine X-rays and an electromyography ("EMG"). Id. Petitioner's X-rays of the cervical spine, performed that day, were normal. Pet. Ex. 10 at 8.

The next day, on October 11, 2016, Petitioner presented to the Barnes-Jewish Hospital ("BJH") ER for numbness "up to her knee," as well as on her nose and upper lip. Pet. Ex. 2 at 471. Petitioner reported no history of neuropathy and no other symptoms associated with numbness. Id. at 473. Petitioner had no known allergies. Id. Petitioner was diagnosed with numbness, discharged home, and told to follow up with her PCP. Id. at 475.

Petitioner reported that after she left the ER on October 11, 2016, she experienced difficulty walking. Pet. Ex. 3 at 830. She returned and was admitted to BJH on October 12, 2016, for numbness that had persisted for ten days. Id. Her admitting diagnosis was GBS. Id.; Pet. Ex. 2 at 491. Dr. Anson Wilks noted that Petitioner had "noncontributory past medical history with week-long course of symptoms of ascending sensory numbness associated with weakness in setting of recent Pneumovax administration."[14] Id. at 632.

Upon admission to BJH on October 12, 2016, Petitioner had mild asymmetric weakness on examination, with bilateral areflexia[15] and dysmetria.[16] Pet. Ex. 2 at 538. Petitioner's motor examination showed decreased sensation below the right and left knee and in the right and left forearm. Pet. Ex. 3 at 834. Petitioner also had a severe proprioception deficit in her toes, and was areflexic in her biceps, triceps, brachioradialis, patellar, and Achilles' tendons. Id. Speech therapy and modified barium swallow showed pharyngeal dysphagia[17] without aspiration. Pet. Ex. 2 at 538. Petitioner underwent an EMG/nerve conduction study ("NCS"), which showed "severe axonal sensorimotor polyneuropathy, due to small or absent [compound muscle action

[14] Petitioner received the Prevnar 13 vaccine, not the Pneumovax vaccine.

[15] Areflexia is the "absence of reflexes." Areflexia, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=4035 (last visited Sept. 12, 2022).

[16] Dysmetria is "a condition in which there is improper estimation of distance in muscular acts, with disturbance of the power to control the range of muscular movement, often resulting in overreaching." Dysmetria, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com /dorland/definition?id=15236 (last visited Sept. 12, 2022).

[17] Dysphagia is "difficulty in swallowing." Dysphagia, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=15265 (last visited Sept. 12, 2022).

potentials ("CMAPs")],[18] absent [sensory nerve action potentials ("SNAPs")],[19] and absent tibial H-wave. The findings do not suggest classic [GBS], but most likely [] acute motor and sensory axonal neuropathy (AMSAN), a variant of GBS."[20] Id. at 530. A lumbar puncture showed protein level in her cerebrospinal fluid was elevated, 105 mg/dL [nl 5-45 mg/dL], consistent with albuminocytologic dissociation. Id. at 521, 714; Pet. Ex. 3 at 836. Dr. Nupur Ghoshal, the attending neurologist, concluded that all of Petitioner's findings were "consistent with the diagnosis of GBS." Pet. Ex. 3 at 836. Dr. Ghoshal noted that Petitioner's "mild asymmetry and early involvement of [her] upper extremities [made] for a less typical presentation," and that there was no "bulbar involvement." Id. However, Dr. Ghoshal also documented that Petitioner had a "rapid progression since time of onset," and that all findings were "consistent with the diagnosis of GBS." Id. Petitioner received IVIG from October 12 to October 14, 2016. Pet. Ex. 2 at 530.

On October 13, 2016, Dr. Naeem Muhammad administered a modified barium swallow assessment with video fluoroscopy due to Petitioner's suspected ileus[21] due to her GBS. Pet. Ex. 11 at 20. Petitioner's swallowing was abnormal, characterized by premature spillage, nasal regurgitation, and base of tongue weakness. Id.

The next day, October 14, 2016, Dr. Wilks documented Petitioner's GBS was "[l]ikely [secondary to] recent Pneumovax administration." Pet. Ex. 2 at 678. Petitioner's examination was significant for worsening weakness. Id. Dr. Wilks was concerned about "impending respiratory failure;" however, he noted "no emergent need for in[tu]bation at this time but patient would benefit from escalation of care" in the intensive care unit ("ICU"). Id. Petitioner was transferred to the ICU and her respiratory signs were closely monitored. Id. at 530, 708.

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[18] Compound muscle action potential ("CMAP") is "a group of almost simultaneous action potentials from several muscle fibers in the same area; they are usually evoked by stimulation of the supplying motor nerve and are recorded as one multipeaked summated action potential." Compound Muscle Action Potential, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=99678 (last visited Sept. 12, 2022).

[19] Sensory nerve action potential ("SNAP") is "a compound nerve action potential recorded from a sensory nerve or from the sensory branch of a mixed nerve." Sensory Potential, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=99720 (last visited Sept. 12, 2022).

[20] The AMSAN variant of GBS is defined in the Qualifications and Aids to Interpretation of the Vaccine Injury Table, relative to the Table claim arising out of GBS following administration of the influenza ("flu") vaccination, as "an axonal form of GBS that is similar to [acute motor axonal neuropathy ("AMAN")], but also affects the sensory nerves and roots." § 100.3(c)(15)(ii).

[21] An ileus is an "intestinal obstruction that is due to a nonmechanical cause, such as paralysis and failure of peristalsis." Ileus, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=24743 (last visited Sept. 12, 2022).

Petitioner's breathing stabilized and she was transferred out of the ICU on October 16. Id. at 685.

Petitioner was discharged from BJH to inpatient rehabilitation on October 20, 2016, with a principal diagnosis of GBS. Pet. Ex. 3 at 795. At discharge, neurologist, Dr. Richard Sommerville noted that Petitioner likely had an AMSAN variant of GBS, rather than classic GBS. Id. Petitioner had also developed pharyngeal dysphagia without aspiration and an ileus during her stay at BJH. Id.; Pet. Ex. 2 at 538.

Petitioner was admitted to Missouri Baptist Medical Center ("Missouri Baptist") for acute rehabilitation on October 20, 2016. Pet. Ex. 3 at 16. Her admitting diagnosis was GBS, noting she received the Prevnar 13 vaccine five days before the onset of symptoms. Id. at 16, 327. Petitioner's sensation to light touch was absent in her legs and feet and impaired in her hands. Id. at 819. At her physical therapy ("PT") evaluation performed on October 21, 2016, by Michelle Hodel, Doctorate in PT ("DPT"), Petitioner stated that she had "numbness all over," tingling of her hands and mouth, and fatigue. Id. at 332, 339. Sensation was impaired bilaterally to her lower extremities. Id. at 333. She was limited in performing passive range of motion due to weakness and ataxia. Id. Strength testing in her lower extremities was abnormally decreased in the hips, knees, and ankles bilaterally. Id. Balance was also very impaired, rated as poor in the seated or standing position, requiring a two person assist to stand. Id. at 334. Her functional ambulation score was zero, indicating that she was "not able to walk at all or need[ed] assistance from two people." Id. She was unable to walk, and demonstrated "severe weakness, ataxia, fatigue, [and] decrease[d] balance." Id. at 335; 800. Prior to her illness, she had worked full-time,[22] been able to drive, and complete all activities of daily living. Id. at 333.

On October 22, 2016, Petitioner had a psychiatric consultation for supportive care "to cope with profound life changes from her [GBS]." Pet. Ex. 3 at 193. Petitioner had no history of "mood or personality disorders." Id. However, she was experiencing acute anxiety associated with shortness of breath and depressed mood due to her concerns that she would "not be able to recover her [prior] levels of independent functioning." Id. at 194.

Petitioner was able to tolerate PT well and complete her therapy sessions from October 22 to October 25, 2016. See Pet. Ex. 3 at 336-80.

Dr. Mohammad Firozi, a gastroenterologist, saw Petitioner on October 25, 2016 for "abdominal distension, abdominal pain[,] and nausea." Pet. Ex. 3 at 49. Dr. Firozi noted that Petitioner's gastrointestinal symptoms were due to an ileus, which was secondary to her immobility and GBS. Id. at 50. A nasogastric tube was placed, and Petitioner was not allowed to eat or drink. Id. Serial X-rays were ordered daily to monitor her ileus. Id.

[22] Petitioner worked full-time as a loan assistant. Pet. Ex. 3 at 345. Her hobbies included watching sports, antique shopping, and refinishing furniture. Id. She also enjoyed playing the piano. Id. at 346.

Dr. Courtney Shands, a urologist, examined Petitioner on October 26, 2016, regarding hematuria and urinary retention. Pet. Ex. 3 at 52. Dr. Shands consult notes indicated that Petitioner "had a pneumonia shot a couple weeks ago and was [functioning normally] at that time. [S]he began having weakness and numbness and now has full-blown [GBS]." Id. Additionally, Petitioner had experienced incontinence. Id. On examination, Petitioner could "barely get her arm to extend forward" to shake Dr. Shands' hand. Id. at 53. Dr. Shands' impression was that Petitioner's "neurologic symptoms d[id] not appear to have stabilized yet." Id. She also noted a urinary tract infection due to *Escherichia coli* ("*E. coli*").[23] Id. Antibiotics and supportive care were recommended. Id.

A nursing rehabilitation note from October 26, 2016, indicated that Petitioner had not had therapy that day due to her medical issues and fatigue. Pet. Ex. 3 at 614. She had a nasogastric tube for decompression of her bowel and intravenous ("IV") fluids because she was not permitted to eat or drink. Id. She was receiving IV antibiotics for her urinary tract infection but had "bright red bloody urine." Id. at 625. She was incontinent of her bladder and bowel. Id. at 627. Accordingly, PT was put on hold on that day due to bed rest. Id. at 381-82.

Due to concerns about Petitioner's hematuria and ileus, and her inability to participate fully in therapy, she was transferred to an acute medical unit of Missouri Baptist on October 27, 2016. Pet. Ex. 3 at 638. Diagnosis on admission was acute ileus. Id. at 1019. Dr. Thishara Merza, an internist, noted that Petitioner had been diagnosed with *E. coli* hemorrhagic cystitis, and that her urine cultures also contained *Morganella morganii* ("*M. morganii*")[24] bacteria. Id. at 1061. On evaluation, Petitioner was able to move her arms and legs slightly but could not move her toes or walk. Id. Petitioner was diagnosed with colonic pseudo-obstruction and Ogilvie syndrome.[25] Id. at 1041. Her additional diagnosis remained GBS (AMSAN/GBS variant). Id.

[23] *Escherichia coli* is "a common facultative organism of the intestines" that can "produc[e] fevers and diarrhea . . . . The fever-causing strains are found in urinary tract infections, abscesses, conjunctivitis, and occasionally septicemic conditions . . . . Shiga toxin-producing groups (STEC, formerly called enterohemorrhagic, or EHEC) cause acute bloody diarrhea and hemolytic-uremic syndrome." Escherichia Coli, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=73835 (last visited Sept. 12, 2022).

[24] *Morganella morganii* is a type of bacteria that "is a primary cause of urinary tract infections and is an opportunistic pathogen, causing secondary infections of the blood, respiratory tract, and wounds." Morganella Morganii, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=89584 (last visited Sept. 12, 2022).

[25] Ogilvie syndrome is the "distention of the colon resembling that caused by obstruction, but without evidence of mechanical obstruction; it is usually due to a defect in the sympathetic nerve supply." Ogilvie Syndrome, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=111096 (last visited Sept. 12, 2022).

That same day, October 27, 2016, Petitioner was seen by podiatrist, Dr. Steven Frank, for a follow-up of a bilateral bunion surgery done five to six weeks prior. Pet. Ex. 13 at 6. Dr. Frank documented that Petitioner had "no strength to the toes/feet" and "no muscle strength to toes/feet/ankles bilaterally." Pet. Ex. 3 at 242.

After receiving treatment for her gastrointestinal issues, Petitioner's condition stabilized and she was discharged from the acute medical care unit and re-admitted to the acute rehabilitation unit at Missouri Baptist on November 1, 2016 for GBS, as well as generalized weakness and functional deficits. Pet. Ex. 3 at 1547. A PT evaluation done November 2, by Matthew Schleuter, Master of PT ("MPT"), showed that Petitioner continued to have diminished sensation in her legs. Id. at 2496, 2502. Balance remained poor in seated and standing positions. Id. at 2497. Diagnosis remained GBS. Id. at 2508.

On November 10, 2016, Petitioner had an episode of possible aspiration. Pet. Ex. 3 at 2473. A pulmonary consultation by Dr. Thomas Spence Jr. was obtained due to cough and shortness of breath. Id. at 1557. Supplemental oxygen, bronchodilators, and anti-inflammatory treatment was initiated. Id. at 1558. By November 22, Dr. Spence documented that Petitioner felt that she was "getting better." Id. at 2191. He also noted that Petitioner had "more sensation in her legs." Id. at 2191, 2193. She continued to be seen by psychiatry for follow-ups. Id. at 1934-36. On November 29, 2016, her mood and affect were improved, and Petitioner reported feeling "quite positive regarding her PT progress." Id. at 1936. Throughout this rehabilitation admission, Petitioner's diagnosis remained GBS.

On December 6, 2016, Petitioner was transferred to Cedar Ridge Health Care Center ("Cedar Ridge"), a skilled nursing facility. Pet. Ex. 5 at 1424. Upon admission, Petitioner's diagnoses included GBS and generalized muscle weakness. Id. An initial PT assessment by Lori Toennies, PT, revealed that Petitioner required maximum assistance of two people to sit and that she was unable to walk. Id. A progress note from December 12, 2016 documented that Petitioner was able to stand upright in the standing frame for three minutes. Id. at 1427. In the next progress note, dated December 19, Petitioner was able to stand upright for three minutes without a drop in her blood pressure. Id. at 1430. She was progressing "extremely slow due to low functional ability and low muscle tone." Id. at 1431. Petitioner was making progress in tolerating a seated position for up to three hours several times a day. Id. However, her blood pressure continued "to drop with standing activities in the standing frame." Id. The physical therapist deemed her prognosis as "excellent due to progress[] with sitting tolerance." Id. Additionally, Petitioner was motivated to participate in her therapy. Id. On December 22, 2016, Petitioner continued to demonstrate progress and had improving upper body and trunk control. Id. at 1434. She was slowly making progress in lower body strength, but she continued "to have difficulty standing." Id. On December 29, Petitioner was able to lift her lower extremities, hold a seated position, and stand for five minutes. Id. at 1436. Her prognosis remained excellent due to her "good progress with sitting balance and transfers." Id. Her diagnosis remained GBS.

While at Cedar Ridge, on December 29, 2016, Petitioner had her first follow-up visit with neurologist Dr. Sommerville since her prior hospitalization on October 20, approximately two months earlier. Pet. Ex. 6 at 9. At the visit, Petitioner reported feeling weak. Id. at 10. Dr. Sommerville thought that Petitioner's quantitative motor testing was "markedly worse" than

when he had last seen Petitioner. Id. at 11. He questioned whether Petitioner's condition had worsened or whether she had reached the nadir of her illness after her hospital discharge. Id. Dr. Sommerville also questioned whether Petitioner had "an axonal or demyelination process." Id. She was still unable to walk. Id. Dr. Sommerville recommended that Petitioner undergo further testing, including an EMG. Id. at 6, 11.

b. 2017 Records

On January 18, 2017, Petitioner underwent an EMG with Dr. Sommerville. Pet. Ex. 6 at 7. The results were again consistent with a demyelinating polyneuropathy, "as supported by the severely prolonged distal latencies and severe slowing of conduction velocity," with "relatively little axon loss." Id.

Petitioner was discharged from Cedar Ridge on January 23, 2017, to be re-admitted to BJH for IV steroid treatment. Pet. Ex. 5 at 1448. At the time of discharge, she was able to stand upright for five minutes without assistance, but she continued to have decreased muscle strength in both lower extremities. Id. Her PT records note that her diagnosis remained GBS. Id.

Petitioner was re-admitted to BJH from January 23 to 27, 2017 for IV methyl prednisone steroid treatment for CIDP. Pet. Ex. 2 at 1723, 1725, 1727, 1735, 1738-40. On admission, Petitioner was evaluated by Dr. Ahmed Bamaga, who noted that Petitioner had been previously treated "in the [F]all of 2016 for numbness that started a week after a pneumonia shot." Id. at 1775. Dr. Bamaga stated, "Dr. Sommerville was not happy with her improvement and given the chronicity[,] . . . she was diagnosed officially with CIDP after reviewing the repeated EMG nerve conduction." Id. On examination, Petitioner had difficulty lifting her legs off the bed. Id. at 1776. During this hospitalization, Petitioner also received IVIG. Id. at 1778. At discharge, Petitioner was told to continue steroid treatments once a week for two months and follow up with Dr. Sommerville as scheduled. Id. at 1779.

