In the United States Court of Federal Claims

OFFICE OF SPECIAL MASTERS

JEFF and JAMIE NICHOLS, legal Representatives of a minor child, CARSON NICHOLS,	*	No. 08-654V Special Master Christian J. Moran
Petitioners,	*	
v.	*	
	*	Filed: February 23, 2018
SECRETARY OF HEALTH AND HUMAN SERVICES,	*	Entitlement, DTaP, death of infant, SIDS, SUID, anaphylaxis.
Respondent.	*	

Marc L. Silverman, Bellevue, WA, for petitioners;
Colleen C. Hartley, United States Dep't of Justice, Washington, DC, for respondent.

DECISION DENYING COMPENSATION[1]

Jeff and Jamie Nichols allege that the diphtheria-tetanus-acellular pertussis (DTaP) vaccine that their four-month old son, Carson Nichols, received on September 11, 2006, caused his death nearly five days later as a result of an anaphylactic reaction to the vaccination. The Nicholses, acting as Carson's legal representatives, bring this action seeking compensation for his death pursuant to the National Childhood Vaccine Injury Compensation Program, codified at 42 U.S.C. § 300aa−10 through 34 (2012).

Though vaccine-triggered anaphylaxis is a recognized mechanism of vaccine injury, the facts presented here do not support a finding that Carson experienced vaccine-triggered anaphylaxis for three reasons. First, the delay between the

[1] The E-Government, 44 U.S.C. § 3501 note (2012) (Federal Management and Promotion of Electronic Government Services). Pursuant to Vaccine Rule 18(b), the parties have 14 days to file a motion proposing redaction of medical information or other information described in 42 U.S.C. § 300aa-12(d)(4). Any redactions ordered by the special master will appear in the document posted on the website.

vaccination and the onset of Carson's symptoms does not support a finding of causation. Second, the evidence does not favor a finding that Carson experienced an anaphylactic reaction. Third, the evidence does support an alternate explanation for what caused Carson's death. As a result, the Nicholses have not met their burden for establishing a causal link between the vaccination and Carson's death, and are thus not entitled to compensation.

I. Facts

Carson Nichols was born on May 8, 2006, at 42 weeks gestation. OB/GYN at 28.[2] At birth, Carson was stable and weighed nine pounds and eight ounces. Id. After delivery, Carson received an APGAR score of 9. Id. Carson was discharged on May 11, 2006, after being treated for hypoglycemia. Puyallup Valley Pediatrics at 11, 13. At discharge, he was a heavy infant, ranking in the 75th percentile. Id. at 14.

For his two-week and his one-month well-baby check-ups, Carson saw Dr. Timothy Jolly, at Puyallup Valley Pediatrics. Id. at 1, 3. At both of these visits, his activity, appetite, voids, and behavior were all noted to be normal. Id.

Six days after his one-month well baby check, Carson was brought to Evergreen Children's Clinic because of dry skin. Evergreen Children's Clinic at 13. During this visit, Carson was diagnosed with atopic dermatitis (eczema). Id. at 14. The Nicholses were given information about eczema and told to return either for Carson's two-month well-child exam or if the rash worsened. Id. at 14-16.

On July 24, 2006, the Nicholses visited Dr. Don Russell at Evergreen Children's Clinic for Carson's two-month well-child visit. Id. at 6-7. Dr. Russell determined that Carson was healthy, though he continued to experience atopic dermatitis. Id. At discharge, the Nicholses were told to return for a four-month well-baby check-up. Id.

Carson returned to Evergreen Children's Clinic on September 11, 2006, for his four-month old well-baby exam. Id. at 1. He was seen by Denise Ladenburg, a nurse practitioner, who described Carson as an alert, active, and generally well-looking infant. Id. at 4. At this visit, the Nicholses did not express any concerns about Carson. Id. at 2. However, a nurse noted that Carson was not living in a smoke-free environment. Id. At this visit, Carson received his second DTaP,

[2] The Nicholses' early filings had duplicative or missing exhibit numbers. To avoid confusion, medical records are identified by their content as opposed to their exhibit number. Expert reports are described by the filed exhibit number.

haemophilus influenzae (HIB), polio (IPV), and pneumococcal (PCV-7) vaccinations. Id. at 4.

On the night of September 15, 2006, Mrs. Nichols fed Carson at approximately 8:00 P.M., before she left for work at around 9:30 P.M, leaving Carson with his father. Pierce County Sheriff Department Incident Report at 3. Carson was sleeping in the Nicholses' bed, which was typical for the family. Id. Mr. Nichols fell asleep at approximately 12:45 A.M., in the same bed as Carson. Id. He reported that he may have been awoken around 2:00 A.M., but was not sure. Mr. Nichols did recall that he woke up at 4:00 A.M. and noticed that Carson was not on the bed. Id. He found Carson lying face-down in a pile of clothes. Id. When his father found him, Carson did not show any signs of life. Id. at 6. While Mr. Nichols began giving Carson CPR, Mr. Nichols had his daughter call 9-1-1. Id. at 3. He noticed that Carson felt warm to his touch. Id. Pierce Fire and Rescue responded to the call and arrived on the scene at 4:28 A.M. Central Pierce Fire and Rescue at 4. Carson was unconscious when E.M.S. arrived and they noted that he was blue, apneic, and asystolic. Id. During transit, E.M.S. alerted the hospital that they were transporting an infant in full arrest. Mary Bridge Emergency Room at 5. E.M.S. intubated Carson, continued CPR, placed bilateral intraosseous infusion lines, and administered doses of atropine and epinephrine. Id.

Carson arrived at the Mary Bridge Emergency Room at 4:40 A.M. Id. Dr. Mary Woolard of Pediatric Emergency Medicine directed his care. Id. Mr. Nichols provided Carson's medical history, indicating that Carson had been his usual, healthy self and did not report any fevers, runny nose, congestion, or cough. Id. After Mrs. Nichols arrived, she added that she and Carson had been in a minor car accident a week earlier, though Carson remained asleep through the entire event and Carson's pediatrician had examined him and said he was fine. Id. See also Evergreen Children's Clinic at 1-4.

Carson could not be resuscitated and was pronounced dead at 4:51 A.M. on September 16, 2006. Mary Bridge Emergency Room at 6. Dr. Woolard noted no deformities or other signs or symptoms of what caused Carson's death. Id. at 5-6. Dr. Woolard's final assessment was "sudden unexplained death in a four month old infant." Id. at 6.

Per hospital protocol, the police were contacted and spoke with Dr. Woolard. The police also talked with the Nicholses and visited the Nicholses' residence. Id. at 10; Pierce County Sheriff Department Incident Report at 3-7. At the residence, Detective O'Brien of the Pierce County Sheriff Department noted a home that was cluttered with laundry and debris. Pierce County Sheriff Department Incident Report at 6. He noted stacks of clothing along the master

bedroom wall. Ryan Thill, a medical investigator, met Detective O'Brien at the home. Mr. Thill also noted that there were piles of clothing in the rooms as well as the smell of cigarette smoke. Pierce County Medical Examiner at 3. Mr. Thill provided the most descriptive report of the scene of Carson's death:

> A mattress was on the floor, with the head end up against the north wall. A nightstand was located on each side of the bed. The nightstand on the west side had a large ash tray, which was full of cigarette butts. The nightstand on the east side was wedged between the bed and the wall. There was about a two foot gap of space between the east side of the bed and the wall. It is in this space that the decedent was found. On the floor of this space were piles of clothes, books, and other items.

Id.