Upon discharge from BJH, Petitioner was re-admitted to Cedar Ridge from January 28 through March 2, 2017 for continued rehabilitation. Pet. Ex. 5 at 1565. During this admission, Petitioner's medical diagnoses included CIDP. Id. Upon discharge, Petitioner was able to stand with upper extremity support. Id. at 1577. Petitioner was discharged home on March 2, 2017, with home health therapy services once she reached the sixty-day limit on skilled nursing facility care covered by insurance. Id.

Petitioner was re-admitted to BJH on March 5, 2017 because she was unable to care for herself at home. Pet. Ex. 7 at 42. Petitioner reported "stable to mild neurologic improvement" due to steroids she received in January 2017, but she was "still unable to do fine motor movements with [her] hands, unable to transfer, sit up, stand without assistance or take more than 2 steps with full assistance." Id. at 50. Petitioner's diagnosis upon admission was CIDP. Id. A neurological examination revealed paresthesias in both hands, numbness in both feet, right foot drop, and inability to elicit deep tendon reflexes. Id. at 46.

On March 6, 2017, Petitioner became hypotensive, requiring IV fluids and a norepinephrine drip. Pet. Ex. 7 at 42, 55. The episode was thought to be caused by either

autonomic dysfunction or adrenal insufficiency. Id. at 55. She was transferred to the Medical ICU ("MICU") for monitoring. Id. at 42. Regarding the diagnosis of CIDP, Dr. Nguyet Nguyen documented,

> patient originally presented to BJH with complaint of [right] hand numbness 1 week after a pneumonia shot. This numbness progressed throughout her hands and feet and eventually also progressed to weakness. During this admission[,] patient was originally diagnosed with [GBS] in [suggestion of] pneumonia shot. She was treated with IVIG and discharged to [Missouri Baptist] for 6 weeks of rehab and then to a [skilled nursing facility]. Patient strength was not returning very well and outpatient neurologist ended up performing an EMG 1/2017 and ultimately diagnosing her with CIDP. Patient was then admitted to the neurology service 1/2017 for high dose aggressive steroid treatment.

Id. Petitioner received high dose steroid treatment. Id. at 55. The pneumococcal vaccine was listed under allergies. Id.

During the hospitalization, Petitioner was diagnosed with deep vein thrombosis and received treatment with Eliquis. Pet. Ex. 7 at 47-48, 55, 102. Petitioner was evaluated by DPT Elisabeth Martin on March 7, 2017. Id. at 35. Petitioner was able to "walk short distance . . . with maximal assistance." Id. Sensation to her legs and feet were impaired. Id. at 36. Petitioner was discharged on March 16, 2017, with plans to seek continued care in a skilled nursing facility. Id. at 56.

c. 2018[26] to Present

Petitioner presented to Dr. Sommerville for a follow-up for CIDP on January 10, 2019. Pet. Ex. 35 at 4. Dr. Sommerville noted Petitioner had improved and he observed that it "does not sound like she is really limited in any way by this." Id. Dr. Sommerville recommended a follow-up in six months. Id. at 5.

On April 16, 2019, Petitioner had a routine office visit with PA-C Boyer. Pet. Ex. 36 at 96. Mr. Boyer noted Petitioner's CIDP was an "unstable chronic condition" and increased her gabapentin prescription. Id.

On July 18, 2019, Petitioner again followed up with Dr. Sommerville for CIDP. Pet. Ex. 22 at 6. By this point, Petitioner was walking without assistance, had been off all corticosteroids for six months, and had not had any worsening of her function. Id. Dr. Sommerville noted that Petitioner's balance was good and that she was active in the gym. Id. He recommended gabapentin for nerve pain at night. Id. Dr. Sommerville stated, "I am hopeful that this is a monophasic course of CIDP." Id. at 7.

On January 23, 2020, Petitioner returned to Dr. Sommerville. Pet. Ex. 35 at 15. Petitioner had no recurrence of any CIDP symptoms. Id. Dr. Sommerville recommended a

[26] Few medical records were provided from 2018. See Pet. Ex. 36 at 105-137.

follow-up in one year. Id. at 16. Petitioner followed up with Dr. Sommerville on July 7, 2021 due to "chronic issues with right hand." Id. at 17. Petitioner stated she had some difficulty typing, but no numbness or pain. Id. Dr. Sommerville's impression was "monophasic CIDP," "with continued absence of any signs of a relapse." Id. at 20. Petitioner exhibited normal strength in her right hand. Id.

Petitioner presented to PA-C Boyer on June 24, 2021 for a routine follow-up. Pet. Ex. 36 at 11. Petitioner declined the influenza ("flu") and pneumococcal vaccines, but she was up to date on her Covid-19 vaccinations. Id. Her CIDP was noted as stable at the time. Id. The pneumococcal vaccine was listed under allergies associated with CIDP. Id. at 12.

D. Petitioner's Hearing Testimony

Prior to her illness in 2016, Petitioner worked full-time as a loan assistant with a bank. Tr. 26. Petitioner testified on June 9, 2022, that after she received the Prevnar 13 vaccine in 2016, she was diagnosed with GBS. Tr. 15. After several months of receiving treatment for her GBS, Dr. Sommerville changed her diagnosis to CIDP. Tr. 16. Petitioner stated Dr. Sommerville explained that "CIDP is the chronic version of GBS." Id.

Petitioner stated her diagnosis remains CIDP and she currently has "numbness in [her] right hand and [her] right foot." Tr. 25. She is able to walk without assistance and takes gabapentin. Id. Petitioner currently works full time but was unable to work for approximately nine months after her injury began. Tr. 26-27. During that nine-month period, Petitioner was in the hospital or in a rehabilitation facility receiving therapy. Tr. 27. After leaving the rehabilitation facility, Petitioner stayed with her sister. Id. She finally returned to her own home after four years. Id. Petitioner was unable to drive for three years after her diagnosis but is now able to do so. Tr. 28.

E. Expert Reports[27]

1. Petitioner's Expert, Dr. Daniel Stein

a. Background and Qualifications

Dr. Stein is board certified in neurology. Pet. Ex. 15 at 1; Pet. Ex. 16 at 1. After receiving his B.S. in neuroscience from the University of Rochester, he attended Albany Medical College where he received his M.D. Pet. Ex. 16 at 1. He completed an internship in internal medicine, a residency in neurology, and a fellowship in immunology of neuromuscular diseases. Id. Dr. Stein currently works in private practice as a neurologist and has for the last twenty-five years. Pet. Ex. 15 at 2. He is also a Clinical Assistant Professor at Florida State University College of Medicine. Id.; Pet. Ex. 16 at 1. For the past five years, Dr. Stein has diagnosed and

[27] Although the undersigned has reviewed all of the expert reports, this Ruling does not include every detail of each expert's opinions. Instead, the undersigned focuses on the material opinions, as they relate to the two relevant issues, diagnosis and causation.

treated approximately 50 patients with GBS and regularly presents on GBS pathogenesis and treatment. Pet. Ex. 15 at 2.

b. Opinion[28]

i. Diagnosis

Dr. Stein opined that Petitioner's diagnosis was AMSAN, a subtype of GBS. Pet. Ex. 15 at 11. "GBS is not one syndrome but a variety of subtypes." Id. at 10. "[GBS] is a form of [AIDP]." Id. Petitioner's initial presentation was consistent with GBS, however she failed to improve. Id. at 11. Dr. Stein stated, "[a]lthough the subsequent diagnosis of CIDP supplanted the GBS diagnosis in the more recent medical record[s], it does not mean that she did not have GBS at the outset of her illness. In fact, she did have GBS and was treated appropriately for that condition." Id. Dr. Stein concluded that Petitioner developed an autoimmune peripheral neuropathy which was appropriately diagnosed as GBS during the initial presentation, and eventually revised to CIDP. Id.

ii. Causation: Althen Prong One

With regard to Althen Prong One, Dr. Stein stated that GBS is an autoimmune disorder which results due to a cross-reaction of an antibody with epitopes in the peripheral nervous system. Pet. Ex. 15 at 7. The mechanism for the development of GBS rests on the concept of molecular mimicry. Id. He stated, "[o]ne potential cause of post-vaccination GBS is that the epitopes present in vaccine antigens promote the production of antibodies that react with similar epitopes present on myelin, Schwann cells[,] or on motor neurons themselves." Id.

Dr. Stein cited Yuki and Hartung, who describe molecular mimicry between *Campylobacter jejuni* ("*C. jejuni*") bacterial infection and the peripheral-nerve components as "appear[ing] to elicit autoantibodies and induce the development of the axonal subtype of [GBS]." Pet. Ex. 17o at 9. "The specific mechanism for immunopathogenesis is cross-reaction of antibodies with gangliosides present at the nodes of Ranvier, which then triggers the attack of macrophages that can invade the myelin sheath and promote its detachment." Pet. Ex. 15 at 7 (citing Pet. Ex. 17o at 4).

In addition to Yuki and Hartung, Dr. Stein cited several other medical articles in support of his opinion as to causation. Hoshino et al.[29] documented a case study of a 36-year-old man admitted to the hospital for urinary retention and muscle weakness after receiving the H1N1 flu vaccine. Pet. Ex. 17p at 1. The patient was diagnosed with GBS and acute disseminated encephalomyelitis ("ADEM"). Id. The authors stated GBS is a neuroinflammatory disorder

[28] Dr. Stein did not testify at the hearing on June 9-10, 2021.

[29] Takea Hoshino et al., Simultaneous Development of Acute Disseminated Encephalomyelitis and Guillain-Barré Syndrome Associated with H1N1 09 Influenza Vaccination, 51 Internal Med. 1595 (2012).

associated with immunization and "[m]olecular mimicry and cross-reactive immune response is considered to play a crucial part in their pathogenesis." Id.

In another article, authored by Nachamkin et al.,[30] the mechanism of molecular mimicry was also described as the cause of GBS, with respect to the H1N1 flu vaccine. Pet. Ex. 17q at 1. Nachamkin et al. noted that GBS was strongly associated with the H1N1 flu vaccine. Id. The authors postulated that molecular mimicry occurred due to *C. jejuni* contaminated vaccine components, which elicited anti-ganglioside antibodies and induced GBS in susceptible hosts. Id. at 2.

In the case of the Prevnar 13 vaccine, the vaccine's antigens are synthetic carbohydrate compounds found on the surface of the *S. pneumoniae* bacteria. Pet. Ex. 15 at 8. The vaccine contains thirteen different strains to develop various antigens. Id. Dr. Stein opined an autoimmune response can generate when "antibodies produced upon injection of the vaccine . . . react with an antigen that mimics the bacterial carbohydrate" also produced in the neurons of the host. Id.

ii. Causation: Althen Prong Two

Here, Petitioner presented with AMSAN, a subtype of GBS. Pet. Ex. 15 at 11. Over time, Petitioner's diagnosis was revised to CIDP, and she continued to have severe neurological deficits. Id. Dr. Stein opined, "[a]lthough the subsequent diagnosis of CIDP supplanted the GBS diagnosis in the more recent medical record[s], it does not mean that she did not have GBS at the outset of her illness. In fact, she did have GBS and was treated appropriately for that condition." Id.

According to Dr. Stein, a syndromic diagnosis, such as GBS, "is based on numerous clinical features at a given point in time and . . . the subsequent diagnosis of CIDP does not negate the fact that her initial presentation was most consistent with GBS." Pet. Ex. 15 at 11. Dr. Stein stated the AMSAN form of GBS is "known to be associated with immunological triggers such as viral infection or vaccination." Id.

Dr. Stein cited numerous case reports identifying cases of AMSAN after viral infection. Pet. Ex. 15 at 11. Jo et al.[31] documented a 21-year-old man who had a serious case of AMSAN

[30] Irving Nachamkin et al., Anti-Ganglioside Antibody Induction by Swine (A/NJ/1976/H1N1) and Other Influenza Vaccines: Insights into Vaccine-Associated Guillain-Barré Syndrome, 198 J. Infectious Diseases 226 (2008).

[31] Yoon-Sik Jo et al., A Case of Acute Motor and Sensory Axonal Neuropathy Following Hepatitis A Infection, 28 J. Korean Med. Sci. 1839 (2013).

following acute hepatitis A infection. Pet. Ex. 17z at 1. Kamihiro et al.[32] reported about a two-year-old boy who developed AMSAN after a rotavirus infection. Pet. Ex. 18a at 1. Finally, Rota et al.[33] found GBS developed post-Toscana virus infection.[34] Pet. Ex. 18b at 1.

Additionally, Dr. Stein noted that numerous physicians felt that the vaccination was important enough to mention in the medical records as part of Petitioner's medical history and "History of Present Illness." Pet. Ex. 15 at 11.

Further, Dr. Stein opined, "[t]here were no other contributing factors, either prior to, or after the vaccination, which contributed to her illness. The only antecedent agent prior to the onset of her GBS was her [Prevnar 13] vaccination." Pet. Ex. 15 at 12. Prior to vaccination on September 22, 2016, "no peripheral neuropathy was present. And [] around the time of the vaccination, and during the following two weeks, no other acute illness was present. Specifically, there was no gastrointestinal or respiratory illness at that time." Id.

iii. Causation: Althen Prong Three

Dr. Stein noted Petitioner's rapidly progressive symptoms of GBS developed thirteen days after the Prevnar 13 vaccination. Pet. Ex. 15 at 9. Her symptoms presented on October 5, 2016. Id. at 11. He stated "[t]his lag time between an immunologic trigger and symptom onset is consistent with published reports of post-vaccinal GBS cases identified by the CDC." Id. at 9. GBS usually occurs within six weeks after vaccination, with the highest incidence reported one to three weeks post-vaccination. Id. at 9-10.

In support of this opinion, Dr. Stein cited the Haber et al.[35] article, which reported an onset of GBS following the Prevnar 13 vaccine up to 42 days post-vaccination. Pet. Ex. 17w at 1, 5. Haber et al. found "an apparent increase in the number of GBS reports" to the Vaccine

[32] Noriki Kamihiro et al., Acute Motor-Sensory Axonal Guillain–Barré Syndrome with Unilateral Facial Nerve Paralysis After Rotavirus Gastroenteritis in a 2-Year-Old Boy, 18 J. Infection Chemotherapy 119 (2011).

[33] Eugenia Rota et al., Guillain-Barré-like Axonal Polyneuropathy Associated with Toscana Virus Infection, 96 Med. 1 (2014).

[34] Toscana virus is "a virus of the Naples serogroup of the genus *Phlebovirus,* an etiologic agent of phlebotomus fever." Toscana Virus, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=118497 (last visited Sept. 12, 2022).

[35] Penina Haber et al., Vaccines and Guillain-Barré Syndrome, 32 Drug Safety 309 (2009).

Adverse Event Reporting System ("VAERS")[36] within six weeks following the flu and meningococcal polysaccharide diphtheria toxoid conjugate vaccines. Id. at 5, 8. Dr. Stein next cited Lasky et al.,[37] which reported that 19 patients had received the flu vaccine within six weeks before onset of GBS. Pet. Ex. 17g at 3.

Dr. Stein further cited another Haber et al.[38] article, which reported onset of GBS after Prevnar 13 up to 42 days post-vaccination. Pet. Ex. 17y at 1, 5. This article reported 11 cases of GBS following the Prevnar 13 vaccine.[39] Id. at 4-5. "The median onset interval of symptoms was 9 days" with a range of 2 to 34 days. Id. at 4.

Petitioner's symptoms of GBS began thirteen days post-vaccination and fit "well within the time frame set forth by the literature." Pet. Ex. 15 at 9. Tseng et al.[40] reviewed clinical trials of patients 65 years and older who received Prevnar 13 vaccines and noted there was one report of GBS in a 78-year-old female "that was considered possibly related to [Prevnar 13]." Pet. Ex. 17x at 2. A review of VAERS found three reports of GBS after Prevnar 13 vaccination. Id. The authors defined a risk window of between 1 and 42 days for GBS after Prevnar 13 vaccination. Id. at 3.

2. Petitioner's Expert, Dr. Lawrence Steinman

a. Background and Qualifications

Dr. Steinman is board certified in neurology and has practiced neurology at Stanford University for over 40 years. Pet. Ex. 23 at 1; Pet. Ex. 24 at 1-2. He received his B.A. from Dartmouth College in 1968 and his M.D. from Harvard University in 1973. Pet. Ex. 24 at 1. Thereafter, he completed an internship in surgery, residency in pediatrics, and residency in pediatric and adult neurology from Stanford University Hospital, as well as three fellowships.

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[36] "VAERS is a national vaccine safety surveillance program . . . . This early warning system is designed to detect possible safety issues with U.S.-licensed vaccines. . . . VAERS data contain information on demographics of the person vaccinated, vaccine type, and [adverse events]." Pet. Ex. 17y at 2.

[37] Tamar Lasky et al., The Guillain-Barré Syndrome and the 1992-1993 and 1993-1994 Influenza Vaccines, 339 New Eng. J. Med. 1797 (1998).

[38] Penina Haber et al., Post-Licensure Surveillance of 13-Valent Pneumococcal Conjugate Vaccine (PCV13) in Adults Aged ≥ 19 Years Old in the United States, Vaccine Adverse Event Reporting System (VAERS), June 1, 2012–December 31, 2015, 34 Vaccine 6330 (2016). This article is also cited by Respondent. See Resp. Exs. A, Tab 5; C, Tab 11.

[39] One of the 11 cases also received a flu vaccine prior to onset. Pet. Ex. 17y at 4.

[40] Hung Fu Tseng et al., Pneumococcal Conjugate Vaccine Safety in Elderly Adults, 6 Open Forum Infectious Diseases 1 (2018).

Id. Dr. Steinman is currently a Professor at Stanford University. Id. Dr. Steinman treats patients with GBS and CIDP. Tr. 8. He has authored or co-authored over 500 publications. Pet. Ex. 24 at 5-47; Tr. 10-11.

b. Opinion

i. Diagnosis

Dr. Steinman opined "[t]he case represents the full spectrum of inflammatory neuropathy with an initial diagnosis of GBS. The inflammatory neuropathy became chronic and a diagnosis of CIDP was made." Pet. Ex. 23 at 6. Dr. Steinman agreed with Respondent's expert, Dr. Chaudhry, that Petitioner's diagnosis is CIDP. Pet. Ex. 27 at 1. Where the parties disagree is whether or not GBS and CIDP represent a spectrum of inflammatory neuropathy. Id.

Regarding the differences between the diagnosis of GBS and CIDP, Dr. Steinman cited to the National Institute of Neurological Disorders and Stroke ("NINDS"), which is part of the National Institute of Health ("NIH"). Dr. Steinman stated, "some neurologists want to split GBS and CIDP into two separate entities, while others, and I include myself, are more aligned with the NINDS fact sheet, which considers the two diseases 'closely related' with CIDP as the chronic version of the acute disease, known as GBS." Pet. Ex. 23 at 6 (citing Pet. Ex. 25a at 1).[41] Experts from Johns Hopkins[42] "think that CIDP is related to the more commonly known disease [GBS]. But while GBS is generally considered more of an acute, or short-term, disease, CIDP is considered a chronic, or long-term, disease." Pet. Ex. 28a at 2. Dr. Steinman opined, "GBS versus CIDP is one of the many controversies in neurology that has both 'lumpers' and 'splitters[.'] However, here the ultimate diagnosis is CIDP." Pet. Ex. 23 at 6.

Dr. Steinman testified that Petitioner's "injury was an inflammatory neuropathy which spanned her initial diagnosis of GBS, which was acute, all the way to the other end of that spectrum, the CIDP, which by its very name is chronic." Tr. 39. Dr. Steinman stated that CIDP was "added" to Petitioner's diagnosis of GBS and opined that "inflammatory neuropathies form a spectrum. At one end is the acute GBS, and the other end is the chronic CIDP." Tr. 42.

ii. Causation: Althen Prong One

The focus of Dr. Steinman's expert reports is how the Prevnar 13 vaccine can trigger GBS, and subsequently CIDP, via molecular mimicry. Pet. Ex. 23 at 7. He reviewed the components of the vaccine and "what's known to be targeted by the human immune system in

[41] Nat'l Inst. Neurological Disorders & Stroke, Guillain-Barré Syndrome Fact Sheet https://www.ninds.nih.gov/guillain-barre-syndrome-fact-sheet (last updated Aug. 26, 2014).

[42] John Hopkins Med., Chronic Inflammatory Demyelinating Polyradiculoneuropathy, https://www.hopkinsmedicine.org/health/conditions-and-diseases/chronic-inflammatory-demyelinating-polyradiculoneuropathy (last visited May 3, 2021).

both GBS and CIDP." Tr. 40. Regarding the mechanism of causation, he stated molecular mimicry "appears in both." Tr. 51.

Dr. Steinman proposed two mechanisms whereby molecular mimicry can trigger GBS following Prevnar 13 vaccination. The first involves glycerophosphate, particularly phosphoglycerol, and its linkage in Prevnar 13 to the pneumococcal polysaccharide antigen. Pet. Ex. 23 at 8-15. The second involves homology between CRM_{197} in the vaccine and Contactin-1, a protein found in humans. Id. at 16-23. Additionally, Dr. Steinman opined that the adjuvant alum in the Prevnar 13 vaccine contributes to the development of inflammatory neuropathy. Id. at 8, 23-25.

1. Phosphoglycerol[43] in Serotypes 18C

The first mechanism described by Dr. Steinman involves homology between phosphoglycerol present in serotype 18C in the Prevnar 13 vaccine and phospholipids, specifically glycerophosphate and glycerocholine in the human myelin sheath. Pet. Ex. 23 at 8-15. "The polysaccharides that are contained in Prevnar [13] are complex and allow for the chemical attachment of capsular polysaccharides via the glycerol moieties[44] known as phosphoglycerol and phosphocholine (or phosphatidylcholine)." Id. at 9.

Based upon information obtained from the vaccine patent,[45] Dr. Steinman explained that the glycerol phosphate side chains in the vaccine are necessary for its immunogenicity.[46] Pet. Ex. 23 at 9-10 (citing Pet. Ex. 25f). Dr. Steinman cited an article by Chang et al.[47] to support his opinion that the phosphoglycerol component is preserved during the process of making the vaccine. Id. at 12. Chang et al. wrote "it is shown that glycerol-phosphate must be preserved for conserving adequate antigenicity of the 18C capsular polysaccharide." Pet. Ex. 25l at 1.

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[43] Phospho- is a "prefix[] indicating the presence of phosphorus in a compound." Stedman's Medical Dictionary 1486 (28th ed. 2006). Glycerol is "[a] sweet viscous fluid obtained by the saponification of fats and fixed oils; used as a solvent, as a skin emollient, . . . and as a vehicle and sweetening agent." Stedman's at 820.

[44] Moiety is defined as "any part or portion." Moiety, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=31829 (last visited Sept. 12, 2022).

[45] The patent is filed as Petitioner's Exhibit 25f. The description of the glycerol phosphate side chain in 18C can be found at page 34, and a diagram of the chemical structure is at page 6.

[46] Immunogenicity is defined as "the property that endows a substance with the capacity to provoke an immune response, or the degree to which a substance possesses this property." Immunogenicity, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=24893 (last visited Sept. 12, 2022).

[47] Janoi Chang et al., Relevance of O-acetyl and Phosphoglycerol Groups for the Antigenicity of the *Streptococcus pneumoniae* Serotype 18C Capsular Polysaccharide, 30 Vaccine 7090 (2012).

Dr. Steinman explained how the data from the vaccine patent and the studies described above relate to the pathogenesis of GBS and CIDP. He opined that phospholipids[48] are the targets of antibodies in both GBS and in CIDP. Pet. Ex. 23 at 10. He asserted that antibodies to phosphoglycerol structures interact with myelin components triggering GBS. Id. Based on his own research, Dr. Steinman explained that "phospholipids are components of the myelin sheath in humans, and they are targeted by antibodies" leading to neuroinflammation in GBS and subsequent CIDP. Id.

In support of this aspect of his opinion, Dr. Steinman relied on several articles. The first was authored by Ho et al.[49] and Dr. Steinman is also a named author. Pet. Ex. 25j. The authors showed that in the demyelinating disease multiple sclerosis ("MS"), autoantibodies primarily target a phosphoglycerol component of myelin. Pet. Ex. 23 at 10. The "findings indicate that myelin phospholipids are targeted by autoimmune responses in MS." Pet. Ex. 25j at 9.

In Gilburd et al.,[50] the authors "studied the reactivity of GBS sera with various phospholipids which are known to be important constituents of myelin, and serve as autoantigens in other autoimmune conditions." Pet. Ex. 25g at 2. Six of the 16 patients with GBS had autoantibodies to various phospholipids. Id. at 2, 5. However, the authors suggested this was "probably [] a result of [] myelin damage rather than [the] cause of demyelination." Id. at 2, 6.

In another study by Nakos et al.,[51] all nine GBS patients in the study had anti-phospholipid antibodies and no such antibodies were detected in the nine control subjects. Pet. Ex. 25h at 1. The authors "detected a wide range of anti-phospholipid antibodies in patients with idiopathic GBS," and "[a]ll nine GBS patients developed anti-phospholipid antibodies directed against at least one lipid during the course of the disease." Id. at 5. They wrote "[t]he association of GBS and certain autoimmune diseases, including systemic lupus erythematosus, is well recognized," and they noted "[h]igh levels of anti-phospholipid antibodies were expressed in a patient with lupus like syndrome who developed secondary GBS." Id. at 6. The authors explained that "[i]t is thought that whenever polyneuropathy occurs in the context of autoimmune diseases, mainly in systemic lupus erythematosus, where anti-phospholipid activity

[48] Phospholipid is defined as "any lipid that contains phosphorus, including those with a glycerol backbone (phosphoglycerides and plasmalogens) . . . . Phospholipids are the major form of lipid in all cell membranes." Phospholipid, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=38759 (last visited Sept. 12, 2022).

[49] Peggy P. Ho et al., Identification of Naturally Occurring Fatty Acids of the Myelin Sheath That Resolve Neuroinflammation, 4 Sci. Translational Med. 1 (2012).

[50] B. Gilburd et al., Autoantibodies to Phospholipids and Brain Extract in Patients with the Guillain-Barré Syndrome: Cross-Reactive or Pathogenic?, 16 Autoimmunity 23 (1993).

[51] G. Nakos et al., Anti-Phospholipid Antibodies in Serum from Patients with Guillain-Barré Syndrome, 31 Intensive Care Med. 1401 (2005).

already exists, these antibodies can cross-react with phospholipids and mediate damage in neural structures containing the particular phospholipids." Id. Of note, the GBS patients in the Nakos et al. study had primary GBS (relevant here), not the secondary form like that which occurs in patients with lupus. Id. The authors also observed anti-ganglioside antibodies, but only in 44% of the patients. Id. They concluded,

> [i]t is not well understood whether these anti-phospholipid antibodies play a role in the pathogenesis of the polyneuropathy or represent a part of a more extensive immunoreaction that takes place in the GBS. However, immunopathology in autopsies suggests that antibody mediated injury is a predominant disorder in the demyelinating form of GBS. The immune attack is directed against components of Schwann cell membrane and is accompanied by the characteristic feature of vesicular demyelination. Therefore, it is crucial to investigate how anti-phospholipid antibodies are related to specific antigens in Schwann cell membrane.
>
> . . . .
>
> Our findings suggest that in GBS there is a more extensive immune reaction, beyond the well known antiganglioside production, which has been related to the demyelination of the peripheral nerves.

Id. at 6-7.

In summary, Dr. Steinman's theory is based on molecular mimicry, and he posits that antibodies to the phosphoglycerol structures present in the components of Prevnar 13 interact with phospholipids in the myelin components of peripheral nerves, triggering GBS and CIDP. Pet. Ex. 23 at 15; Tr. 83.

2. CRM_{197} and Contactin-1

The second homology posited by Dr. Steinman is between the protein carrier in the vaccine, CRM_{197},[52] and Contactin-1,[53] a protein found in humans. Pet. Ex. 23 at 16. Prevnar 13 is a conjugate vaccine in which the individual polysaccharides of the capsular antigens of *S.*

[52] Protein carrier "CRM_{197} is a nontoxic variant of diphtheria toxin isolated from cultures of *Corynebacterium diphtheriae* strain C7 (β197) grown in a casamino acids and yeast extract-based medium or in a chemically-defined medium." Pet. Ex. 25e at 22 (Prevnar 13 package insert).

[53] Contactin-1, or CNTN1, "is a key axonal adhesion molecule, which interacts with CNTNAP1 (previously known as Caspr1) on the axon and neurofascin-155 on the glial side, and is essential for the formation of the paranodal septate-like junction." Pet. Ex. 25r at 2 (Yumako Miura et al., Contactin I IgG4 Associates to Chronic Inflammatory Demyelinating Polyneuropathy with Sensory Ataxia, 138 Brain 1484 (2015)).

pneumoniae are linked to a non-toxic diphtheria CRM_{197} protein. Id. at 7. "CRM_{197} is a nontoxic variant of diphtheria toxin," used as a protein carrier which makes the vaccine more immunogenic. Id. (quoting Pet. Ex. 25e). "CRM_{197} differs from diphtheria toxin by only one amino acid," and therefore, it "is not toxic, though like diphtheria toxoid[,] it is quite immunogenic." Id.

Again, based on his own research, Dr. Steinman determined that molecular mimicry might occur between CRM_{197} and Contactin-1, a molecule that has been identified in patients with GBS and CIDP. Pet. Ex. 23 at 16. He testified that "there [are] antibodies to Contactin-1 in both GBS and CIDP." Tr. 58. Dr. Steinman relied on Miura et al., a study done on patients with CIDP. Pet. Ex. 23 at 25-26 (citing Pet. Ex. 25r). Prior to the Miura et al. study, another group of researchers reported finding autoantibodies against Contactin-1 in patients with CIDP. Pet. Ex. 25r at 1. The patients had an aggressive onset and did not respond well to treatment with IVIG. Id. Based on the findings reported in that study, Miura et al. set out to replicate the finding of Contactin-1 autoantibodies and determine its relevance. Id. Miura et al. focused their research on patients with CIDP, but used sera from patients with GBS, MS, and healthy patients as controls. Id. at 2. Anti-Contactin-1 Immunoglobulin G ("IgG") antibodies were found in 16 of the 533 patients with CIDP, with 13 of the 533 CIDP patients (2.4%) having anti-Contactin-1 IgG antibodies. Id. at 3, 5, 6 tbl.2; Tr. 52. They also found that five of the 200 patients with GBS had anti-Contactin-1 IgG antibodies. Pet. Ex. 25r at 3, 6 tbl.2; Tr. 54.

The Miura et al. authors explained the theory of pathogenesis relevant to Dr. Steinman's theory, as it relates to Contactin-1. They stated,

> [c]ell adhesion molecules play a crucial role in the formation of the nodes of Ranvier and in the rapid propagation of the nerve impulses along myelinated axons. In the peripheral nerves, the domain organization of myelinated axons depends on specific axo-glial contacts between the axonal membrane and Schwann cells at nodes, paranodes[,] and juxtaparanodes. Recently, we showed that some of the patients with CIDP present IgG autoantibodies directed against the nodes of Ranvier or the paranodal axo-glial apparatus. Notably, we identified . . . [C]ontactin 1 (CNTN1) as [one of] the targets of autoantibodies in some patients with CIDP.

Pet. Ex. 25r at 2.

Based on this information about the potential importance of Contactin-1, Dr. Steinman conducted a BLAST[54] search to determine whether there was homology between CRM_{197} in the

[54] A BLAST (Basic Local Alignment Search Tool) search "finds regions of similarity between biological sequences. The program compares nucleotide or protein sequences to sequence databases and calculates the statistical significance." BLAST, https://blast.ncbi.nlm.nih.gov/Blast.cgi (last visited Sept. 12, 2022).

vaccine and Contactin-1.[55] Pet. Ex. 23 at 16. He found a sequence[56] that "might be capable of inducing a neuroinflammatory disease." Id. He found "it is an epitope in diphtheria toxin, which provides the basis for CRM_{197}." Id. at 22. After additional research, Dr. Steinman identified another sequence[57] that "has known cross-reactivity with epitopes described in humans" on the *Corynebacterium diphtheriae* microbe. Id.

Relying on Root-Bernstein,[58] Dr. Steinman opined the two sequences he found were significant due to five matches of identical amino acids. Tr. 66. Root-Bernstein found that "[s]imilarities were considered to be significant if a sequence contained at least 5 identical amino acids in 10." Pet. Ex. 28b at 1.

3. Alum[59] in Prevnar 13

Dr. Steinman opined there is "another strong link in the peer reviewed literature to how the alum in the Prevnar [13] vaccine can contribute to the development of the acute aspect of an inflammatory neuropathy." Pet. Ex. 23 at 23. By stimulating the cytokines, IL-1β and IL-18, alum "contributes to the pathogenesis of GBS." Id. Dr. Steinman cited Eisenbarth et al.,[60] Sokolovska et al.,[61] and Mannhalter et al.[62] to support that aluminum adjuvants activate an intracellular innate immune response system. Pet. Ex. 23 at 12 (citing Pet. Exs. 25v; 25w; 25x.)