The medical examiner, Dr. Roberto Ramoso, conducted Carson's autopsy on September 16, 2006. Id. at 16. Dr. Ramoso created histology slides from several organs. Id. at 19. He also recorded the weight of several organs. Id. at 17. Toxicology reports did not detect any CNS drugs in Carson's system. Id. at 21. However, nicotine and cotine were detected via blood analyses. Id. The autopsy findings were summarized as pulmonary edema, petechiae of thymus, pleura, and epicardium, with no anomalies noted. Id. at 15. After considering the circumstances of Carson's death, his medical history,[3] and the postmortem examination, Dr. Ramoso classified Carson's death "as death during infancy – no identifiable cause." Id. Dr. Ramoso's opinion was that the manner of Carson's death was undetermined. Id.

II. Procedural History

The Nicholses' petition is the oldest case on the undersigned's docket to not yet reach a determination on entitlement. The undersigned recognizes that the Vaccine Program was designed to provide recourse to vaccine-injured claimants quickly and easily. H.R. Rep. No. 99-908, at 3 (1986). Given that the Nicholses filed this case in 2008 and the case now includes 12 expert reports, the litigation process clearly has been neither a quick nor easy experience for the Nicholses. The undersigned sympathizes with the petitioners for having this added burden

[3] The autopsy report makes clear that the medical examiner knew of Carson's recent vaccinations. See Pierce County Medical Examiner at 4 (noting that the father had reported that Carson "had just recently seen his pediatrician for shots and a well-baby check-up."); Id. at 11 (documenting that Carson had been to the pediatrician "2-3 days before death" for "shots & check-up."

after having already losing their son. Due to the protracted length of this case, the undersigned provides more detail than usual to the procedural background.

Jeff and Jamie Nichols filed a petition on behalf of their son, Carson, pro se, more than nine years ago. Pet., filed Sept. 12, 2008, at 1. The Nicholses claimed that their son's death was caused by the DTaP vaccination he received on September 11, 2006. Id. The Nicholses were given information about the process of bringing a claim in the Vaccine Program and were notified that a status conference had been scheduled to discuss their case. Order, filed Nov. 12, 2008. The status conference was rescheduled because the Nicholses were unable to be reached. Order, filed Nov. 20, 2008. Additionally, the Clerk's Office was instructed to provide the Nicholses with a copy of the Vaccine Rules, Guidelines, and a list of attorneys who practice in the Vaccine Program. Id.

During the initial status conference, the Nicholses were instructed to file any of Carson's medical records that they possessed. Order, filed Nov. 24, 2009. Almost a year passed before the undersigned was able to reach the Nicholses by telephone. Order, filed Dec. 7, 2010. During this status conference, they were instructed to file any medical records they had gathered and to mail a copy of those records to the Secretary. Id. Although several attempts to contact the Nicholses were made, Carson's medical records were still not filed five months later. Order, filed Apr. 15, 2011. The Nicholses successfully filed medical records on June 6, 2011. After reviewing what had been filed, the Secretary requested additional medical records, including Carson's pediatrician records and the emergency response records. Resp't's Status Rep., filed June 28, 2011, at 1.

The Nicholses were unable to be reached for several months, until a telephonic conference in December 2011. Order, filed Dec. 13, 2011. During this status conference, the Secretary reported that he had received the medical records, but they were not paginated or labeled with exhibit numbers. Id. The Nicholses were instructed to refile the records with pagination and exhibit numbers as soon as possible. Id. The Nicholses were unavailable for several status conferences and were reminded that failure to comply with Court orders may result in the dismissal of their case. Order, filed Mar. 22, 2012. After missing another status conference, the Nicholses were successfully reached and the deadline for the Secretary's Rule 4(c) report was set. Order, filed May 1, 2012.

The Secretary filed his Rule 4(c) report, stating the Nicholses had failed to show that they were entitled to compensation under the Act. Resp't's Rep., filed June 29, 2012, at 9. A few weeks later, the Nicholses were instructed to begin searching for an expert to provide an opinion for their claim and were reminded of the option to seek the services of an attorney. Order, filed July 13, 2012.

Three months later, the Nicholses discussed obtaining phone records from Sprint Nextel and Carson's pediatrician's office. Order, filed Oct. 25, 2012. The next month, they reported that the pediatrician's office did not have any records logging a call from Mrs. Nichols, but they had successfully contacted Sprint Nextel and received guidance on where to send a subpoena. Order, filed Nov. 29, 2012. During this telephonic conference, the Nicholses also expressed a concern that the medical examiner's office was withholding lab records. Id. The Secretary agreed to assist in obtaining any additional records from the medical examiner's office. Id. The undersigned then granted the Nicholses' requests to subpoena Sprint Nextel and the Pierce County Medical Examiner's Office. Order, filed Jan. 24, 2013; order, filed Jan. 24, 2013.

A few months later, another status conference was held to assess the Nicholses' progress of obtaining the records. Order, filed Apr. 3, 2013. The process for sending a subpoena was clarified and the Nicholses were instructed to send the subpoena via certified mail. Id. Additionally, the Secretary reported that he expected to receive the records from the medical examiner's office in the next 30 days. Id. The Secretary filed the medical records he received on April 30, 2013. The following month, the Nicholses reported that a subpoena had been sent to Sprint Nextel via certified mail, but they were still waiting on a response. Order, filed May 22, 2013.

The next month, the Nicholses stated they had received an electronic copy of the phone records, but were waiting to receive the records in the mail. Order, filed June 25, 2013. In response, the Secretary questioned the importance of the phone records in determining entitlement and noted that this case had been proceeding for five years. Id. The Nicholses were gathering the records at the suggestion of an attorney, who was considering representing them. Id. The following month, the Nicholses stated they were interested in obtaining Mrs. Nichols' phone records, were in the process of retaining a medical expert, and were contacting Vaccine Program attorneys. Order, filed July 22, 2013.

The same week, the undersigned granted the Nicholses' motion to substitute Kelly Burdette as the attorney of record on the case. Order, filed July 29, 2013. However, almost two months later, the undersigned granted Ms. Burdette's motion to withdraw as counsel and the Nicholses were again proceeding pro se. Order, filed Sept. 23, 2013.

During a status conference three weeks later, the Nicholses reported that they had identified two potential candidates to serve as expert witnesses. Order, filed Nov. 13, 2013. The Nicholses were ordered to file a status report detailing their progress in retaining an expert witness. Order, filed Dec. 16, 2013. The

Nicholses did not meet this deadline, however, and their status report deadline was extended for another month. Order, filed Jan. 16, 2014.

Three months later, the Nicholses informally provided the undersigned with an update, stating that they were in the process of providing Dr. Steve Rostad with a release that would allow him to discuss the case with the medical examiner's office for the purposes of preparing an expert report. Order, filed Apr. 10, 2014. The Nicholses then filed a status report indicating they had retained Dr. Rostad as their expert witness and that he was reviewing the medical files, medical examiner's report, and slides. Pet'rs' Status Rep., filed Apr. 18, 2014.

The undersigned set a June 30, 2014 deadline for the Nicholses to file their expert report. Order, filed Apr. 29, 2014. Dr. Rostad was not able to complete his report by this deadline. Order, filed July 8, 2014. The undersigned instructed the Nicholses to file Dr. Rostad's expert report by August 21, 2014.

The next month, the Nicholses filed a motion for enlargement of time because Dr. Rostad had increased the price of his report. Pet'rs' Mot., filed Aug. 18, 2014, at 1. According to petitioners, the additional cost presented financial challenges and would delay the filing of the report. Id. The undersigned granted the Nicholses' motion for enlargement of time and granted an additional 120 days to file the expert report. Order, filed Aug. 25, 2014. The Nicholses filed Dr. Rostad's report shortly after the deadline. Exhibit 1, filed Dec. 22, 2014.

A status conference was held two weeks later in which the undersigned requested that the Nicholses file Dr. Rostad's curriculum vitae with an exhibit number. Order, filed Jan. 7, 2015. In addition, the Secretary requested 90 days to file his responsive expert report. Id.

The next month, the undersigned granted the Nicholses' motion to appoint Marc Silverman as their attorney of record. Order, filed Feb. 23, 2015. A few weeks later, a status conference was held to review the case with Mr. Silverman. Order, filed Mar. 12, 2015. In this status conference, the Nicholses represented that they were open to settlement discussions, whereas the Secretary preferred to wait until after his responsive expert report to determine if settlement was an option. Id.

On March 26, 2015, respondent moved for, and was granted, an extension of time to file his expert report due to a delay in receiving the tissue slides. Resp't's Mot. at 1; Order, filed Mar. 31, 2015. A second motion for enlargement of time was filed by the Secretary, requesting additional time for his previously identified expert, Dr. Harris, and a yet to be identified expert in the field of pediatric immunology, to file their expert reports. Order, filed May 5, 2015. The Nicholses

strongly objected. Id. The undersigned granted the Secretary's motion in part, denied it in part, and extended the deadline for the Secretary's expert reports for an additional month. Id. The Secretary filed the expert reports of Dr. Harris and Dr. Dreskin within this extended deadline. See exhibit A, filed June 30, 2015 (Dr. Harris' report); exhibit C, filed June 20, 2015 (Dr. Dreskin's report).

A status conference was held within two weeks of the Secretary filing his reports. Order, filed July 10, 2015. The Nicholses stated that Dr. Rostad would file a responsive report to Dr. Harris' report and that they were searching for an immunologist to respond to Dr. Dreskin's report. Id. The Nicholses missed their first deadline to file a status report, but filed a report the next month stating that they were still searching for an immunologist. Order, filed Aug. 24, 2015; Pet'rs' Status Rep., filed Sept. 3, 2015. After this status report, the Nicholses were instructed to file any outstanding reports as they were completed. Order, filed Sept. 3, 2015.

Two months later, the Nicholses reported that they were consulting with an immunologist, whom they hoped would provide a report responding to Dr. Dreskin's report. Pet'rs' Status Rep., filed Nov. 5, 2015. After this update, the undersigned established mid-December deadlines for both Dr. Rostad's responsive report and the immunologist's responsive report. Order, filed Nov. 6, 2015. The Nicholses filed Dr. Rostad's report prior to this deadline. Exhibit 2, filed Dec. 7, 2015.

Approximately a month after Dr. Rostad's report was filed, a status conference was held to determine the Nicholses' progress in obtaining an immunologist to serve as an expert. Order, filed Jan. 13, 2016. The Nicholses were given an additional 60 days to retain an immunologist or to update the undersigned on their progress. Id. A month later, the Nicholses filed a motion for enlargement of time to allow Dr. Ofer Levy, the immunologist whom they retained, time to complete his report. Pet'rs' Mot., filed Feb. 16, 2016. The undersigned granted the motion and set the new deadline for filing Dr. Levy's expert report for mid-April, 2016. Order, filed Feb. 17, 2016.

Citing a death in Dr. Levy's family, the Nicholses moved for--and the undersigned granted--a second motion for enlargement of time for the completion of Dr. Levy's report. Order, filed Apr. 12, 2016. The Nicholses were instructed to file Dr. Levy's expert report by the end of May. Id. A third motion for enlargement of time was granted when Dr. Levy reported, via the Nicholses, being delayed in completing the report. Order, filed June 7, 2016. The Nicholses were encouraged to meet the new extended deadline of June 30, 2016. Id. The Nicholses filed Dr. Levy's report on June 29, 2016. Exhibit 3.

Two weeks later, a status conference was held to discuss Dr. Levy's report and the next steps that should be taken. Order, filed July 12, 2016. The Nicholses agreed to file an index of the exhibits and to file the curriculum vitae for both Dr. Rostad and Dr. Levy. Id. The Secretary also requested 60 days to file a responsive report from one or both of his experts. Id. Additionally, the undersigned discussed scheduling a hearing and the parties were instructed to determine mutually convenient dates for a three-day hearing. Id. The Nicholses filed their exhibit list and the curriculum vitae for both of their experts the next day. Due to difficulty the petitioners were having reaching Dr. Levy, the undersigned granted the Nicholses an extension until the middle of September to indicate Dr. Levy's availability for a hearing. Order, filed Aug. 30, 2016.

The following week, the Secretary filed both Dr. Dreskin's and Dr. Harris' supplemental expert reports. Exhibit E, filed Sept. 8, 2016; Exhibit F, filed Sept. 8, 2016. Petitioners moved to strike Dr. Harris' supplemental report on the basis that its filing was a violation of the rules of civil procedure and of petitioners' rights to due process. Pet'rs' Mot., filed Sept. 12, 2016. Respondent filed a response on September 27, 2016, and petitioners filed a reply on October 7, 2016. Petitioners' motion to strike was denied. Order, filed Oct. 14, 2016.

On the same day that petitioners moved to strike Dr. Harris' supplemental expert report, petitioners moved for a 90-day enlargement of time to file a report from a new immunologist because Dr. Levy would no longer be able to testify in this case. Pet'rs' Mot., filed Sept. 12, 2016. Petitioners' motion for enlargement was granted. Order, filed Oct. 14, 2016.

On December 12, 2016, petitioners stated that despite an "energetic search" to find a replacement for Dr. Levy, they were unable to find a new immunologist to opine on the case. Pet'rs' Mot., filed Dec. 12, 2016. The Nicholses therefore moved for two additional weeks so that their other expert, Dr. Rostad, could provide a rebuttal report to the previously filed report from Dr. Harris. Id. Petitioners' motion was granted. Order, filed Dec. 16, 2016.

On the same day that the Nicholses moved for additional time to file a rebuttal report from Dr. Rostad, they moved for a decision without an evidentiary hearing. Pet'rs' Mot. for Decision, filed Dec. 12, 2016. Petitioners' motion was two pages in length and did not develop the factual or legal basis for a determination of compensation. See id.

On December 20, 2016, petitioners moved again for an enlargement of time to file Dr. Rostad's report. Pet'rs' Mot., filed Dec. 20, 2016. The undersigned granted the Nicholses' motion, allowing an additional 21 days for Dr. Rostad's

report to be filed. Order, filed Dec. 20, 2016. The next day, the undersigned granted the Secretary's motion to stay his response deadline until the evidentiary record was closed on account of the extension of time provided to petitioners for filing Dr. Rostad's report. Order, filed Dec. 21, 2016. The Nicholses' deadline for filing Dr. Rostad's report remained unchanged and the Secretary was given a month after that date to file his response to the Nicholses' motion for a decision. Id. The Nicholses timely filed Dr. Rostad's report. Exhibit 6, filed Jan. 17, 2017.

After Dr. Rostad's report had been filed, the Secretary submitted his response and requested that the Nicholses' claim be denied. Resp't's Resp. to Mot. for Decision, filed Feb. 14, 2017. The Secretary asserted that the Nicholses had failed to meet their burden in establishing a scientifically reliable theory of causation, a logical sequence of cause and effect, and a medically accepted temporal relationship. Id.

A status conference was held the following week, during which the Nicholses requested 45 days to file a reply to respondent's response to their motion. Order, filed Feb. 24, 2017. The undersigned emphasized that this was petitioners' opportunity to explain why they were entitled to compensation. Id.

The Nicholses moved for an extension of their deadline to file a responsive brief on March 24, 2017. Pet'rs' Mot., filed Mar. 24, 2017. Petitioners' motion was granted. Order, filed Mar. 27, 2017. The Nicholses timely filed their responsive brief on the motion for decision on May 9, 2017. Pet'rs' reply, filed May 9, 2017. On that same day, the Nicholses filed an unexpected supplemental reply from Dr. Rostad. Exhibit 7, filed May 9, 2017.