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[55] For a complete explanation of Dr. Steinman's investigation, including his discussion on the number of amino acids required for homology relevant to molecular mimicry as well as the procedure he followed in conducted his BLAST searches, see Pet. Ex. 23 at 16-23.

[56] The sequence is "WEQAKALSVE," which "has five of ten identical amino acids." Pet. Ex. 23 at 21.

[57] The second sequence is "EYMAQACAGNRVRR." Pet. Ex. 23 at 22.

[58] Robert Root-Bernstein, Rethinking Molecular Mimicry in Rheumatic Heart Disease and Autoimmune Myocarditis: Laminin, Collagen IV, CAR, and B1AR as Initial Targets of Disease, 2 Frontiers Pediatrics 1 (2014).

[59] Alum is short for aluminum adjuvants. Pet. Ex. 23 at 23; Pet. Ex. 25w at 1; Pet. Ex. 25x at 1.

[60] Stephanie C. Eisenbarth et al., Crucial Role for the Nalp3 Inflammasome in the Immunostimulatory Properties of Aluminum Adjuvants, 453 Nature 1122 (2008).

[61] Anna Sokolovska et al., Activation of Dendritic Cells and Induction of CD4+ T Cell Differentiation by Aluminum-Containing Adjuvants, 25 Vaccine 4575 (2007).

[62] J.W. Mannhalter et al., Modulation of the Human Immune Response by the Non-Toxic and Non-Pyrogenic Adjuvant Aluminum Hydroxide: Effect on Antigen Uptake and Antigen Presentation, 61 Clinical Experimental Immunology 143 (1985).

"IL-1 and IL-18 are strongly upregulated during active GBS and [] [are] reduced as GBS resolves." Pet. Ex. 23 at 23. Nyati et al.[63] found the enzyme, matrix metalloproteinase ("MMP"), and proinflammatory cytokine, IL-1β, "were significantly higher in GBS patients in the progressive phase of the disease." Pet. Ex. 25z at 2. Jander and Stoll[64] documented IL-18 serum levels to be significantly higher in GBS patients than controls. Pet. Ex. 26a at 1. Dr. Steinman opined, "[t]hese papers on the role of alum in GBS, based on human and animal studies, constitute a strong scientific foundation for providing a basis for how the alum in the Prevnar 13 vaccine containing alum as an adjuvant would lead to an increase in pro-inflammatory cytokines like IL-18, and thus could induce inflammatory polyneuropathy." Pet. Ex. 23 at 25.

During the hearing, however, Dr. Steinman did not expand on his theory that alum contributed to the diagnosis of GBS and CIDP. Tr. 123.

iii. Causation: Althen Prong Two

With regard to a logical sequence of cause and effect, Dr. Steinman stated, "[g]iven the role of antibody to either glycerophosphate or phosphocholine (phosphatidylcholine) in the pathogenesis of GBS and given the role of immunity to [C]ontactin-1 in GBS and in CIDP, the Prevnar 13 vaccine[] was sufficient to trigger an acute attack that became chronic." Pet. Ex. 23 at 26.

Moreover, in the case report by El Khatib et al.,[65] the authors report one case of *S. pneumoniae* associated with GBS. Pet. Ex. 28c at 1. The authors documented a 13-year-old male, who developed septic shock due to pneumococcus with acute respiratory distress syndrome, had neurological findings significant of GBS. Id.

Dr. Steinman agreed with Respondent's expert, Dr. Chaudhry, that Petitioner's underlying diabetes and possible nutritional deficiency—related to her gastric bypass surgery—may have contributed to the neuropathy as well. Pet. Ex. 23 at 6. He stated that Petitioner "did have other conditions," however, "there was no doubt that an inflammatory neuropathy requiring hospitalization and a major and expensive biologic IVIG never happened until the Prevnar [13] vaccine." Tr. 87-88. Moreover, and analysis of cerebrospinal fluid did not show an infectious cause for Petitioner's illness. Tr. 133.

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[63] Kishan K. Nyati et al., Correlation of Matrix Metalloproteinases-2 and -9 with Proinflammatory Cytokines in Guillain-Barré Syndrome, 88 J. Neuroscience Research 3540 (2010).

[64] Sebastian Jander & Guido Stoll, Interleukin-18 Is Induced in Acute Inflammatory Demyelinating Polyneuropathy, 114 J. Neuroimmunology 253 (2001).

[65] Hassan El Khatib et al., Case Report: Guillain Barré Syndrome with Pneumococcus – A New Association in Pediatrics, 11 ID Cases 26 (2018).

iv. Causation: Althen Prong Three

Petitioner received the Prevnar 13 vaccination on September 22, 2016, and her inflammatory neuropathy began on October 5, 2016. Pet. Ex. 23 at 25. Dr. Steinman cited Schonberger et al.[66] to show "this interval of 13 days is well within the time interval where a different vaccine was shown to induce the acute phase of an inflammatory neuropathy (GBS)." Id. at 26. Schonberger et al. reviewed case reports of GBS after the flu vaccine administration and found, on average, an onset between two and three weeks. Pet. Ex. 26g at 2.

Regarding CIDP, "if GBS persists for more than eight weeks, then consideration should be considered to giving it a second diagnosis, CIDP." Tr. 84. Initially, within 13 or 14 days after the vaccine, Petitioner's correct diagnosis was GBS. Tr. 85. Then after eight weeks, the disease became chronic, and her second diagnosis became CIDP. Id.

3. Respondent's Expert, Dr. Vinay Chaudhry

a. Background and Qualifications

Dr. Chaudhry is board certified in neurology, neuromuscular diseases, electrodiagnostic medicine, and clinical neurophysiology. Resp. Ex. A at 1. He received his M.B. and B.S. in India, and then completed an internship, residency in neurology, and fellowship in neuromuscular diseases. Resp. Ex. I at 1-2. He was a Professor of Neurology at the Johns Hopkins University School of Medicine and the Co-Director of the EMG Laboratory at Johns Hopkins Hospital. Resp. Ex. A at 1. Currently, Dr. Chaudhry is the chief of the Neuromuscular Division at the University of North Carolina. Tr. 142-43. Dr. Chaudhry specializes in the field of neuromuscular diseases. Resp. Ex. A at 1. He has an active clinical practice where he sees over 2,000 patients per year. Id.; Resp. Ex. I at 50. He has authored or co-authored over 200 publications. Resp. Ex. I at 4-22. A majority, at least 50%, of Dr. Chaudhry's practice is peripheral nerve related, which includes GBS and CIDP. Tr. 141.

b. Opinion

i. Diagnosis

Dr. Chaudhry disagreed that Petitioner had GBS. Resp. Ex. A at 8. Instead, he believed Petitioner's symptoms and treatment were consistent with the sole diagnosis of CIDP. Id. at 6; Tr. 154. Particularly, he believed Petitioner suffered from CIDP that had an acute onset. Resp. Ex. A at 8. He opined that "[c]alling GBS and CIDP the same diseases is ignoring the plethora of book chapters, reviews, manuscripts, diagnostic criteria written for these two diseases . . . . Clearly GBS and CIDP are two different diseases with different time courses, different response[s] to treatment, different prognosis, and different pathogenesis." Resp. Ex. E at 1. "CIDP is commonly considered to be a chronic form of GBS or the peripheral nervous system

[66] Lawrence B. Schonberger et al., Guillain Barré Syndrome Following Vaccination in the National Influenza Immunization Program, United States, 1976-1977, 110 Am J. Epidemiology 105 (1979).

equivalent of [MS]. However, those conceptions may be overly simplistic." Resp. Ex. A, Tab 10 at 8.

Dr. Chaudhry stated that once Dr. Sommerville diagnosed Petitioner with CIDP, he did not keep the GBS diagnosis. Tr. 158. Dr. Sommerville also noted his puzzlement that Petitioner continued to get worse, which did not make sense given her diagnosis of GBS. Tr. 157. Once Petitioner's diagnosis changed to CIDP, Dr. Chaudhry declared that her diagnosis of GBS was no longer a consideration. Tr. 158. He believed that Petitioner's CIDP began acutely, which initially can be confused with GBS. Id.

Dr. Chaudhry cited an article by Willison et al.,[67] which discussed the etiology of GBS, as well as acute onset chronic inflammatory demyelinating neuropathy. Resp. Ex. A, Tab 7 at 8. Under diagnostic criteria for GBS, the authors listed "[f]eatures that should raise doubt about the diagnosis of [GBS]." Id. at 5. The list included "[s]low progression of weakness and without respiratory involvement (consider subacute inflammatory demyelinating polyneuropathy or acute onset [CIDP])." Id. The authors continued that in patients with progression of symptoms exceeding four weeks, "the question often arises as to whether the diagnosis is still consistent with [GBS], or the patient has [CIDP] with acute onset." Id. at 8.

Vallat et al. stated that CIDP "develops over more than 8 weeks, distinguishing the condition from [GBS], which has an acute onset." Resp. Ex. A, Tab 1 at 1. "CIDP is regarded as an autoimmune disease involving cellular and humoral immunity. However, by contrast with GBS, a single triggering antigen has not yet been found, except in rare cases of CIDP associated with melanoma." Id. CIDP is more frequent in patients with diabetes mellitus than it is in the general population. Id. at 2-3. "In some cases, CIDP can start acutely with a GBS-like presentation. Distinguishing true GBS from acutely starting CIDP is challenging and has major therapeutic implications." Id. at 3.

Sejvar et al. listed the Brighton Criteria to define GBS and stated, "[t]hese criteria have been included in an attempt to discern GBS from [CIDP], which is thought to be clinically and pathologically distinct from GBS." Resp. Ex. E, Tab 3 at 4. The Brighton GBS Working Group who developed the criteria acknowledged that some patients with GBS "will have one or more episodes of worsening after initial improvement and that such cases may appear to overlap with CIDP. However, initial episodes of worsening in the setting of treatment of GBS may be fluctuations rather than separate episodes of recurrence of symptoms." Id.

The Sejvar et al. authors characterized GBS in patients with "progressive limb weakness, most often beginning in the legs and progressing to the arms and bulbar muscles. The weakness is associated with decreased or absent deep tendon reflexes, and tends to be relatively symmetric." Resp. Ex. E, Tab 3 at 2. "Paresthesias and subjective numbness or tingling may be an early feature and tends to affect the distal extremities. The weakness progresses in an acute to subacute fashion, reaching its clinical nadir of weakness within 2-4 weeks." Id.

[67] Hugh J. Willison et al., Guillain-Barré Syndrome, 388 Lancet 717 (2016).

The European Federation of Neurological Societies ("EFNS") Task Force[68] also provided criteria to define CIDP. Resp. Ex. E, Tab 4 at 1. The Task Force recommended that "CIDP should be considered in any patient with a progressive symmetrical or asymmetrical polyradiculoneuropathy in whom the clinical course is relapsing and remitting or progresses for more than 2 months." Id. at 3.

Similarly, Ruts et al.[69] conducted a study to provide criteria to distinguish between GBS and CIDP. Resp. Ex. A, Tab 4 at 1. The authors found that the "diagnosis of [acute]-CIDP should be considered when a patient thought to have GBS deteriorates again beyond 8 weeks from onset or when deterioration occurs 3 times or more. Patients with [acute]-CIDP generally are less severely disabled compared to patients with GBS." Id. at 6.

Regarding Dr. Steinman's reliance on the NINDS and Johns Hopkins fact sheets for GBS and CIDP, Dr. Chaudhry stated the authors are distinguishing between GBS and CIDP when they state "that CIDP is related to the more commonly known disease GBS." Tr. 202 (citing Pet. Ex. 28a at 2). Dr. Chaudhry stated he did not "know what the term 'related' means" but thought it was written for "layman purposes." Tr. 203.

ii. Causation: Althen Prong One

Dr. Chaudhry opined the Prevnar 13 vaccine is not thought to cause GBS or CIDP for several reasons. Resp. Ex. A at 7; Tr. 154.

First, Dr. Chaudhry stated there is a lack of an association between the Prevnar 13 vaccine and GBS. Resp. Ex. A at 7. Regarding epidemiological studies, Dr. Chaudhry cited Baxter et al., who evaluated the relationship between GBS and vaccinations, including the 23-valent pneumococcal polysaccharide vaccine. Resp. Ex. A, Tab 6 at 1, 4. The authors reviewed records of 415 hospitalized patients diagnosed with GBS from 1995 to 2006. Id. at 1. Of these, 25 had received a vaccine within a six-week period prior to onset of their GBS. Id. at 4. The vaccines included flu (18 patients), 23-valent pneumococcal polysaccharide (2 patients),[70] tetanus-diphtheria combination (3 patients), and hepatitis A and B (3 patients). Id. "[U]sing a case-centered method to control for seasonality and other time-varying confounders, [they] found

[68] P.Y.K. Van den Bergh et al., European Federation of Neurological Societies/Peripheral Nerve Society Guideline on Management of Chronic Inflammatory Demyelinating Polyradiculoneuropathy: Report of a Joint Task Force of the European Federation of Neurological Societies and the Peripheral Nerve Society — First Revision, 17 Eur. J. Neurology 356 (2010).

[69] L. Ruts et al., Distinguishing Acute-Onset CIDP from Fluctuating Guillain-Barré Syndrome: A Prospective Study, 74 Neurology 1680 (2010).

[70] Petitioner did not receive this vaccine. However, as described by Respondent's expert, Dr. Whitton, the Prevnar 13 and 23-valent pneumococcal polysaccharide vaccines contain the same 13 bacterial polysaccharides. See Tr. 254.

no evidence of an increased risk of GBS following any vaccination." Id. at 5. The authors acknowledged, however, that the study had "limited power to fully assess the risk of GBS following vaccination due to the rarity of the outcome." Id. at 7. And they concluded that the results "provide reassurance that the risk of GBS following any vaccine . . . is extremely low." Id.

Next, Dr. Chaudhry relied on the study by Haber et al., who studied vaccine adverse event reports in adults related to the Prevnar 13 vaccine reported to VAERS from June 2012 to December 2015. Pet. Ex. 17y at 1. During that time period, there were 2,976 total reports. Id. Most of the reports related to injection site adverse events (injection site pain, redness, and swelling). Id. at 3 tbl.1. There were 11 cases of GBS reported following the Prevnar 13 vaccination, and in ten of those, the Prevnar 13 vaccine was the only vaccine administered. Id. at 4. One patient also received a flu vaccine. Id. The authors concluded that their "data mining analysis noted no disproportionate reporting for GBS." Id. at 5.

Another article cited by Dr. Chaudhry was authored by Doneddu et al.,[71] who noted that the cause of CIDP is still unknown. Resp. Ex. H, Tab 1 at 1-2. The authors studied 411 patients with CIDP and reported 8% of them had flu-like syndrome within 1-42 days before the onset of CIDP symptoms, 2% had an upper respiratory tract infection, 2% had gastrointestinal infection, and 1.5% had a vaccination (all of them had the flu vaccine). Id. at 3; Tr. 164. This study concluded "that antecedent events are unlikely to play a role in the risk of CIDP." Resp. Ex. H, Tab 1 at 6.

Thus, unlike GBS, Dr. Chaudhry opined that "antecedent infections or trauma rarely precipitate[] CIDP, reducing the likelihood that molecular mimicry serves as a trigger to initiate aberrant tissue-specific pathogenic immune responses." Resp. Ex. A at 8 (citing Resp. Ex. A, Tab 10 at 12). Dr. Chaudhry relied on two articles to support this opinion. First, Ubogu noted the "immunopathogenesis of CIDP has yet to be elucidated." Resp. Ex. A, Tab 10 at 12. But Ubogu observed that CIDP could occur due to an autoimmune disorder: "The co-existence of CIDP or a CIDP-like disorder" with other systemic autoimmune disorders and the response "to immune modulatory treatments provides indirect evidence that CIDP occurs in the setting of a dysregulated immune system." Id.

The second article cited by Dr. Chaudhry on this point was by Dalakas.[72] However, Dalakas noted that "CIDP is viewed as the chronic counterpart of GBS because it shares with GBS certain clinical, electrophysiologic, histologic, laboratory[,] and autoimmune features. It differs from GBS predominantly by its tempo, mode of evolution, prognosis, and responsiveness to steroids or immunosuppressants." Resp. Ex. A, Tab 11 at 2. "In contrast to GBS however,

[71] P.E. Donnedu et al., Risk Factors for Chronic Inflammatory Demyelinating Polyradiculoneuropathy (CIDP): Antecedent Events, Lifestyle and Dietary Habits. Data from the Italian CIDP Database, 27 Eur. J. Neurology 136 (2020).