On May 25, 2017, the undersigned scheduled a status conference, sua sponte, to discuss the potential need for a fact hearing on the issue of whether Carson experienced symptoms of anaphylaxis days before his death. Order, filed May 25, 2017. The need for this arose out of representations made by Carson's parents that were incorporated into Dr. Rostad's previous reports, but were inconsistent with the medical records. Id. The undersigned proposed holding a hearing with percipient witnesses during the summer of 2017. Id.

On June 5, 2017, petitioners filed another unexpected expert report from Dr. Rostad. Exhibit 8, filed June 5, 2017. Dr. Rostad maintained that his previous reports did not rely on the representations made by Carson's parents.

The status conference ordered on May 25, 2017, was held on June 7, 2017. Order, filed June 9, 2017. During the status conference, the Nicholses stated that there was no need for a hearing to develop a factual basis for their previous assertion that Carson experienced symptoms of anaphylaxis days before his death.

Id. The Nicholses stated that the medical records--specifically Carson's organ weights, eosinophilia, and pulmonary edema--spoke for themselves and that there was no other explanation for these findings other than anaphylaxis. Id. As such, the petitioners agreed to withdraw from consideration any accounts put forth by his parents indicating that Carson experienced symptoms of anaphylaxis days prior to his death. Id.

During the status conference, respondent expressed a concern about the two expert reports filed by the petitioners after the parties had already agreed that the record was closed. Id. Respondent was provided an opportunity to speak to his experts so that they could evaluate these reports and determine whether responsive reports were necessary. Id.

On June 16, 2017, respondent filed a status report stating that he would like an opportunity to have his experts respond to Dr. Rostad's last two expert reports. Resp't's Rep., filed June 16, 2017. Respondent was given until August 15, 2017, to file these reports. Respondent timely filed the reports from Dr. Harris (exhibit G, filed Aug. 15, 2017) and Dr. Dreskin (exhibit H, filed August 15, 2017).

On September 8, 2017, petitioners filed another unexpected filing, consisting of five pages of attorney argument rebutting the opinions provided by Drs. Harris and Dreskin. A status conference was held, on petitioners' request, on October 10, 2017. During the status conference, the undersigned noted that the record appeared complete and the matter was ripe for adjudication.[4]

III. Experts' Backgrounds and Opinions

Because the events in Carson's life are largely undisputed, the critical evidence comes in the form of reports from the four doctors whom the parties retained. This section sets forth the qualifications of each of the four doctors and then summarizes their opinions.

[4] The procedural history demonstrates the dueling demands placed on special masters in Vaccine Program cases. On the one hand, Congress envisioned an easy and informal program for petitioners to be compensated for their injuries. As a result, the undersigned attempts to provide generous deadlines to petitioners and will dismiss a case for their failure to prosecute only after affording multiple chances to cure any deficiency. On the other hand, Congress envisioned a program for "quick" resolution of these issues. Unfortunately, these two demands are often mutually exclusive, as is the case here. Ultimately, the petitioners are largely responsible for shaping the procedural posture of the matter. The undersigned has attempted to establish a process that was fair to both sides, even if that process took longer than anticipated.

A. The Experts' Qualifications

1. Dr. Steven Rostad, MD

Dr. Steven Rostad was one of two experts who submitted reports on behalf of the Nicholses. He submitted five expert reports and opined that the vaccines Carson received caused Carson to suffer an anaphylactic reaction that led to his untimely death.

Dr. Rostad is currently a Staff Pathologist for CellNetix Pathology, PLLC and an attending Pathologist / Neuropathologist at the Swedish Medical Center in Seattle, Washington. Exhibit 4 (curriculum vitae) at 1. Dr. Rostad also serves a Clinical Associate Professor of Pathology at the University of Washington School of Medicine. Id. He is board certified in both anatomic pathology and neuropathology. Id. at 2. His postgraduate training included work as a neuropathology fellow and chief resident of anatomic pathology. Id. at 1.

2. Dr. Ofer Levy, MD, PhD

Dr. Ofer Levy was the other expert who provided an opinion on behalf of the Nicholses. He submitted one expert report.

Dr. Levy currently serves as a staff physician in the Medicine / Infectious Disease Department at Boston Children's Hospital. Exhibit 5 (curriculum vitae) at 2. He also serves as a consultant for in the department of Neonatology at Brigham & Women's Hospital and Beth Israel Deaconess Medical Center, and as a Consultant in the Department of Pediatrics at Dana Farber Cancer Institute. Id. Additionally, Dr. Levy works as an Associate Professor of Pediatrics and a Faculty Member for Human Biology & Translational Medicine and Biological & Biomedical Sciences at Harvard Medical School. Id. His postgraduate studies allowed him to focus his training and he worked as a resident in the Pediatrics Department and a fellow in the Pediatric Infectious Disease Department of Boston Children's Hospital. Id. at 1. Dr. Levy is board certified in pediatric infectious diseases. Id. at 21.

3. Dr. Brent Harris, MD, PhD, F.C.A.P.

Dr. Brent Harris submitted two reports on behalf of the Secretary. He challenged the Nicholses' theory that Carson's death was caused by or related to the vaccinations he received.

Dr. Harris currently holds several hospital / clinical appointments, including working as an AP Staff Neuropathologist at Howard University Hospital and

MedStar Georgetown University Hospital, serving as a Consulting Neuropathologist for the DC Veterans Association Medical Hospital, as the Director of Neuropathology at MedStar Georgetown University Hospital, and a consultant for the Office of the Chief Medical Examiner of Washington, D.C. Exhibit B (curriculum vitae) at 2. In addition, he serves as an Associate Professor of Neurology and Pathology at Georgetown University School of Medicine, an Adjunct Associate Professor of Pathology at Howard University Medical School, and as Teaching Faculty for Children's National Medical Center Pediatric Neurology Program. Id. 1-2. His postgraduate training included working as a neuropathology fellow and serving as chief resident of the Pathology Department at Stanford University Medical School. Id. at 1. Dr. Harris is currently certified by the American Board of Pathology in Anatomic Pathology and Neuropathology. Id.

4. Dr. Stephen Dreskin, MD, PhD

Dr. Stephen Dreskin provided two expert reports for the Secretary. Dr. Dreskin also rebutted the theory presented by the Nicholses.

Dr. Dreskin is currently a member of the full time staff at the University of Colorado ("UC") Hospital and the consulting staff at the National Jewish Hospital. Exhibit D (curriculum vitae) at 3. He currently works in many roles including as an Associate Professor of Medicine and Immunology at the UC School of Medicine, as the Practice Director of UC Denver Allergy, Asthma, and Immunology Practice and UC Denver Rheumatology Practice, as a consultant for the Clinical Immunization and Safety Assessment Network, and as the Medical Director and Clinical Consultant for the Clinical Immunology / Flow Cytometry laboratory of ClinImmune Labs. Id. 2-3. Dr. Dreskin currently holds board certification in internal medicine, allergy and immunology, and diagnostic laboratory immunology. Id. at 1.

B. The Experts' Reports

The expert reports are presented in the order in which they were filed, beginning with the earliest report. Thus, the parties' filings are interspersed with each other.

1. Dr. Rostad's First Report (Exhibit 1)

In his first report, Dr. Rostad concluded that the findings in this case were consistent with a death caused by a vaccine-related allergic reaction. Exhibit 1 at 4. Dr. Rostad began his report by summarizing the relevant facts. Id. at 2-4. He then reported the findings of increased organ weights and eosinophils in multiple organs. Id. at 4-5. He asserted that these findings were reflective of

"inflammation-related edema and congestion secondary to the cascade of events related to an allergic response." Id. at 5.

He then turned to an analysis of the medical theory of vaccinations causing a delayed allergic reaction to connect the administration of vaccines and death. Id. at 6. Dr. Rostad asserted that a hypersensitivity reaction was the most reasonable mechanism to explain Carson's death. Id. In coming to this conclusion, Dr. Rostad appeared to rely heavily on this diagnosis being one of exclusion. He notes: "Carson was exposed to multiple vaccines and died approximately four days later, with no other supporting causes of death, such as accidents, infections or SIDS. Careful tissue and scene examination does not provide for alternative explanation. The most adequate cause of death is exposure to an allergen such as a vaccine, followed by a systemic immune reaction and overwhelming physiologic response." Id. Dr. Rostad did not note that Carson was found at the scene face-down in a pile of clothes.

Dr. Rostad stated that allergic hypersensitivity presents differently in adults and children and that in children it can be especially difficult to identify. Id. Supporting this proposition, he cites to exhibit 1.14 (Paul A. Greenberger et al., Fatal Anaphylaxis: Postmortem Findings and Associated Comorbid Diseases, 98 Annals Allergy Asthma Immunology 252 (2007)). Dr. Rostad also noted that allergic hypersensitivity can present in a wide array of ways, including anaphylaxis. Anaphylaxis, he reported, is a dramatic reaction to an allergen, frequently presenting as an emergency. Dr. Rostad provided details about the biological mechanisms that give rise to anaphylaxis by referencing exhibit 1.9 (Claude Delage & N. S. Irey, Anaphylactic Deaths: A Clinicopatholgic Study of 43 Cases, 17 J. Forensic Sci. 525 (1972)).

Dr. Rostad noted that anaphylactic shock refers to an immediate type of hypersensitivity that usually occurs within 30 minutes following presentation of the antigen. Exhibit 1 at 6. However, Dr. Rostad identified that some instances of delayed reactions occur up to 72 hours after exposure. Id. To support this claim, he referenced exhibit 1.23 (Roni D. Lane & Robert G. Bolte, Pediatric Anaphylaxis, 23 Pediatric Emergency Care 49 (2007)). Dr. Rostad then briefly mentioned the additional possibility of a bi-phasic reaction, which involves a recurrence of signs and symptoms within 72 hours after resolution of an initial event. Exhibit 1 at 6. To support this claim, he provided exhibit 1.24 (Phillip Lieberman, Biphasic Anaphylactic Reactions, 95 Annals Allergy Asthma Immunology 217 (2005)).

Dr. Rostad provided an in-depth analysis of the importance of eosinophils. Exhibit 1 at 7. Dr. Rostad began by reporting that eosinophils play an important

role as response cells during an anaphylactic reaction. Id. He outlined the general steps that occur in an allergic reaction. Id. Eosinophils are responsible for regulating mast cells, responding to allergens, directing the respiratory allergic response for asthma, and modulating T-cells. Id. Dr. Rostad also noted that several studies recognized eosinophils were responder cells in hypersensitivity reactions to the formalin-inactivated respiratory syncytial virus and measles vaccines. Id. Amongst these were: exhibit 1.37 (Helene F. Rosenberg et al., Respiratory Viruses and Eosinophils: Exploring the Connections, 83 Antiviral Res. 1 (2009)), exhibit 1.25 (C. A. Lindemans et al., Systemic Eosinophil Response Induced by Respiratory Syncytial Virus, 144 Clinical Experimental Immunology 409 (2006)), and exhibit 1.15 (D. E. Griffin et al., Measles Vaccines, 13 Frontiers Biosciences 1352 (2008)). Based upon the eosinophils' important role in the response to allergens, Dr. Rostad asserted that finding eosinophils in Carson's tissues links the vaccinations he received to a systemic response that ultimately led to his death. Exhibit 1 at 7.

Then Dr. Rostad discussed specifically how an anaphylactic response can result in death. In this case, he put forth that the hypersensitivity reaction caused the release of vasoactive chemicals that resulted in a severe disruption of cardiovascular homeostasis. Id. at 8. This results in decreased cardiac output, increased left ventricular end diastolic pressure, and an acute increase in respiratory resistance with pulmonary interstitial edema. Id. The sum of these reactions is a fatal cardiovascular collapse, followed by pulmonary edema leading to hypoxemia and death. Id.

Dr. Rostad noted that Carson's pulmonary edema, while not specific for anaphylaxis, is not explained by other etiologies such as "sepsis, pneumonia, primary heart failure or other forms of shock such as massive hemorrhage." Id. Dr. Rostad did not address Carson's resuscitation efforts as a possible cause. Id.

Reflecting back on the evidence he had presented so far, Dr. Rostad notes that "[i]n view of the lack of attributable cause for the eosinophil infiltration and pulmonary edema, the cause of death appears most likely vaccine related." Exhibit 1 at 8.

Dr. Rostad then addressed the timing between vaccination and death. Id. at 9. In forming his opinion on the timing, he asserted that Carson's symptoms began around 40 hours after vaccination and continued into the following day. Id. Though Dr. Rostad did not provide a factual basis in this part of his report for this assertion, on the previous page he noted that "Carson's initial response to the vaccines was noted approximately 40 hours after exposure with arching of the back and tightening of his fists." Id. at 8. This version of events was provided by

Carson's parents in an email to Dr. Rostad. Email from Jeff Nichols, dated Jan. 19, 2014. However, as noted above, the medical records state that Carson did not experience any such symptoms. See Mary Bridge Emergency Room at 5 ("According to dad, [Carson's] past medical history is benign. He had been his usual healthy self with no fevers, running nose, congestion, cough or other illness symptoms."). At petitioners' election, Carson's parents' report has been excluded from the record. Order, filed June 9, 2017. This, accordingly, makes evaluating Dr. Rostad's opinion on timing more difficult because his opinion does not account for the version of events reflected in the medical records. See Burns by Burns v. Sec'y of Dep't of Health & Human Servs., 3 F.3d 415, 417 (Fed. Cir. 1993) (noting that a special master properly rejected the testimony of petitioner's medical expert when the expert's opinion was based on facts not substantiated by the record).

Dr. Rostad discussed several articles to support the idea of a delayed reaction between the vaccination and the onset of symptoms. Exhibit 1 at 9. The first article reported an individual developing rhabdomylosis one week after receiving an inactivated influenza vaccine: exhibit 1.34 (K.S. Raman et al., Influenza Vaccine-induced Rhabdomylosis Leading to Acute Renal Transplant Dysfunction, 21 Nephrology Dialysis Transplantation 530 (2006)). The next article described a young adult who reported acute myopericarditis two days after receiving DTaP, meningococcal conjugated (MCV4), and hepatitis A vaccines: exhibit 1.40 (Maria T. Thanjan et al., Acute Myopericarditis After Multiple Vaccinations in an Adolescent: Case Report and Review of the Literature, 119 Pediatrics 1400 (2007)). Dr. Rostad then noted several articles where myocarditis and perimyocarditis occurred three days, four days, and three weeks after receiving the tetanus, diphtheria/tetanus toxoid / polio and smallpox vaccines respectively. Id. at 8. These were: exhibit 1.10 (Embiya Dilber et al., Acute Myocarditis Associated with Tetanus Vaccination, 78 Mayo Clinic Proc. 1431 (2003)), exhibit 1.7 (Franck Boccara et al., Acute Myopericarditis After Diphtheria, Tetanus, and Polio Vaccination, 120 Chest 16 (2001)), and exhibit 1.29 (Joseph G. Murphy et al., Eosinophilic-lymphocytic Myocarditis After Smallpox Vaccination, 362 Lancet 1378 (2003)). Though petitioners did not file the article, Dr. Rostad also relayed the findings of Manette T. Niu et al., which reported 18 deaths following hepatitis B vaccine with up to a 20 days between the vaccination and the onset of symptoms. Neonatal Deaths After Hepatitis B Vaccine: The Vaccine Adverse Event Reporting System, 1991-1998, 153 Archives Pediatric Adolescent Med. 1279 (1999). As Dr. Rostad notes, these articles present merely correlational data and, more importantly, do not associate the deaths with anaphylaxis to the vaccinations. Exhibit 1 at 9.