[72] Marinos C. Dalakas, Pathogenesis of Immune-Mediated Neuropathies, 1852 Biochimica et Biophysica Acta 658 (2015).

where ganglioside antibodies play a causative role in the axonal and ataxic variants . . . , no specific antibody has yet been identified as the causative factor in CIDP." Id. at 5. The author concluded, "[o]verall, the immunopathogenetic scheme . . . summarizing the proposed role of T cells, cytokines, B cells[,] and autoantibodies for GBS[] is also relevant in CIDP." Id.

Dr. Chaudhry further cited Mathey et al.,[73] who stated that the "abiding theory of CIDP pathogenesis is that cell-mediated and humoral[74] mechanisms act synergistically to cause damage to peripheral nerves." Resp. Ex. A, Tab 12 at 3. "Although some patients have reported antecedent infections prior to onset of neurological symptoms neither the target(s) nor the trigger for the autoimmune response has been identified and no infectious agent has been consistently linked with initiation of disease." Id. "However, the autoimmune aetiology is supported by the efficacy of treatments that target the immune system, . . . and by evidence of an inflammatory response in the blood and peripheral nerves." Id.

Finally, while the package insert for the flu vaccine reports increased incidence of GBS occurring within six weeks of vaccination, Dr. Chaudhry noted that the Prevnar 13 package insert does not give any similar warning or post marketing concerns. Resp. Ex. A at 7-8 (citing Resp Ex. A, Tab 8 (flu package insert); Pet. Ex. 25e (Prevnar 13 package insert)).

Dr. Chaudhry does not dispute that molecular mimicry is a recognized mechanism for how some infectious agents, such as *C. jejuni*, Epstein-Barr virus, flu A virus, *Mycoplasma pneumoniae*, and *Hemophilus influenza*, can cause GBS. Resp. Ex. A at 7 (citing Resp. Ex. A, Tab 7 at 1). In fact, two-thirds of patients with GBS have an antecedent infection. Tr. 162. The concept of molecular mimicry proffered by Dr. Stein and Dr. Steinman invoked an infectious agent such as *C. jejuni*, which shares an antigenic similarity to a self-antigen such as ganglioside epitopes on peripheral nerves. Resp. Ex. E at 3. "An immune reaction against that particular antigen on specific strains of *C*[.] *jejuni* is also an immune reaction against GM1 gangliosides antigens on the peripheral nerve. This antibody against GM1 ganglioside on the axons of the peripheral nerve leads to [a] form of GBS after *C. jejuni* infection." Id.

However, Dr. Chaudhry opined that "[t]his concept cannot be extended to all infections or vaccines (only defined for *C. jejuni*), or all vaccinations (none known to produce molecular mimicry) produce all forms of immune neuropathies." Resp. Ex. E at 4. Particularly, the "[*S.*] *pneumonia*[*e*] infection is not one of the infectious agents reported to precede GBS and hence pneumococcal vaccines against the bacteria [*S.*] *pneumoniae* is unlikely to cause GBS." Resp. Ex. A at 7; see also Tr. 173-74.

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[73] Emily K. Mathey et al., Chronic Inflammatory Demyelinating Polyradiculoneuropathy: From Pathology to Phenotype, 86 J. Neurology Neurosurgery Psychiatry 973 (2015).

[74] Humoral is "pertaining to elements dissolved in the blood or body fluids, e.g., humoral immunity from antibodies in the blood as opposed to cellular immunity." Humoral, Dorland's Med. Dictionary Online, https://www.dorlandsonline.com/dorland/definition?id=23202 (last visited Aug. 3, 2022).

The Yuki article identified four criteria that "must be satisfied to conclude that a disease is triggered by molecular mimicry." Resp. Ex. E at 4 (quoting Pet. Ex. 17a at 1). The four criteria are (1) "establishment of an epidemiological association between the infectious agent and the immune-mediated disease;" (2) "identification of T cells or antibodies directed against the patient's target antigens;" (3) "identification of microbial mimics of the target antigen;" and (4) "reproduction of the disease in an animal model." Pet. Ex. 17a at 1. According to Dr. Chaudhry, while these criteria have been met for *C. jejuni*, they have not been met for *S. pneumoniae*. Resp. Ex. E at 4.

Therefore, according to Dr. Chaudhry, "just because molecular mimicry can be induced by the carbohydrate antigen in one form of GBS does not mean that Prevnar 13 vaccine received by [Petitioner] will have molecular mimicry hypothesis and to a different disease CIDP." Resp. Ex. E at 4.

Next, Dr. Chaudhry opined that neither of Dr. Steinman's two proposed molecular mimics, phosphoglycerol or CRM_{197} protein conjugates, are supported by evidence. Resp. Ex. E at 4.

About Dr. Steinman's first molecular mimicry theory, based on phosphoglycerol components of the Prevnar 13 vaccine, Dr. Chaudhry raised several objections. First, Dr. Chaudhry disagreed that literature cited by Dr. Steinman supports the theory. Resp. Ex. E at 4. Dr. Steinman cited Nakos et al. as support for the proposition that anti-phospholipids have been found in patients with GBS. Id. (citing Pet. Ex. 25h). Dr. Chaudhry took issue with Dr. Steinman's interpretation, citing Nakos et al. where the authors stated "[i]t is not well understood whether these anti-phospholipid antibodies play a role in the pathogenesis of the polyneuropathy or represent a part of a more extensive immunoreaction that takes place in [] GBS." Pet. Ex. 25h at 6.

Dr. Chaudhry also questioned whether the Gilburd et al. article supports an association between anti-phospholipid antibodies (antibodies to phosphatidyl-ethanolamine, phosphatidyl-choline, or phosphatidylserine) and GBS. Resp. Ex. E at 4. He quoted Gilburd et al., who stated "no significant association was found between the presence of specific anti[-]phospholipid antibodies . . . and GBS when compared to controls." Id. (quoting Pet. Ex. 25g at 5).

Dr. Steinman cited the Ho et al. article to support the notion that antibodies targeting the phosphoglycerol component of myelin are pathogenic. See Pet. Ex. 23; Pet. Ex. 25j. However, the Ho et al. article was designed "to determine whether lipids in the myelin sheath are targeted by autoimmune responses in MS." Resp. Ex. E at 4 (citing Pet. Ex. 25j at 9). Therefore, Dr. Chaudhry opined Ho et al. had no bearing on CIDP diagnosis. Id.

Regarding the CRM_{197} protein conjugate and Prevnar 13, Dr. Chaudhry stated there is "no evidence to support that [C]ontactin-1 plays any part in GBS." Resp. Ex. E at 5. Dr. Chaudhry testified "we don't know" as to the state of knowledge for whether the Contactin-1

antibody has any relevance to the causation of CIDP. Tr. 186. Citing Lehmann et al.,[75] Dr. Chaudhry stated, "[a]nti-[Contactin-1] antibody-positive patients are clinically distinct with predominant involvement of motor fibers and axonal damage, a pattern not seen with [Petitioner] who was never documented to have [C]ontactin-1 antibodies."[76] Resp. Ex. E at 5 (citing Resp. Ex. E, Tab 6 at 3). Lehmann et al. noted anti-Contactin-1 antibodies are found in 2.2%-8.7% of patients with CIDP. Resp. Ex. E, Tab 6 at 3. Anti-Contactin-1 antibody-positive patients "tended to respond poorly to IVIG." Id. In comparison, Dr. Chaudhry noted Petitioner "was never documented to have [C]ontactin-1 antibodies" and responded to IVIG. Resp. Ex. E at 5.

In response to Dr. Steinman's BLAST search for linear amino acid sequence homology, Dr. Chaudhry opined that "similar conformational structure between an exogenous agent and a self-antigen alone [is] not sufficient to prove that molecular mimicry is the pathogenic mechanism for a disease. Many such homologies exist, and the vast majority of these are not associated with biologically relevant autoimmune phenomena or actual human disease." Resp. Ex. E at 5 (citing Resp. Ex. A, Tab 15 at 10).[77]

Based on evidence from large epidemiological studies and mass immunization campaigns in different countries, Dr. Chaudhry stated there is "no correlation between alum-containing vaccines and GBS." Resp. Ex. E at 5 (citing Pet. Ex. 17w at 3-4). Alum adjuvants are present in almost all vaccines licensed in the United States and have been used safely in vaccines for decades. Id.

iii. Causation: Althen Prong Two

Dr. Chaudhry disagreed with Drs. Stein's and Steinman's assertion that molecular mimicry caused Petitioner's CIDP after Prevnar 13 administration. Resp. Ex. A at 10. He asserted that only certain subtypes of "GBS have been conclusively linked to a molecular mimicry hypothesis." Id.

He opined that while Petitioner did not have a gastrointestinal or respiratory illness prior to her symptoms of CIDP, Dr. Chaudhry thought it unlikely that the vaccine triggered her illness. Resp. Ex. A at 11. Dr. Chaudhry opined that antecedent infections rarely precede the onset of CIDP. Id. (citing Resp. Ex. A, Tab 10 at 12). Additionally, even in individuals with GBS, approximately one-third of those with GBS have no history of gastrointestinal or respiratory infection. Id. (citing Resp. Ex. A, Tab 7 at 2). Moreover, while two-thirds of GBS cases are

[75] Helmar Christoph Lehmann et al., Chronic Inflammatory Demyelinating Polyneuropathy: Update on Diagnosis, Immunopathogenesis and Treatment, 90 J. Neurology Neurosurgery Psychiatry 981 (2019).

[76] Diagnostic testing for anti-Contactin-1 antibodies was not done on Petitioner.

[77] Inst. of Med., Evaluating Biological Mechanisms of Adverse Events, in Adverse Effects of Vaccines: Evidence and Causality 57 (Kathleen Stratton et al. eds., 2012).

associated with prior acute infection, *S. pneumoniae* is not recognized as a known pathogen associated with onset. Id. (citing Resp. Ex. A, Tab 7 at 1).

Dr. Chaudhry noted that underlying diabetes and possible nutritional deficiency such as a deficiency of vitamin B12, related to Petitioner's gastric bypass surgery, may have contributed to the neuropathy as well. Resp. Ex. A at 7; Tr. 161.

In all, Dr. Chaudhry stated Petitioner "suffered from CIDP, a disease that is different clinically, pathogenically[,] and in response to treatment from GBS. There is no evidence to support that the Prevnar 13 vaccine caused her CIDP." Resp. Ex. E at 5.

iv. Causation: Althen Prong Three

Dr. Chaudhry did not offer an opinion as to whether there was a proximate temporal association between Petitioner's Prevnar 13 vaccination and her illness, or otherwise refute Petitioner's assertion that there was an appropriate temporal association.

4. Respondent's Expert, Dr. Noel R. Rose[78]

a. Background and Qualifications

Dr. Rose received his B.S. from Yale University and his M.A. and Ph.D. in Medical Microbiology from the University of Pennsylvania. Resp. Ex. D at 1. Dr. Rose received his M.D. from State University of New York. Id. Dr. Rose was Professor Emeritus in four departments at Johns Hopkins University, including the departments of Pathology and Medicine in the School of Medicine, and The Feinstone Department of Molecular Microbiology and Immunology and Environmental Health Sciences in the Bloomberg School of Public Health. Resp. Ex. C at 1. He was the founding director of the Johns Hopkins Center for Autoimmune Disease Research, former Director of the Division of Immunology in the Department of Pathology at the School of Medicine, and former Chairman of the Department of Immunology and Infectious Diseases, School of Public Health. Id. He authored or co-authored over 800 publications related to immune-mediated diseases. Id.; Resp. Ex. D at 7-44.

b. Opinion

i. Diagnosis

Dr. Rose opined Petitioner's "precise diagnosis [i]s uncertain." Resp. Ex. C at 3. Most of Petitioner's treating physicians believed she "had some form of inflammatory demyelinating polyneuropathy." Id. Dr. Rose declined to opine further about Petitioner's diagnosis and instead focused on the issue of causation.

[78] Dr. Rose filed one expert report. Resp. Ex. C. Dr. Rose did not testify during the hearing in 2021 as he sadly passed away in 2020.

ii. Causation

According to Dr. Rose, "[i]n the developed, industrialized countries, type 2 diabetes mellitus is the most common cause of peripheral neuropathy and is growing in frequency, probably related to increasing obesity and environmental toxic exposures." Resp. Ex. C at 3 (citing Resp. Ex. C, Tab 1 at 13).[79] Dr. Rose opined peripheral neuropathy has occurred following surgery, including bariatric surgery as a method of weight control, as well as some infectious diseases. Id. He agreed with Dr. Chaudhry that the most studied infectious agent is *C. jejuni*, a common intestinal enteric pathogen. Id.

With respect to post-infectious GBS, Dr. Rose explained that "[t]he relationship between *C. jejuni* infection and GBS depends on the precise antigenic type (serotype) of the bacterium. Serotypes are determined by ganglioside-like moieties expressed on the bacterial cell surface. Extensive studies of bacterial gangliosides suggest that they have structural similarity to gangliosides present on peripheral nerve cells." Resp. Ex. C at 3-4. Molecular mimicry occurs when the antibody induced by the bacterial infection acts on the peripheral nerve cells of the host. Id. at 4. However, he opined that molecular mimicry for *S. pneumoniae* has not been described as associated with GBS. Id.

Dr. Rose cited the same four criteria as Dr. Chaudhry, for establishing mimicry as the cause of a human disease. Resp. Ex. C at 7 (Resp. Ex. C, Tab 21 at 2-4).[80] They include (1) evidence of an epidemiologic association between the putative pathogen and the disease; (2) demonstration of immune cells or antibodies directed against an antigen concerned with the disease; (3) cross reactivity of immune cells or antibodies of the host with the pathogen and (4) reproduction by the antigen of the disease process in vivo or in vitro. Resp. Ex. C, Tab 21 at 2-4. Dr. Rose opined that "[w]hile the criteria have been largely fulfilled in a few human diseases including the AMSAN form of GBS, they do not at our present state of knowledge apply to other forms of acute or chronic peripheral neuropathy." Resp. Ex. C at 7.

Like GBS, Dr. Rose opined that CIDP is frequently attributed to a preceding viral infection, but he opined that there is no convincing evidence of vaccination being a trigger. Resp. Ex. C at 4 (citing Resp. Ex. C, Tab 5 at 14-15).[81] He cited Lunn et al., who noted "[a] preceding illness, infection, or vaccination has been identified in patients with CIDP in 32% in the 6 months and 16% in the 6 weeks preceding their illness. Others have found no convincing evidence of vaccination being a trigger." Resp. Ex. C, Tab 5 at 14-15.

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[79] Istvan Katona & Joachim Weis, Diseases of the Peripheral Nerves, in 145 Handbook of Clinical Neurology 454-74 (G.G. Kovacs & I. Alafuzoff eds., 2018).

[80] C. Wim Ang et al., The Guillain-Barré Syndrome: A True Case of Molecular Mimicry, 25 Trends Immunology 61 (2004).

[81] Michael P.T. Lunn et al., Peripheral Neuropathies, in The Autoimmune Diseases 757 (N. Rose & I. Mackay eds., 5th. ed. 2014).

There are three components of Prevnar 13: polysaccharides, alum adjuvant, and modified diphtheria toxin. Resp. Ex. C at 5. The pneumococcal polysaccharides can induce antibodies to the corresponding pneumococcal serotype and to some extent other, antigenically related, serotypes. Id. (citing Resp. Ex. C, Tab 7 at 2).[82] However, Dr. Rose opined that the "cross-reactive antibodies are not known to cause any damage in humans." Id.

Regarding alum, Dr. Rose stated aluminum adjuvants are used widely in vaccines and "[o]ther than rare local inflammatory reactions of some individuals at the site of injection, they have not been associated with any adverse effects of the vaccine." Resp. Ex. C at 5 (citing Resp. Ex. C, Tab 8 at 2).[83]

"The third component of the polysaccharide vaccine is diphtheria toxin in the form of a modified, non-toxic protein (toxoid) . . . . the material used as the protein carrier in the pneumococcal conjugate vaccine is a recombinant mutant (CRM_{197}) of the diphtheria toxin produced in [*E.*] *coli*." Resp. Ex. C at 6 (citing Resp. Ex. C, Tab 10 at 1).[84] Dr. Rose opined "[i]t is the same material given to virtually all infants and children in the United States and repeated periodically in many adults. Except for local pain and low fever in a few individuals, it has virtually no adverse side effects." Id.

Citing Haber et al., who reviewed VAERS reports, Dr. Rose stated that "GBS was reported only in subjects equal to or later than 65 years of age and its prevalence in these older individuals did not exceed that expected in the population generally." Resp. Ex. C at 6 (citing Pet. Ex. 17y). Overall, Dr. Rose stated "[t]here have been no reports of a statistical association of pneumococcal polysaccharide vaccines with GBS or CIDP." Id.

5. Respondent's Expert, Dr. Lindsay Whitton

a. Background and Qualifications

Dr. Whitton received his B.Sc. in molecular biology, his M.B., Ch.B. in medicine, and his Ph.D. in herpesvirus transcription from the University of Glasgow in Scotland. Resp. Ex. G at 1. He also completed internships in medicine and surgery, and held various professor positions since 1986. Resp. Ex. F at 1; Resp. Ex. G at 1. He currently works as a Professor in the Department of Immunology and Microbial Science at Scripps Research Institute in California. Resp. Ex. G at 1. Dr. Whitton is a member of various professional societies and editorial boards

[82] M.J.M. Bonten et al., Polysaccharide Conjugate Vaccine Against Pneumococcal Pneumonia in Adults, 372 New Eng. J. Med. 1114 (2015).

[83] Peng He et al., Advances in Aluminum Hydroxide-Based Adjuvant Research and Its Mechanism, 11 Hum. Vaccines Immunotherapeutics 477 (2015).

[84] Philippe Goffin et al., High-Yield Production of Recombinant CRM197, a Non-Toxic Mutant of Diphtheria Toxin, in the Periplasm of *Escherichia Coli*, 12 Biotechnology J. 1700168 (2017).

and has authored or co-authored almost 200 publications. Id. at 1-15. Dr. Whitton does not provide patient care, or diagnose or treat patients with GBS or CIDP.

b. Opinion

Dr. Whitton did not offer an opinion as to Petitioner's diagnosis or take a position on whether the diagnosis of GBS was appropriate. Resp. Ex. F at 2; Tr. 235. Instead, he focused on the issue of causation: whether the Prevnar 13 vaccine can cause GBS/CIDP.[85] See Resp. Exs. F, J. Dr. Whitton opined that "Prevnar 13 has an excellent safety record, and [he] [was] not aware of any evidence that associates it with GBS." Resp. Ex. F at 29. He did not "believe the vaccine played any role" in Petitioner's illness. Tr. 234.

Dr. Whitton raised a litany of objections about Drs. Stein's and Steinman's opinions. First, Dr. Whitton opined that *S. pneumoniae* is not generally thought capable of triggering GBS. Resp. Ex. F at 9; Tr. 238-39. He testified the *C. jejuni* bacteria appears to evoke molecular mimicry between specific molecules on the bacteria outer wall and the body's gangliosides. Tr. 238. He asserted, however, that *S. pneumoniae* is completely different. Id. Dr. Whitton believed that it was inaccurate for Drs. Stein and Steinman to conclude that the bacterial polysaccharides in Prevnar 13 cause GBS via molecular mimicry. Resp. Ex. F at 9. Drs. Stein and Steinman asserted that "structures are shared between bacterial polysaccharides, and hypothetical targets that are present on host nerve cells; Dr. Stein propose[d] that gangliosides are the targets, while Dr. Steinman disagree[d], and suggests[ed] that the imaginary immune response attacks polar head groups on phospholipid molecules." Id. at 11. However, Dr. Whitton stated that medical literature, such as Haber et al., concludes, "from a review of the VAERS database, that there is no increased signal of GBS following Prevnar-13 vaccination." Tr. 250.

For molecular mimicry to occur, Dr. Whitton stated that at least three things must happen: (1) the vaccine must trigger a host immune response; (2) the "immune response to the bacterial polysaccharide, or to a few amino acids in the CRM_{197} carrier protein, must inevitably be able to recognize (cross-react with) the 'shared' host material;" and (3) the cross-reactive immune response must be harmful. Resp. Ex. F at 12. Dr. Whitton opined that Petitioner's theory is speculative because "in reality, we do not know if the vaccine actually induced the autoimmune response." Id. at 13.

Dr. Whitton cited the Institute of Medicine (now the National Academy of Sciences) and stated that "[w]hile molecular mimicry is a well-established mechanism in selected animal models, its relevance to human autoimmune disease remains in most cases to be convincingly

[85] Dr. Whitton's criticisms of Dr. Steinman's expert reports are far ranging. For the sake of brevity and clarity, the undersigned discusses the material points and omits discussion of less relevant information.

proven." Resp. Ex. F at 13 (citing Resp. Ex. F, Tab 22 at 15).[86] Dr. Whitton does not agree that molecular mimicry is "a common cause of human diseases." Tr. 261.

Dr. Whitton cited Baxter et al., which reviewed the Pneumovax-23 vaccine in relation to the risk of developing GBS. Tr. 254. Dr. Whitton testified the Pneumovax-23 vaccine contains the bacterial polysaccharides from 23 different strains of *S. pneumoniae*, which includes the same 13 bacterial polysaccharides contained in the Prevnar 13 vaccine. Id. Unlike Prevnar 13, Dr. Whitton stated that the Pneumovax-23 does not contain CRM_{197} or alum. Id. Thus, Dr. Whitton contended the Baxter et al. study was able to show whether the polysaccharides trigger GBS. Id. According to Dr. Whitton, the authors concluded that "the bacterial polysaccharides really don't trigger GBS . . . the bacteria themselves don't trigger GBS." Tr. 254-55.

However, Dr. Whitton's characterization of the Baxter et al. article is somewhat misleading. The authors did not specifically conclude that bacterial polysaccharides do not trigger GBS; instead, they found "no evidence of an increased risk of GBS following any vaccination." Resp. Ex. A, Tab 6 at 5. Further, of the 415 patients with GBS who were studied, 25 received a vaccine in the six weeks prior to onset of illness and two of the patients received the Pneumovax-23 vaccine. Id. at 4. Of the two patients who had post-vaccination GBS, onset was at 14 and 18 days. Id. at 5. Additionally, the authors noted the limitations of the study, and specifically stated that they were "unable to exclude any possible association between vaccines and GBS." Id. at 7.

Also according to Dr. Whitton, the Baxter et al. study provided evidence of whether CRM_{197} triggers GBS by molecular mimicry. Tr. 255-56. CRM_{197} is "very similar to diphtheria toxin and different by only one amino acid." Tr. 255. Dr. Whitton opined that if CRM_{197} was suspected to trigger GBS by molecular mimicry, then diphtheria vaccines would therefore be expected to trigger GBS by the same mechanism. Tr. 256. Dr. Whitton stated the two diphtheria vaccines studied in Baxter et al. did not show an association with GBS. Id. (citing Resp. Ex. F, Tab 20 at 6 tbl.2). A review of the Baxter et al. study shows that four of the 25 patients in the post-vaccination group received diphtheria-containing vaccines. Resp. Ex. F, Tab 20 at 5 tbl.1.

Next, Dr. Whitton believed that it was inaccurate for Dr. Steinman to conclude that anti-phospholipid antibodies play a role in disease causation. Resp. Ex. F at 16-17. While Dr. Whitton agreed that that these antibodies "may be the cause of disease," he opined that they may also be "the result of the disease" or "irrelevant to the disease." Id. at 16. Dr. Whitton quoted Gilburd et al., who stated "these autoantibodies are probably produced as a result of the myelin damage rather than cause the demyelination." Id. at 16-17 (quoting Pet. Ex. 25g at 1). He also cited Nakos et al., who stated that "[i]t is not well understood whether these anti-phospholipid antibodies play a role in the pathogenesis of the polyneuropathy or represent a part of a more extensive immunoreaction that takes place in [] GBS." Id. (citing Pet. Ex. 25h at 6).

[86] Institute of Medicine, Evaluating Biological Mechanisms of Adverse Events, in Adverse Effects of Vaccines: Evidence and Causality 57 (2012).

Dr. Whitton also believed that Dr. Steinman's reliance on Kanter et al.,[87] Ho et al., and Wang et al.,[88] was misplaced because these studies focus on MS, not GBS. Resp. Ex. F at 17 (citing Pet. Exs. 25i, 25j, 25k). "MS is a disease of the central nervous system, while GBS is generally viewed as a disorder of the peripheral nervous system." Id. Kanter et al. explained that "[l]ipids are important targets of immune responses in a variety of microbial and autoimmune diseases. Autoimmune responses directed against phospholipids and gangliosides contribute to the pathogenesis in systemic lupus erythematosus and [GBS], respectively." Id. (citing Pet. Ex. 25i at 1). Dr. Whitton opined that Kanter et al. underscored that "different autoimmune disorders can have different targets for autoimmune attack; therefore, it is not appropriate to use MS as a model for GBS." Id.

Dr. Whitton then discussed Dr. Steinman's argument that the polar head groups, present in Prevnar 13, induce molecular mimicry, which targets polar head groups on phospholipids in host nerves, causing GBS. Resp. Ex. F at 17. Instead of phospholipids, Dr. Whitton opined "it is currently thought that the targets of autoimmune attack in GBS are gangliosides." Id. Dr. Whitton believed Dr. Steinman's argument was incorrect because a phospholipid with a polar head group and a ganglioside are structurally different from one another, and gangliosides generally do not contain polar head groups. Id. Therefore, "even if Prevnar 13 induced antibodies that reacted with isolated polar head groups, those antibodies would not cross-react with gangliosides and, therefore, would not trigger GBS." Id.

As for Dr. Steinman's discussion on glycerol phosphate and reference to Chang et al., which illustrates the "phosphate head group," Dr. Whitton had several observations. Resp. Ex. F at 19-20. Dr. Whitton suggested that the more likely explanation for the importance of the phosphate group in the vaccine is "related to its role in defining the overall shape of the polysaccharide," which is "distinguishable by the immune system." Id. at 19. He also asserted that the phosphate groups in the vaccine are "very small molecular structures that are ubiquitous in biological materials." Id. "[W]hile there is no doubt that antibodies can be (and are) directed against large molecules that contain a few phosphate groups," Dr. Whitton "suspect[ed]" that an "antibody response [] focused solely on this small, and ubiquitous, molecule would . . . have extremely widespread effects on the host." Id. at 20 (emphasis omitted). Lastly, Dr. Whitton observed that if Dr. Steinman is right, then "the glycerophosphate group of one strain [of *S. pneumoniae*] would induce an antibody response that would recognize the glycerophosphate group in a different strain," but, he asserted that there is no such antibody cross reactivity. Id.

In his second expert report, Dr. Whitton reiterated the issues addressed in his first report, and raised additional objections to Dr. Steinman's second expert report and its reliance on phosphoglycerol. See Resp. Ex. J. Dr. Steinman showed a glycerophosphate group as part of the recognition site of an antibody that recognizes the polysaccharide in the 23F strain of *S.*

[87] Jennifer L. Kanter et al., Lipid Microarrays Identify Key Mediators of Autoimmune Brain Inflammation, 12 Nature Med. 138 (2006).

[88] Denong Wang et al., Uncovering Cryptic Glycan Markers in Multiple Sclerosis (MS) and Experimental Autoimmune Encephalomyelitis (EAE), 75 Drug Dev. Rsch. 172 (2014).

pneumoniae. Pet. Ex. 27 at 12. However, Dr. Whitton stated, "it is clear that that antibody does not bind only to the glycerophosphate group because, if it did, it would also bind to the same phosphate group that is present in the polysaccharides of some other strains of *S. pneumoniae*." Resp. Ex. J at 6. Dr. Whiton concluded that "[a]ntibodies to *S. pneumoniae* are strain (serotype) specific." Id.

Dr. Whitton also criticized Dr. Steinman's citation of Root-Bernstein to support the use of the BLAST tool. Resp. Ex. J at 7; Tr. 278. Dr. Whitton opined that Root-Bernstein made errors concerning the use of the BLAST, which lead to "unjustifiable conclusions regarding molecular mimicry." Resp. Ex. J at 8-9.

Additionally, Dr. Whitton testified that Dr. Steinman's reliance on the case report El Khatib et al. was misplaced. Tr. 270. El Khatib et al. documented a young boy with septic shock, and according to Dr. Whitton, it would be "difficult . . . to diagnose GBS in such a situation." Id.

Ultimately, when asked whether the Prevnar 13 vaccine can cause GBS via molecular mimicry, Dr. Whitton stated, "I think it's extraordinarily unlikely to be able to do so based on all of the extant evidence." Tr. 305.

Regarding a temporal association between Petitioner's Prevnar 13 vaccination and the onset of her GBS, Dr. Whitton stated that "coincidental temporal associations are inevitable." Resp. Ex. F at 28. He stated that with the millions of Prevnar 13 vaccines administered annually, "it follows that there will be multiple instances of purely coincidental temporal association between the vaccine and subsequent (causally unrelated) GBS." Id. (emphasis omitted).

III. DISCUSSION

A. Standards for Adjudication

The Vaccine Act was established to compensate vaccine-related injuries and deaths. § 10(a). "Congress designed the Vaccine Program to supplement the state law civil tort system as a simple, fair and expeditious means for compensating vaccine-related injured persons. The Program was established to award 'vaccine-injured persons quickly, easily, and with certainty and generosity.'" Rooks v. Sec'y of Health & Hum. Servs., 35 Fed. Cl. 1, 7 (1996) (quoting H.R. Rep. No. 908 at 3, reprinted in 1986 U.S.C.C.A.N. at 6287, 6344).

Petitioner's burden of proof is by a preponderance of the evidence. § 13(a)(1). The preponderance standard requires a petitioner to demonstrate that it is more likely than not that the vaccine at issue caused the injury. Moberly v. Sec'y of Health & Hum. Servs., 592 F.3d 1315, 1322 n.2 (Fed. Cir. 2010). Proof of medical certainty is not required. Bunting v. Sec'y of Health & Hum. Servs., 931 F.2d 867, 873 (Fed. Cir. 1991). Petitioner need not make a specific type of evidentiary showing, i.e., "epidemiologic studies, rechallenge, the presence of pathological markers or genetic predisposition, or general acceptance in the scientific or medical communities to establish a logical sequence of cause and effect." Capizzano v. Sec'y of Health & Hum.

Servs., 440 F.3d 1317, 1325 (Fed. Cir. 2006). Instead, Petitioner may satisfy her burden by presenting circumstantial evidence and reliable medical opinions. Id. at 1325-26.

In particular, a petitioner must prove that the vaccine was "not only [the] but-for cause of the injury but also a substantial factor in bringing about the injury." Moberly, 592 F.3d at 1321 (quoting Shyface v. Sec'y of Health & Hum. Servs., 165 F.3d 1344, 1352-53 (Fed. Cir. 1999)); see also Pafford v. Sec'y of Health & Hum. Servs., 451 F.3d 1352, 1355 (Fed. Cir. 2006). The received vaccine, however, need not be the predominant cause of the injury. Shyface, 165 F.3d at 1351. A petitioner who satisfies this burden is entitled to compensation unless Respondent can prove, by a preponderance of the evidence, that the vaccinee's injury is "due to factors unrelated to the administration of the vaccine." § 13(a)(1)(B). However, if a petitioner fails to establish a prima facie case, the burden does not shift. Bradley v. Sec'y of Health & Hum. Servs., 991 F.2d 1570, 1575 (Fed. Cir. 1993).

"Regardless of whether the burden ever shifts to the [R]espondent, the special master may consider the evidence presented by the [R]espondent in determining whether the [P]etitioner has established a prima facie case." Flores v. Sec'y of Health & Hum. Servs., 115 Fed. Cl. 157, 162-63 (2014); see also Stone v. Sec'y of Health & Hum. Servs., 676 F.3d 1373, 1379 (Fed. Cir. 2012) ("[E]vidence of other possible sources of injury can be relevant not only to the 'factors unrelated' defense, but also to whether a prima facie showing has been made that the vaccine was a substantial factor in causing the injury in question."); de Bazan v. Sec'y of Health & Hum. Servs., 539 F.3d 1347, 1353 (Fed. Cir. 2008) ("The government, like any defendant, is permitted to offer evidence to demonstrate the inadequacy of the [P]etitioner's evidence on a requisite element of the [P]etitioner's case-in-chief."); Pafford, 451 F.3d at 1358-59 ("[T]he presence of multiple potential causative agents makes it difficult to attribute 'but for' causation to the vaccination. . . . [T]he Special Master properly introduced the presence of the other unrelated contemporaneous events as just as likely to have been the triggering event as the vaccinations.").

B. Factual Issues

A petitioner must prove, by a preponderance of the evidence, the factual circumstances surrounding her claim. § 13(a)(1)(A). To resolve factual issues, the special master must weigh the evidence presented, which may include contemporaneous medical records and testimony. See Burns v. Sec'y of Health & Hum. Servs., 3 F.3d 415, 417 (Fed. Cir. 1993) (explaining that a special master must decide what weight to give evidence including oral testimony and contemporaneous medical records). Contemporaneous medical records, "in general, warrant consideration as trustworthy evidence." Cucuras v. Sec'y of Health & Hum. Servs., 993 F.2d 1525, 1528 (Fed. Cir. 1993). But see Kirby v. Sec'y of Health & Hum. Servs., 997 F.3d 1378, 1382 (Fed. Cir. 2021) (rejecting the presumption that "medical records are accurate and complete as to all the patient's physical conditions"); Shapiro v. Sec'y of Health & Hum. Servs., 101 Fed. Cl. 532, 538 (2011) ("[T]he absence of a reference to a condition or circumstance is much less significant than a reference which negates the existence of the condition or circumstance." (quoting Murphy v. Sec'y of Health & Hum. Servs., 23 Cl. Ct. 726, 733 (1991), aff'd per curiam, 968 F.2d 1226 (Fed. Cir. 1992))), recons. den'd after remand, 105 Fed. Cl. 353 (2012), aff'd mem., 503 F. App'x 952 (Fed. Cir. 2013).