Returning to anaphylactic responses, Dr. Rostad briefly mentioned that delayed anaphylactic reactions have been documented in response to mammalian meat. Id. To support this assertion, he cited exhibit 1.42 (Anubha Tripathi et al., Delayed Anaphylaxis to Red Meat Masquerading as Idiopathic Anaphylaxis, 2 J. Allergy Clinical Immunology: In Prac. 259 (2014)). However, Dr. Rostad does not provide much in the way of detail about the specifics of this delayed response and how it affects this case. Examining the article reveals that this article presents a case report of a single individual who experienced an anaphylactic response to pork 3 hours after eating. This was notable, to the authors, since "[a]naphylaxis is traditionally recognized as a rapidly developing combination of symptoms that often includes hives and hypotension or respiratory symptoms. Furthermore, when a specific cause is identified, exposure to this cause is usually noted to have occurred within minutes to 2 hours before the onset of symptoms." Exhibit 1.42 (Tripathi) at 1. Dr. Rostad also points to 10-24 hour delays for wheat-dependent exercise-induced anaphylaxis reported in exhibit 1.36 (Zhu Rongfei et al., Wheat - Dependent Exercise-Induced Anaphylaxis Occurred with a Delayed Onset of 10 to 24 hours After Wheat Ingestion: A Case Report, 6 Allergy Asthma Immunology Res. 370 (2014)). Again, the article is a case report of an extreme reaction wherein the article itself notes that wheat-dependent exercise-induced anaphylaxis usually occurs 1-4 hours after ingestion of the allergen. Exhibit 1.36 (Rongfei) at 370. Thus, it would seem that the article stands for the conclusion that 10-24 hours is, itself, a remarkable delay. Dr. Rostad continues to cite two additional cases with delayed responses: exhibit 1.12 (O. Ferreira et al., Acute hemorrhagic edema of childhood after H1N1 immunization, 30 Cutaneous Ocular Toxicology 167 (2011)) and exhibit 1.16 (N. Hewitt et al., Drug Reaction with Eosinophilia and Systemic Symptoms Associated with H1N1 Vaccination, 42 Internal Med. J. 1365 (2012)). But again, both do not involve cases of anaphylactic reactions. Though evaluated and considered, these articles need no additional discussion here.

Next, Dr. Rostad discussed the evidence he used to support a cause and effect relationship between the vaccines Carson received and his death. Exhibit 1 at 10. He restated his opinion that Carson's death was caused by pulmonary edema, which was secondary to an allergic reaction. Id. He relied upon the increased weight of the lungs and the autopsy findings of pulmonary edema to support his theory because these findings are typical within the context of an allergic reaction. Id. Dr. Rostad also relied upon the presence of eosinophils to support his proposed cause and effect relationship. Id. He cited articles that noted an increase in eosinophils in the spleen and heart of individuals who suffered an anaphylactic death. Id. Specifically, he provided exhibit 1.11 (Erik Edston, Accumulation of Eosinophils, Mast Cells, and Basophils in Anaphylactic Death, 9

Forensic Sci. Med. Pathology 496 (2013)) and exhibit 1.22 (Nicholas G. Kounis et al., Accumulation of Eosinophils, Mast Cells, and Basophils in the Spleen and the Coronary Arteries in Anaphylactic Deaths: Is the Kounis Hypersensitivity Associated Syndrome Present?, 10 Forensic Sci. Med. Pathology 150 (2014)). Additionally, he relied on a case study that reported tissue eosinophilia in an individual who suffered an unexpected death after a multi-organ inflammatory allergic reaction, described in exhibit 1.5 (Erica J. Armstrong, Allergy in Extremis: A Case of Sudden Unexpected Death Due to an Allergy Associated Disease, 35 Am. J. Forensic Med. Pathology 163 (2014)). Finally, Dr. Rostad asserted that the autopsy findings supported the cause and effect relationship. Exhibit 1 at 11. He stated that pulmonary edema and congestion were the most common findings when individuals who experienced fatal anaphylactic shock were autopsied. Id.

In the penultimate section of his report, labelled "Non-vaccine Potential Causes," Dr. Rostad raised the possibility that adjuvants in the vaccine had a role in Carson's death. Id. It is again notable that Dr. Rostad fails to raise, if only to dismiss, the fact that Carson was found face-down in clothes the morning of his death. By failing to acknowledge, even superficially, a critical fact, Dr. Rostad diminishes the value of the rest of his opinions because it appears that Dr. Rostad is focusing only on those pieces of evidence that support a conclusion he was inclined to make.

Dr. Rostad concluded his first report by stating that although there are many non-specific pieces of evidence, "when pieced together with the circumstances and considerable data and understanding of immunology, that they show a synergistic and coherent explanation of the disease." Id.

2. Dr. Harris' First Responsive Report (Exhibit A)

In his first expert report, Dr. Harris concluded that the appropriate diagnosis for this case was sudden unexplained death in infancy (SUID), the same diagnosis provided by Dr. Woolard and Dr. Ramoso. Exhibit A at 6; Mary Bridge Emergency Room at 6; Pierce County Medical Examiner at 15. Dr. Harris opined that the vaccinations did not cause Carson's death.

Dr. Harris began his report by summarizing the relevant facts and autopsy results. Exhibit A at 2-3. Dr. Harris proceeded to discuss SUID and its subcategories of Sudden Infant Death Syndrome (SIDS), Unknown, and Accidental Suffocation and Strangulation in Bed. Id. He agreed with Dr. Rostad that SIDS was not an appropriate diagnosis in this case. Id. However, Dr. Harris asserted that either Unknown or Accidental Suffocation and Strangulation in Bed

would be the appropriate diagnosis based upon Carson's atypical sleeping environment and how he was found the morning of his death. Id. at 5.

Dr. Harris compared the autopsy findings to the pathological findings associated with anaphylaxis described in the literature he cited. He specifically referenced exhibit A, tab 5 (Paul A. Greenberger et al., Fatal Anaphylaxis: Postmortem Findings and Associated Comorbid Diseases, 98 Annals Allergy Asthma Immunology 252 (2007)) and exhibit C, tab 15 (Yiwen Shen et al., Anaphylactic Deaths in Maryland (United States) and Shanghai (China): A Review of Forensic Autopsy Cases from 2004 to 2006, 186 Forensic Sci. Int'l 1 (2009)). Exhibit A at 5. While Dr. Harris noted that some of the findings documented in the autopsy report could be found with anaphylaxis (pulmonary edema and petechial hemorrhages), it was "much more likely" that they are attributable to the resuscitative efforts performed on Carson. Id.

Next, Dr. Harris addressed the increased number of eosinophils found in many of Carson's organs. Id. While he agreed that this finding was "atypical," Dr. Harris referenced, though did not appear to file, Marc E. Rothenberg and Simon P. Hogan, The Eosinophil, 24 Ann. Rev. Immunology 147 (2006) and exhibit A, tab 8 (The Office on Smoking and Health, The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General, Centers for Disease Control and Prevention (2006)) for the proposition that accumulation of eosinophils is a non-specific finding, that can be associated with cases of drug reaction, anaphylaxis, some systemic infections, some autoimmune diseases, or chronic exposure to smoking. Exhibit A at 5. Dr. Harris concluded, with regard to the eosinophils, that "[c]learly [Carson] was exposed to smoking and was found to have nicotine in the blood on autopsy toxicology, and this known smoke exposure is the most likely cause of the increased eosinophils. Id. at 6.