There are situations in which compelling testimony may be more persuasive than written records, such as where records are deemed to be incomplete or inaccurate. Campbell v. Sec'y of Health & Hum. Servs., 69 Fed. Cl. 775, 779 (2006) ("[L]ike any norm based upon common sense and experience, this rule should not be treated as an absolute and must yield where the factual predicates for its application are weak or lacking."); Lowrie v. Sec'y of Health & Hum. Servs., No. 03-1585V, 2005 WL 6117475, at *19 (Fed. Cl. Spec. Mstr. Dec. 12, 2005) ("[W]ritten records which are, themselves, inconsistent, should be accorded less deference than those which are internally consistent." (quoting Murphy v. Sec'y of Health & Hum. Servs., 23 Cl. Ct. 726, 733 (1991), aff'd per curiam, 968 F.2d 1226 (Fed. Cir. 1992))). Ultimately, a determination regarding a witness's credibility is needed when determining the weight that such testimony should be afforded. Andreu v. Sec'y of Health & Hum. Servs., 569 F.3d 1367, 1379 (Fed. Cir. 2009); Bradley, 991 F.2d at 1575.

Despite the weight afforded to medical records, special masters are not bound rigidly by those records in determining onset of a petitioner's symptoms. Valenzuela v. Sec'y of Health & Hum. Servs., No. 90-1002V, 1991 WL 182241, at *3 (Fed. Cl. Spec. Mstr. Aug. 30, 1991); see also Eng v. Sec'y of Health & Hum. Servs., No. 90-1754V, 1994 WL 67704, at *3 (Fed. Cl. Spec. Mstr. Feb. 18, 1994) (Section 13(b)(2) "must be construed so as to give effect also to § 13(b)(1) which directs the special master or court to consider the medical records (reports, diagnosis, conclusions, medical judgment, test reports, etc.), but does not require the special master or court to be bound by them").

C. Causation

To receive compensation through the Program, Petitioner must prove either (1) that she suffered a "Table Injury"—i.e., an injury listed on the Vaccine Injury Table—corresponding to a vaccine that she received, or (2) that she suffered an injury that was actually caused by a vaccination. See §§ 11(c)(1), 13(a)(1)(A); Capizzano, 440 F.3d at 1319-20. Petitioner must show that the vaccine was "not only a but-for cause of the injury but also a substantial factor in bringing about the injury." Moberly, 592 F.3d at 1321 (quoting Shyface, 165 F.3d at 1352-53).

Because Petitioner does not allege she suffered a Table Injury, she must prove a vaccine she received actually caused her injury. To do so, Petitioner must establish, by preponderant evidence: "(1) a medical theory causally connecting the vaccination and the injury; (2) a logical sequence of cause and effect showing that the vaccination was the reason for the injury; and (3) a showing of a proximate temporal relationship between vaccination and injury." Althen, 418 F.3d at 1278.

The causation theory must relate to the injury alleged. Petitioner must provide a sound and reliable medical or scientific explanation that pertains specifically to this case, although the explanation need only be "legally probable, not medically or scientifically certain." Knudsen v. Sec'y of Health & Hum. Servs., 35 F.3d 543, 548-49 (Fed. Cir. 1994). Petitioner cannot establish entitlement to compensation based solely on her assertions; rather, a vaccine claim must be supported either by medical records or by the opinion of a medical doctor. § 13(a)(1). In determining whether Petitioner is entitled to compensation, the special master shall consider all material in the record, including "any . . . conclusion, [or] medical judgment . . . which is

contained in the record regarding . . . causation." § 13(b)(1)(A). The special master must weigh the submitted evidence and the testimony of the parties' proffered experts and rule in Petitioner's favor when the evidence weighs in her favor. See Moberly, 592 F.3d at 1325-26 ("Finders of fact are entitled—indeed, expected—to make determinations as to the reliability of the evidence presented to them and, if appropriate, as to the credibility of the persons presenting that evidence."); Althen, 418 F.3d at 1280 (noting that "close calls" are resolved in Petitioner's favor).

"Expert medical testimony which merely expresses the possibility—not the probability—of the occurrence of a compensable injury is insufficient, by itself, to substantiate the claim that such an injury occurred." LaCour v. Sec'y of Health & Hum. Servs., No. 90-316V, 1991 WL 66579, at *5 (Fed. Cl. Spec. Mstr. Apr. 15, 1991); accord Burns v. Sec'y of Health & Hum. Servs., No. 90-953V, 1992 WL 365410, at *6 (Fed. Cl. Spec. Mstr. Nov. 6, 1992), aff'd, 3 F.3d 415. The Federal Circuit has likewise made clear that the mere possibility of a link between a vaccination and a petitioner's injury is not sufficient to satisfy the preponderance standard. Moberly, 592 F.3d at 1322 (emphasizing that "proof of a 'plausible' or 'possible' causal link between the vaccine and the injury" does not equate to proof of causation by a preponderance of the evidence); Waterman v. Sec'y of Health & Hum. Servs., 123 Fed. Cl. 564, 573-74 (2015) (denying Petitioner's motion for review and noting that a possible causal link was not sufficient to meet the preponderance standard); Boatmon v. Sec'y of Health & Hum. Servs., 941 F.3d 1351, 1359-60 (Fed. Cir. 2019). While certainty is by no means required, a possible mechanism does not rise to the level of preponderance. Moberly, 592 F.3d at 1322; see also de Bazan, 539 F.3d at 1351.

IV. ANALYSIS

A. Diagnosis

As Federal Circuit precedent establishes, in certain cases it is appropriate to determine the nature of an injury before engaging in the Althen analysis. Broekelschen v. Sec'y of Health & Hum. Servs., 618 F.3d 1339, 1346 (Fed. Cir. 2010). Since "each prong of the Althen test is decided relative to the injury[,]" determining facts relating to the claimed injury can be significant in a case like this, where the parties dispute Petitioner's diagnosis. Id. Thus, before determining if Petitioner has met each prong of Althen, the undersigned addresses the issue of diagnosis.

The undersigned finds that there is preponderant evidence that Petitioner's initial diagnosis following vaccination was GBS. This finding is based on her clinical course, diagnostic tests, the opinions of Petitioner's treating physicians, and the opinions of Petitioner's experts. Further, the undersigned finds that given the facts and circumstances of this case, Petitioner was subsequently diagnosed with CIDP due to the chronicity of her illness; she did not initially present with CIDP. Further, Petitioner's diagnosis of CIDP did not indicate that she did not initially have GBS. Instead, the diagnosis of CIDP was used by Petitioner's physicians to signify that her GBS had become chronic. Petitioner's CIDP was the chronic version of her GBS.

Petitioner received her Prevnar 13 vaccination on September 22, 2016. On October 5, she had tingling in her hands. Petitioner was admitted to BJH on October 12 for numbness that had persisted for ten days. She also had mild asymmetric weakness, bilateral areflexia, and decreased sensation below the right and left knee and the right and left forearm. On October 13, a barium swallow revealed that Petitioner had abnormal swallowing, nasal regurgitation, and weakness at the base of her tongue. On October 14, Petitioner had worsening weakness and was transferred to the ICU. Twelve days later, on October 26, urologist Dr. Shands documented that she was having incontinence. Dr. Shands also observed that her "neurologic symptoms do not appear to have stabilized yet." Pet. Ex. 3 at 53. By October 27, Petitioner could not move her toes, had no strength in her feet, and could not walk.

According to the literature filed by the parties, early symptoms of GBS may include tingling of the distal extremities. Early symptoms are followed by progressive weakness associated with decreased or absent deep tendon reflexes, which may be relatively symmetric. Weakness progresses, reaching the clinical nadir of weakness within two to four weeks. Here, Petitioner had the tingling in her hands on October 5, 2016, followed by mild weakness and bilateral loss of reflexes on October 12. By October 27, approximately two weeks after onset of weakness, she was incontinent and unable to walk. Thus, Petitioner's mild weakness progressed to an inability to move her toes or walk in a period of approximately two weeks. This clinical course is consistent with GBS.

Further, Petitioner's diagnostic tests were consistent with GBS. Petitioner's EMG/NCS on October 12, 2016, showed absent SNAPs in multiple locations consistent with GBS. Additionally, CSF testing showed an abnormally elevated protein level in the context of a normal cell count, which is also consistent with GBS.

Moreover, Petitioner was seen by a number of different physicians, who all diagnosed her with GBS, and her medical records are replete with the diagnosis of GBS. For example, on admission to BJH on October 12, 2016, Dr. Wilks noted Petitioner's "week-long course . . . of ascending sensory numbness associated with weakness in the setting of recent Pneumovax administration." Pet. Ex. 2 at 632. Petitioner's admitting diagnosis was GBS. On October 14, Dr. Wilks again documented a diagnosis of GBS. On October 20, the date of discharge from BJH, Petitioner's diagnosis was still GBS. On admission to Missouri Baptist for rehabilitation on October 20, Petitioner's admitting diagnosis was also GBS.

Numerous specialists saw Petitioner for complications with her GBS, and they also documented a diagnosis of GBS. Dr. Firozi, the gastroenterologist who treated Petitioner for an ileus, attributed her gastrointestinal problems to her GBS. Urologist Dr. Shands noted that Petitioner had incontinence in the face of GBS. On December 6, 2016, Petitioner was admitted to Cedar Ridge, a skilled nursing facility, where her admitting diagnosis was GBS.

The Sejvar et al. article that documented the Brighton Collaborative Working Group's efforts to distinguish between GBS and CIDP, advised that CIDP "typically has an onset phase of [more than] 8 weeks, and the weakness may remit and relapse." Resp. Ex. E, Tab 3 at 4. It does not appear that Petitioner's onset phase lasted more than eight weeks, as her weakness progressed from mild to profound inability to walk within about two weeks. Using the Brighton

timeline, Petitioner would not have been characterized as having CIDP. Although Petitioner had a very lengthy initial course of her illness, it is not clear that she had periods of relapse. Instead, the trajectory of her illness suggests that she had severe weakness, and several serious complications of GBS. Her complications included an ileus that persisted and required transfer to an acute medical floor during her rehabilitation. She also had autonomic dysfunction, which appears to have caused hypotension, making it difficult for her to participate in physical therapy. She also developed deep vein thrombosis, which also required acute medical care. It is not evident, however, that Petitioner ever had "separate episodes of recurrence of symptoms," which are typical for CIDP. See Resp. Ex. E, Tab 3, at 4.

Neurologist Dr. Sommerville was the first to question whether Petitioner's condition had worsened. He evaluated Petitioner on October 20, 2016, the day she was initially discharged from BJH. At that time, her diagnosis was GBS. Also at that time, her weakness had not progressed to the point that she was incontinent or unable to walk. Dr. Sommerville did not see Petitioner again for over two months, until December 29, 2016. At that visit, he observed that Petitioner's condition had worsened.[89] However, the timeline described in the records establish that Petitioner had not yet reached the nadir of her weakness on October 20, 2016, when Dr. Sommerville performed his assessment. It was not until October 27, that the records indicate Petitioner was unable to move her toes or walk. Dr. Sommerville did not see or evaluate her after October 20, so he did not see her when her weakness was most profound. Thus, when he saw her on December 29, after not seeing her for two months, it may have been difficult for him to accurately assess when the worsening in her condition occurred. He acknowledged this possibility on December 29, when he stated, "it is possible, of course, that she did get her clinical nadir shortly after the discharge [October 20], though well within two weeks of symptoms onset, and that, in fact she has improved compared to that." Pet. Ex. 6 at 11.

When Petitioner was readmitted to BJH on January 23, 2017, Dr. Bamaga indicated that Petitioner had been diagnosed with CIDP due to the "chronicity" of her condition. Pet. Ex. 2 at 1775. This understanding of why Petitioner was diagnosed with CIDP was also embraced by Dr. Nguyen on March 6, 2017, when he wrote, "patient was originally diagnosed with [GBS] in [suggestion of] pneumonia shot . . . . Patient strength was not returning very well and outpatient neurologist . . . ultimately diagnos[ed] her with CIDP." Pet. Ex. 7 at 42. There is no suggestion in Petitioner's medical records that any of her physicians ever thought that her initial diagnosis of GBS was inaccurate. There is no support for the idea that she had two different distinct illnesses, GBS and CIDP, or that her initial diagnosis should have been CIDP.

After treatment with steroids and rehabilitation, Petitioner's condition improved. In July 2019, Dr. Sommerville suggested that she had "a monophasic course of CIDP." Pet. Ex. 22 at 7. The next year, on January 24, 2020, Dr. Sommerville's diagnosis was "monophasic CIDP, with continued absence of any signs of a relapse." Pet. Ex. 35 at 20. At the time of the hearing, Petitioner had not had any relapse of her condition.

[89] Dr. Sommerville's notes for the visit on December 29, 2016, state that in the past three weeks, while at Cedar Ridge, Petitioner's caretakers told Petitioner that she was improving, and that Petitioner also thought she was improving. Pet. Ex. 6 at 10. This history suggests that Petitioner was improving, and not worsening.

GBS is "characterized by acute areflexic paralysis with albuminocytologic dissociation." Resp. Ex. C, Tab 2 at 1. In most patients, symptoms continue to progress for up to one to three weeks after onset. "Two thirds of patients are unable to walk [] when maximum weakness is reached. . . . Among severely affected patients, 20% remain unable to walk 6 months after onset of symptoms." Id. at 3. In contrast, "CIDP continues to progress or has relapses for greater than 8 weeks." Resp. Ex. A, Tab 2 at 1. "CIDP should be suspected when a patient with GBS deteriorates after 9 weeks from onset or when deterioration occurs three times or more." Resp. Ex. A, Tab 3 at 2. The course of CIDP is "slowly progressive, often relapsing." Resp. Ex. C, Tab 1 at 15. It is "more frequently diagnosed by nerve biopsy than GBS/AIDP, especially in atypical cases." Id.

Taking Petitioner's full clinical course into consideration, the undersigned finds that Petitioner was appropriately diagnosed with GBS. Subsequently, whether she met the criteria for a diagnosis of CIDP is less clear. Petitioner's medical records establish that her presentation was acute, and that she progressed from mild weakness to paralysis (unable to move toes or walk) within approximately two weeks. Further, a nerve biopsy was not done to confirm the diagnosis of CIDP. Given her acute progression, Petitioner does not meet the criteria for a diagnosis of CIDP. Additionally, Petitioner had a monophasic course. She did not have separate episodes or recurrence of illness that is characteristic of CIDP.

There is, however, a definitional framework for CIDP that is consistent with Petitioner's clinical course and with her diagnoses of both GBS and CIDP. The NINDS, part of the NIH, provides that "CIDP is closely related to [GBS] and it is considered the chronic counterpart of that acute disease." Resp. Ex. E, Tab 5 at 1. Dyck and Tracy[90] describe the history of CIDP and note that due to a prior study of patients in 1975, it was "recognized that CIDP was different from [GBS] in that it was progressive and ongoing." Resp. Ex. E, Tab 7 at 3. But the authors added that "[t]he justification of the separation of CIDP from AIDP was made mostly because of the different temporal profiles and long-term outcome of these 2 entities." Id.

Here, it appears that Dr. Sommerville made the diagnosis of CIDP because of the chronicity of Petitioner's illness. This approach is consistent with the definition used by the NINDS, which considers CIDP to be the chronic counterpart of GBS. But recharacterizing Petitioner's illness based on its chronicity does not negate the fact that she had an acute onset that was accurately diagnosed as GBS.

This finding is consistent with case law. The Federal Circuit has made clear that "identifying [the Petitioner's] injury is a prerequisite" to the Althen analysis. Broekelschen, 618 F.3d at 1346. But it is not necessary to diagnose an exact condition. Astle v. Sec'y of Health & Hum. Servs., No. 14-369V, 2018 WL 2682974, at *19 (Fed. Cl. Spec. Mstr. May 15, 2018). In Lombardi, the Federal Circuit explained that "[t]he function of a special master is not to diagnose vaccine-related injuries, but instead to determine based on the record evidence as a whole and the

[90] James B. Dyck & Jennifer A. Tracy, History, Diagnosis, and Management of Chronic Inflammatory Demyelinating Polyradiculoneuropathy, 93 Mayo Clinic Proc. 777 (2018).

totality of the case, whether it has been shown by a preponderance of the evidence that a vaccine caused the [P]etitioner's injury." Lombardi v. Sec'y of Health & Hum. Servs., 656 F.3d 1343, 1351 (Fed. Cir. 2011) (internal quotation marks omitted) (quoting Andreu, 569 F.3d at 1382); see also Broekelschen, 618 F.3d at 1346 (citing Kelley v. Sec'y of Health & Hum. Servs., 68 Fed. Cl. 84, 100-01 (2005) for the proposition that "the [P]etitioner [is] not required to categorize his injury where the two possible diagnoses [are] 'variants of the same disorder'"). Furthermore, neither the Vaccine Act nor Althen burdens Petitioner with establishing a specific diagnosis. See Kelley, 68 Fed. Cl. at 100 ("The Vaccine Act does not require [P]etitioners coming under the non-Table injury provision to categorize their injury; they are merely required to show that the vaccine in question caused them injury—regardless of the ultimate diagnosis.").

Therefore, undersigned finds that Petitioner has proven by preponderant evidence that she suffered GBS following her Prevnar 13 vaccination. Her illness was subsequently diagnosed as CIDP, but that fact does not invalidate her original diagnosis of GBS.

B. Causation

1. Althen Prong One

Under Althen Prong One, Petitioner must set forth a medical theory explaining how the received vaccine could have caused the sustained injury. Andreu, 569 F.3d at 1375; Pafford, 451 F.3d at 1355-56. Petitioner's theory of causation need not be medically or scientifically certain, but it must be informed by a "sound and reliable" medical or scientific explanation. Boatmon v. Sec'y of Health & Hum. Servs., 941 F.3d 1351, 1359 (Fed. Cir. 2019); see also Knudsen, 35 F.3d at 548; Veryzer v. Sec'y of Health & Hum. Servs., 98 Fed. Cl. 214, 223 (2011) (noting that special masters are bound by both § 13(b)(1) and Vaccine Rule 8(b)(1) to consider only evidence that is both "relevant" and "reliable"). If Petitioner relies upon a medical opinion to support her theory, the basis for the opinion and the reliability of that basis must be considered in the determination of how much weight to afford the offered opinion. See Broekelschen, 618 F.3d at 1347 ("The special master's decision often times is based on the credibility of the experts and the relative persuasiveness of their competing theories."); Perreira v. Sec'y of Health & Hum. Servs., 33 F.3d 1375, 1377 n.6 (Fed. Cir. 1994) (stating that an "expert opinion is no better than the soundness of the reasons supporting it" (citing Fehrs v. United States, 620 F.2d 255, 265 (Ct. Cl. 1980))).

For the following reasons, the undersigned finds Petitioner has provided by preponderant evidence a sound and reliable theory that the Prevnar 13 vaccine can cause GBS, and subsequently CIDP, defined specific to this case as described above, and therefore, Petitioner has satisfied the first Althen prong.

Molecular mimicry has long been invoked as the causal mechanism for many different autoimmune diseases, including GBS. Many of the articles filed in this case support the mechanism as the leading hypothesis for the etiology of GBS. See, e.g., Pet. Ex. 17a at 1. The theory has been extended from infectious agents to vaccine-associated autoimmune illnesses, including GBS. See, e.g., Pet. Ex. 17o; Pet. Ex. 28c.

Molecular mimicry has been accepted as a sound and reliable theory in many demyelinating conditions, including GBS, in the Vaccine Program, forming the basis for petitioners to be entitled to compensation. See, e.g., Conte v. Sec'y of Health & Hum. Servs., No. 17-403V, 2020 WL 5743696, at *23 (Fed. Cl. Spec. Mstr. July 27, 2020) (noting the theory of molecular mimicry in a GBS case is "well-established and well-settled in the Vaccine Program"); Barone v. Sec'y of Health & Hum. Servs., No. 11-707V, 2014 WL 6834557, at *8-9 (Fed. Cl. Spec. Mstr. Nov. 12, 2014) (noting molecular mimicry "has been accepted in other Program cases as a reliable medical explanation for how various autoimmune conditions could develop after the receipt of different kinds of vaccinations"); Koller v. Sec'y of Health & Hum. Servs., No. 16-439V, 2021 WL 5027947, at *18 (Fed. Cl. Spec. Mstr. Oct. 8, 2021); Pierson v. Sec'y of Health & Hum. Servs., No. 17-1136V, 2022 WL 322836, at *31 (Fed. Cl. Spec. Mstr. Jan. 19, 2022); Deshler v. Sec'y of Health & Hum. Servs., No. 16-1070V, 2020 WL 4593162, at *19 (Fed. Cl. Spec. Mstr. July 1, 2020); Maloney v. Sec'y of Health & Hum. Servs., No. 19-1713V, 2022 WL 1074087 (Fed. Cl. Spec. Mstr. Mar. 17, 2022).[91]

Dr. Chaudhry and Dr. Rose both assert that four criteria must be met to establish whether a vaccine can cause GBS via molecular mimicry. The criteria include supportive epidemiology, identification of antibodies directed against human antigens, identification of the mimics of the target antigen, and reproduction in an animal model. Given the state of current scientific knowledge, a petitioner could not satisfy these criteria. Further, fulfilment of these criteria would require scientific certainty, which is a bar too high. See Knudsen, 35 F.3d at 549 (explaining that "to require identification and proof of specific biological mechanisms would be inconsistent with the purpose and nature of the vaccine compensation program").

Dr. Whitton takes a different tack. He criticizes the fact that Petitioner has not invoked a causal mechanism that implicates gangliosides as the targets of autoimmunity. However, the literature filed by the parties does not support the notion that gangliosides are the only player in the game of molecular mimicry. Thus, the argument that the Petitioner's mechanism must rely on gangliosides fails.

There is scientific support for Dr. Steinman's theories. To use the language in the criteria cited by Dr. Chaudhry, Dr. Steinman has identified components of the vaccine that could initiate development of antibodies that could cross-react with epitopes on peripheral nerve myelin or axonal glycoproteins. He has identified components of the Prevnar 13 vaccine that could trigger a human antibody response.

Regarding Petitioner's theory based on phosphoglycerol in serotypes 18C in the vaccine, Dr. Steinman produced papers to show that in MS, myelin phospholipids are targeted by an immune response. He has also shown that myelin is comprised of phospholipids, and that phospholipids can serve as autoantigens in autoimmune disorders. He has shown that patients with GBS have autoantibodies to phospholipids. In the Gilburd et al. study, the autoantibodies were thought to be due to myelin destruction. However, in Nakos et al., the researchers had a

[91] The undersigned acknowledges that the first two cases in this string cite involve a different vaccine, although the same illness.

different view. They suggested that anti-phospholipids either "play a role in pathogenesis of the polyneuropathy or represent a part of a more extensive immunoreaction that takes place in GBS." Pet. Ex. 25h at 7. In summary, there is sound support from reputable medical studies for each foundational aspect of the phosphoglycerol theory.

There is also evidence to support Dr. Steinman's second theory based on CRM_{197} and Contactin-1. Dr. Steinman identified sequences of shared homology between the proteins in the vaccine and those in Contactin-1.[92]

Moreover, the causal theory proffered by Dr. Steinman here has previously been accepted as sound and reliable in three recent cases, decided by different special masters, including the undersigned. See Maloney, 2022 WL 1074087; Koller, 2021 WL 5027947; Pierson, 2022 WL 322836. While prior decisions are not binding on the undersigned, they can be considered by the undersigned in forming her opinions. See Hanlon v. Sec'y of Health & Hum. Servs., 40 Fed. Cl. 625, 630 (1998), aff'd, 191 F.3d 1344 (Fed. Cir. 1999); Boatmon, 941 F.3d at 1358.

In another decision addressing the Prevnar 13 vaccine and GBS, the proffered causal theory was unsupported by evidence, and the Chief Special Master found that Petitioner was not entitled to compensation. Deshler, 2020 WL 4593162. There, the Petitioner relied on molecular mimicry, and suggested that there was homology between polysaccharide components of the vaccine and the myelin sheath, but evidence was insufficient to establish the scientific soundness of the theory. Id. at *19-21. Due to the lack of supportive evidence, the Respondent's expert was effective in establishing that the polysaccharides in the vaccine "do not share structural homology with self-structures of the peripheral nervous system, and therefore do not contribute to the pathogenesis of GBS." Id. at *20. In contrast, the theory proffered here is more well-developed and based on supportive foundational evidence from several scientific studies.

For these reasons, the undersigned finds that Petitioner has proven by preponderant evidence a sound and reliable causal theory establishing that the Prevnar 13 vaccine can cause GBS, satisfying Althen Prong One.

2. Althen Prong Two

Under Althen Prong Two, Petitioner must prove by a preponderance of the evidence that there is a "logical sequence of cause and effect showing that the vaccination was the reason for the injury." Capizzano, 440 F.3d at 1324 (quoting Althen, 418 F.3d at 1278). "Petitioner must show that the vaccine was the 'but for' cause of the harm . . . or in other words, that the vaccine was the 'reason for the injury.'" Pafford, 451 F.3d at 1356 (internal citations omitted).

In evaluating whether this prong is satisfied, the opinions and views of the vaccinee's treating physicians are entitled to some weight. Andreu, 569 F.3d at 1367; Capizzano, 440 F.3d at 1326 ("[M]edical records and medical opinion testimony are favored in vaccine cases, as treating physicians are likely to be in the best position to determine whether a 'logical sequence

[92] The undersigned makes no finding as to the aspect of Dr. Steinman's theory based on the adjuvant alum, as it was not well developed.

of cause and effect show[s] that the vaccination was the reason for the injury.'" (quoting Althen, 418 F.3d at 1280)). Medical records are generally viewed as trustworthy evidence, since they are created contemporaneously with the treatment of the vaccinee. Cucuras, 993 F.2d at 1528. While the medical records and opinions of treating physicians must be considered, they are not binding on the special master. § 13(b)(1)(B) (specifically stating that the "diagnosis, conclusion, judgment, test result, report, or summary shall not be binding on the special master or court").

A petitioner need not make a specific type of evidentiary showing, i.e., "epidemiologic studies, rechallenge, the presence of pathological markers or genetic predisposition, or general acceptance in the scientific or medical communities to establish a logical sequence of cause and effect." Capizzano, 440 F.3d at 1325. Instead, Petitioner may satisfy her burden by presenting circumstantial evidence and reliable medical opinions. Id. at 1325-26.

There are three reasons why the undersigned finds preponderant evidence of a logical sequence of cause and effect establishing that the Prevnar 13 vaccination administered to Petitioner on September 22, 2016, was the cause of her GBS, which was subsequently diagnosed as CIDP. First, Petitioner was initially and appropriately diagnosed with GBS, and Petitioner has proffered a sound and reliable mechanism of vaccine causation.

Second, Petitioner's various treating physicians' statements provide circumstantial evidence in support of vaccine causation. On October 12, 2016, Dr. Wilks documented Petitioner had "noncontributory past medical history with week-long course of symptoms of ascending sensory numbness associated with weakness in setting of recent Pneumovax administration." Pet. Ex. 2 at 632. Two days later, Dr. Wilks noted that Petitioner's GBS was "[l]ikely [secondary to] recent Pneumovax administration." Id. at 678. On October 25, 2016, Dr. Shands' consult notes indicate Petitioner "had a pneumonia shot a couple weeks ago and was normally functioning at that time. [S]he began having weakness and numbness and now had full-blown [GBS]." Pet. Ex. 3 at 52. Petitioner's discharge note from Missouri Baptist on October 27 states "[GBS] from pneumonia vaccine." Id. at 29. On March 6, 2017, regarding the diagnosis of CIDP, Dr. Nguyen documented, "patient originally presented to BJH with complaint of [right] hand numbness 1 week after a pneumonia shot. . . . During this admission patient was originally diagnosed with [GBS] in [suggestion of] pneumonia shot." Pet. Ex. 7 at 42. Finally, on June 24, 2021, Petitioner's PCP, PA-C Boyer, identified Prevnar 13 as an allergy related to Petitioner's CIDP. Pet. Ex. 36 at 12. Individually and collectively, these statements constitute circumstantial evidence that the Petitioner's treating physicians associated her vaccine with the development of GBS, and subsequently, CIDP.

Third, the evidence does not support an alternate cause for Petitioner's GBS/CIDP. Dr. Chaudhry stated Petitioner's underlying diabetes and possible nutritional deficiency, related to her gastric bypass surgery, may have contributed to the neuropathy as well. Although Dr. Chaudhry suggests these conditions "contributed" to Petitioner's condition, he does not opine that they likely caused her GBS/CIDP.

Further, the medical records and diagnostic workup did not identify any alternate cause of Petitioner's illnesses. There is no reference to an antecedent infection or other possible etiology. During her multiple hospitalizations, Petitioner underwent diagnostic studies of her cerebrospinal

fluid to investigate the cause of her GBS. The studies were all negative for any other cause. The only causal association documented in the Petitioner's medical record was the Prevnar 13 vaccine.

In conclusion, the undersigned finds that Petitioner has proven by preponderant evidence a logical sequence of cause and effect establishing that the Prevnar 13 vaccination caused her GBS/CIDP and has satisfied the second Althen prong.

3. Althen Prong Three

Althen Prong Three requires Petitioner to establish a "proximate temporal relationship" between the vaccination and the injury alleged. Althen, 418 F.3d at 1281. That phrase has been defined as a "medically acceptable temporal relationship." Id. A petitioner must offer "preponderant proof that the onset of symptoms occurred within a timeframe for which, given the medical understanding of the disorder's etiology, it is medically acceptable to infer causation-in-fact." de Bazan, 539 F.3d at 1352. The explanation for what is a medically acceptable time frame must also coincide with the theory of how the relevant vaccine can cause the injury alleged (under Althen Prong One). Id.; Koehn v. Sec'y of Health & Hum. Servs., 773 F.3d 1239, 1243 (Fed. Cir. 2014); Shapiro, 101 Fed. Cl. at 542 (2011), recons. den'd after remand, 105 Fed. Cl. 353 (2012), aff'd mem., 503 F. App'x 952 (Fed. Cir. 2013).

Here, the Respondent's experts do not disagree that there is a temporal association between Petitioner's vaccination and onset of GBS. Dr. Chaudhry does not offer an opinion on the issue of temporal association, while Dr. Whitton opined that the temporal association between Petitioner's Prevnar 13 vaccination and her GBS was "coincidental." Resp. Ex. F at 28.

Petitioner received her Prevnar 13 vaccination on September 22, 2016. She had early symptoms of tingling on October 5, followed by progressive numbness in her hands and feet. Dr. Wilks' notes on October 12 states Petitioner has "noncontributory past medical history with week-long course of symptoms of ascending sensory numbness associated with weakness in setting of recent Pneumovax administration." Pet. Ex. 2 at 632. Her admitting diagnosis was GBS. Id. at 491. Thus, the earliest manifestation of symptoms, the tingling in Petitioner's hands on October 5, was 13 days after vaccination.

This time frame from vaccination to the initial manifestation of symptoms is appropriate given the theory of molecular mimicry, as demonstrated in the Haber et al. article, which reported 11 cases of GBS following a Prevnar 13 vaccine, with a median onset interval of 9 days. This temporal association is also consistent with the onset period of 3 to 42 days as set forth in the Vaccine Injury Table for GBS following flu vaccination. 42 C.F.R. § 100.3(a)(XIV)(D).

Further, this time frame has been acknowledged as appropriate in other Vaccine Program cases in which molecular mimicry has been proffered as the causal mechanism. See, e.g., Maloney, 2022 WL 1074087, at 36; Koller, 2021 WL 5027947, at *23 (finding a GBS onset of 12 days after Prevnar 13 vaccination to be "within the medically accepted timeframe consistent with [P]etitioner's theory of molecular mimicry [and] that has been accepted in other Vaccine Program cases."); Barone, 2014 WL 6834557, at *13 ("[S]pecial masters have never gone

beyond a two-month (meaning eight week) interval in holding that a vaccination caused a demyelinating illness.").

Therefore, undersigned finds that Petitioner has met her burden of proof as to Althen Prong Three.

V. CONCLUSION

Based on the record as a whole, and for the reasons discussed above, the undersigned finds there is preponderant evidence to satisfy all three Althen prongs and to establish that Petitioner's Prevnar 13 vaccination caused her GBS and CIDP. Thus, the undersigned finds that Petitioner is entitled to compensation. A separate damages order will issue.

IT IS SO ORDERED.

s/Nora Beth Dorsey
Nora Beth Dorsey
Special Master