Dr. Harris then directly addressed the conclusions made in Dr. Rostad's first report. Id. Dr. Harris did not dispute the rareness of vaccines causing deadly allergic reactions or the difficulty in diagnosing anaphylaxis. Id. Dr. Harris stated that the findings of pulmonary edema and excess organ weights, on which Dr. Rostad relies as evidence of an allergic reaction, are not specific findings of an allergic reaction. Id. Instead, Dr. Harris asserts that these findings were more likely caused by the administration of CPR. Id. Additionally, Dr. Harris noted that Dr. Rostad did not discuss Carson's sleep position or the effect of exposure to smoke. Id. Dr. Harris emphasized the fact that these critical pieces of evidence account for the same symptoms that Dr. Rostad used to draw his conclusion of anaphylaxis. Id.

In concluding his first report, Dr. Harris restated his opinion that the appropriate diagnosis for this case is SUID. Id. Specifically, accidental suffocation/strangulation is possible based on the Carson's sleeping position. Id. Additionally, Dr. Harris attributed the presence of increased eosinophils to Carson's exposure to smoke. Id. Finally, Dr. Harris asserted that the timing of Carson's death does not support a relationship between the vaccines Carson received and an anaphylactic reaction because anaphylaxis is expected to occur within minutes or hours of exposure to the allergen. Id.

3. Dr. Dreskin's First Responsive Report (Exhibit C)

In his initial report, Dr. Dreskin began by addressing the pertinent facts and then moved into a discussion of the relevant diseases, theory, and timing. Exhibit C at 1. Dr. Dreskin first discussed Carson's only reported medical issue prior to his death—atopic dermatitis—and described it as "a skin disease characterized by excess eosinophils in the blood and in the skin." Id. at 2.

Dr. Dreskin then proceeded into an in-depth analysis of anaphylaxis. He began by noting that while there are minor differences in how anaphylaxis exactly is defined, "it is generally agreed that the onset must be rapid (although this is now extended to 6 hours) and there must be evidence of an allergic reaction affecting at least 2 organ systems." Exhibit C at 2. In coming to his conclusions, he specifically referenced seven articles that informed his analysis: exhibit C, tab 2 (Jens U. Ruggeberg et al., Anaphylaxis: Case Definition and Guidelines for Data Collection, Analysis, and Presentation of Immunization Safety Data, 25 Vaccine 5675 (2007)); exhibit C, tab 8 (Simon G.A. Brown et al., Anaphylaxis: Clinical Patterns, Mediator Release, and Severity, 132 J. Allergy Clinical Immunology 1141 (2013)); exhibit C, tab 4 (Jeffrey Zilberstein et al., Anaphylaxis, 47 J. Emergency Med. 182 (2014)); exhibit C, tab 5 (Phillip Lieberman, The Diagnosis and Management of Anaphylaxis Practice Parameter: 2010 Update, 126 J. Allergy Clinical Immunology 477 (2010)); exhibit C, tab 6 (F. Estelle R. Simons et al., World Allergy Organization Anaphylaxis Guidelines: Summary, 127 J. Allergy Clinical Immunology 587 (2011)); exhibit C, tab 7 (A. Muraro, Anaphylaxis: Guidelines from the European Academy of Allergy and Clinical Immunology, 69 Allergy 1026 (2014)); exhibit C, tab 8 (F. Estelle R. Simons, International Consensus on (ICON) Anaphylaxis, 7 World Allergy Organization J. 1 (2014)).

Dr. Dreskin first details the criterion put forth by Ruggeberg et al. Exhibit C at 2. Though Ruggeberg is the oldest of the articles, it also was the only to consider anaphylaxis specifically in the context of vaccines. Id. Dr. Dreskin reports that Ruggeberg et al. found that anaphylaxis following vaccination can be found at three different levels of certainty:

> According to Ruggeberg et al., at the highest level, there should be skin findings and/or cardiovascular or respiratory findings. At the mid level (level 2), there should be either significant cardiovascular or respiratory findings, and there should be other minor findings in the cardiovascular respiratory gastrointestinal or laboratory (elevated serum tryptase) arenas. At the lowest level (level 3) of diagnostic certainty there should be at least one minor cardiovascular or respiratory criterion and at least one minor criterion from at least 2 other categories (skin, GI, or laboratory evaluation).

Id. As Dr. Dreskin noted, "In the current case, there is only evidence of cardiovascular failure. The autopsy findings of pulmonary edema are not one of the criterion listed." Id.

Dr. Dreskin then reviewed the ICON report. This report provides that all definitions of anaphylaxis involve a "serious, generalized or systemic, allergic or hypersensitivity reaction" Exhibit C at 2 (citing exhibit C, tab 8 (Simons) at 1). To define what constitutes such a reaction, Dr. Dreskin paraphrases from Lieberman et al., which provides that to be consistent with anaphylaxis, the presence or absence of the following should be considered: 1) were there cutaneous manifestations (i.e. itching, flushing, hives, or externally visible swelling), 2) was there any sign of airway obstruction, 3) were there gastrointestinal symptoms (i.e. nausea, vomiting, diarrhea) and 4) were there syncopal symptoms (passing out or nearly passing out). Exhibit C at 2 (citing exhibit C, tab 5 (Lieberman) at 480.e5).

Building upon this, Dr. Dreskin notes that Simons et al., like Ruggeberg et al., provides criteria for anaphylaxis at different levels of certainty. Exhibit C at 2. Simons et al. provides that anaphylaxis is "highly likely" when there is an acute onset of an illness with involvement of the skin, mucosal tissue or both and either respiratory compromise or reduced blood pressure. Exhibit C, tab 6 (Simons) at 593. At a lower level, Simons et al. states that anaphylaxis is likely if two or more of the following systems have symptoms (minutes to several hours) after exposure to a likely allergen for that patient: skin, respiratory, cardiovascular, gastrointestinal. Id. at 593.

Finally, Dr. Dreskin briefly reviewed the Muraro et al. criterion. Exhibit C at 3. He reports that Muraro characterizes anaphylaxis as a "Severe, potentially life-threatening systemic hypersensitivity reaction. This is characterized by being rapid in onset with life-threatening airway, breathing, or circulatory problems and is usually, although not always, associated with skin and mucosal changes." Exhibit C, tab 7 (Muraro) at 1027.

Dr. Dreskin then addressed Dr. Rostad's propositions of delayed anaphylaxis and bi-phasic anaphylaxis. Exhibit C at 3. Dr. Dreskin found it "highly unlikely both from the timing and pathological findings" that Carson experienced a delayed anaphylactic reaction. Id. To establish a time frame for a delayed reaction, Dr. Dreskin relied on the Brown et al. study which analyzed 29 cases of delayed anaphylaxis. Exhibit C, tab 3 (Simon G. A. Brown et al., Anaphylaxis: Clinical Patterns, Mediator Release, and Severity, 132 J. Allergy Clinical Immunology 1141 (2013)). Looking only at cases involving a delayed onset, 76% had the reaction occur within four hours and all but one within 13 hours. Id. at 1133-34.

Dr. Dreskin then critiqued Dr. Rostad's comparison of vaccines to red meat in support of the proposition of a delayed reaction. Dr. Dreskin highlighted the difference between ingesting red meat and receiving a vaccine. Exhibit C at 3. Because a vaccine is injected, it should cause an allergic reaction quicker than a reaction caused by the ingestion of meat. Id. Dr. Dreskin refers to Kelso et al., which states that vaccines should cause allergic reactions, such as anaphylaxis, more quickly than red meat--typically within 4 hours. Exhibit C, tab 9 (John M. Kelso, Allergic Reactions After Immunization, 110 Annals Allergy Asthma Immunology 397 (2013)) at 398. With this time frame established, Dr. Dreskin stated that the time frame of 96 hours between Carson's vaccination and his death is not explained by a delayed anaphylactic reaction. Exhibit C at 3.

Next, Dr. Dreskin addressed the theory that a bi-phasic anaphylactic reaction was applicable in this case. Id. He agreed that in a bi-phasic anaphylactic reaction an initial event can be followed up to 72 hours later by another reaction. Id. However, Dr. Dreskin did not find any evidence of an initial event or an early phase reaction in Carson's history. Id. He then stated that he did not know of any cases reporting a bi-phasic anaphylactic reaction that occur without an initial anaphylactic reaction. Id.

Like Dr. Harris, Dr. Dreskin disagreed with the weight Dr. Rostad gave the evidence of eosinophils being found in multiple organs. Id. Dr. Dreskin stated that the articles Dr. Rostad relied upon noted that it is typical for eosinophils to be present in organs and that an increased number of eosinophils can be attributed to a variety of situations, including that of atopic dermatitis, which Carson had. Id. He further noted that references reporting increased numbers of eosinophils following anaphylaxis are only found following referenced to increased numbers of mast cells and basophils, which were not noted in Carson's tissues. Id.

Dr. Dreskin then concludes that is was his opinion that "there is no logical sequence that can connect Carson's death on 9/16/2006 to anaphylaxis from the vaccines he received on 9/11/2006." Id. Dr. Dreskin did not find evidence that

indicated that Carson suffered from an anaphylactic reaction. Id. Even if Carson had, Dr. Dreskin found the time between vaccinations and cardiopulmonary arrest too long to support the conclusion that a delayed reaction occurred. Id. He did not accept the mild symptoms reported by the Nicholses to be indications of initial anaphylaxis or any type of allergic reaction. Id. Therefore, a bi-phasic reaction could not have occurred because there was no initial event. Id.

4. Dr. Rostad's First Responsive Report (Exhibit 2)

In his second expert report, Dr. Rostad provided a reply to Dr. Harris' first expert report. Petitioners' other expert, Dr. Levy--an immunologist--provided a response to Dr. Dreskin's report. Dr. Rostad began by addressing Dr. Harris' claim that pulmonary edema and excess organ weights could be attributed to resuscitation efforts. Exhibit 2 at 1. Dr. Rostad agreed that these findings were non-specific. Id. However, he noted that no specific findings were attributed to resuscitation and disagreed with Dr. Harris' conclusion. Id. Further, Dr. Rostad reasserted that the increased organ weights were reflective of inflammation-related edema, which is connected to an allergic response through the increased number of eosinophils. Id. at 2.

Dr. Rostad then critiqued Dr. Harris' conclusion that the increased number of eosinophils was a result of smoke exposure. Id. Dr. Rostad did not agree with how Dr. Harris reached this conclusion and stated it assumed smoke exposure and increased eosinophils are causally related. Id. Although evidence shows that smoke exposure may induce eosinophilia in the lungs, Dr. Rostad states that increased eosinophils in multiple organs is not a recognized effect. Id. Accordingly, Dr. Rostad argued that smoke exposure does not account for the atypical finding of increased multi-organ eosinophils. Id. at 2-3. Dr. Rostad also argued that the alternative explanations for increased multi-organ eosinophils proposed by Dr. Harris were speculation. Id. at 3. Dr. Rostad briefly noted that he and Dr. Harris agreed that the findings in this case did not support a SIDS diagnosis. Id. at 3-4.

Dr. Rostad then rebutted the timeline Dr. Harris established for a delayed anaphylactic reaction to occur. Id. at 4. He found Dr. Harris' statement that Carson's death was too delayed to be inconsistent with the literature. Id. He uses Greenberger et al. to support this claim, since in the Greenberger article four individuals had a 24 to 96 hours elapse between the time of allergen exposure to death. Exhibit C, tab 14 (Greenberger) at 254. Dr. Rostad also cites Shen et al., pointing out that the authors in that paper reported "exposure to death" intervals of up to three days. Exhibit C, tab 15 (Shen) at 3. Finally, Dr. Rostad again raised the possibility of a biphasic anaphylactic reaction. Exhibit 2 at 4. In discussing

these articles, Dr. Rostad is relying upon the time between allergen presentation and death, and not the time between allergen presentation and the onset of symptoms. Because the parties have agreed to proceed with the assumption that Carson did not present any symptoms in the days before his death, it appears that the former time frame is the more relevant one.

In his second report, Dr. Rostad also addressed the autopsy findings and how the evidence supported the conclusion that an anaphylactic reaction occurred. Id. Dr. Rostad asserted that in applying the criteria for diagnosing anaphylaxis suggested by Dr. Harris, Carson exhibited three of the features from the diagnostic criteria: pulmonary edema, petechial hemorrhages, and multi-organ eosinophils. Id. Dr. Rostad reemphasized the difficulty of diagnosing anaphylaxis at autopsy and agreed with Dr. Harris that the upper airway tissues should have been analyzed. Id. As a result, Dr. Rostad stated that it is unknown whether signs of upper airway edema or hyperinflation of the lungs were present. Id.

Dr. Rostad then turned to Dr. Harris' assertion that the autopsy findings could be explained by resuscitation efforts. Id. at 6. Dr. Rostad did not agree that resuscitation efforts could explain the findings of pulmonary edema and petechial hemorrhages because these findings are not diagnostic pathological criteria for resuscitation, that is "features whose presence means that it was present beyond any doubt." Id. Dr. Rostad noted again that multi-organ eosinophils were not a diagnostic feature for either resuscitation or smoke exposure. Id. Dr. Rostad claimed that Dr. Harris ignored these findings as signs of anaphylaxis. Id.

Dr. Rostad concluded his report by summarizing the weaknesses of Dr. Harris' report. Id. He asserted that Dr. Harris did not provide a clear explanation for the autopsy findings and that he used outdated criteria for diagnosing anaphylaxis. Id. at 6-7. Further, he determined that Dr. Harris dismissed evidence of anaphylaxis, although the signs of anaphylaxis are subtle and diagnosis in an infant is extremely difficult. Id. at 7. Both Dr. Rostad and Dr. Harris agreed that multi-organ eosinophils were an atypical finding and that SIDS was not an appropriate diagnosis in this case. Id. Dr. Rostad concluded by emphasizing that pulmonary congestion and edema were the most common findings in individuals who died of anaphylaxis and therefore, these findings should serve as evidence that Carson experienced an anaphylactic reaction. Id. at 8.

5. Dr. Levy's Report (Exhibit 3)

In his only expert report, Dr. Levy concluded that it was "plausible the vaccines received on 9/11/06 contributed to Carson Nichols' death." Exhibit 3 at 1. He began his report by summarizing the relevant facts, including the reports of

fussiness made by Carson's parents in the email to Dr. Rostad, and addressing other relevant alternative diagnoses. Id. at 2. Dr. Levy explained that while sudden infant death syndrome (SIDS) can be associated with smoke exposure, it does not include symptoms of multi-organ eosinophils. Id.

Dr. Levy described anaphylaxis and how it supports the plausibility of vaccines contributing to Carson's death. He also cited Exhibit C, tab 15 (Greenberger) for the proposition that anaphylactic reactions can occur 24-96 hours after being exposed to the allergen. Exhibit 2 at 2-3. Again, the undersigned notes that no case documented in Greenberger presented more than 60 minutes after the onset of the allergen. Exhibit C, tab 14 (Greenberger) at 254. Referencing exhibit 3.19 (Phil Liberman, Biphasic Anaphylactic Reactions, 95 Ann Allergy Asthma Immunology 217 (2005)), Dr. Levy differentiated a bi-phasic reaction as a specific type of anaphylactic reaction, defining it as a primary event followed by a secondary reaction up to 72 or more hours later. Exhibit 2 at 3. In the context of vaccine cases, he referenced exhibit 3.10 (Michael M. McNeil et al., Risk of Anaphylaxis After Vaccination in Children and Adults, 137 J. Allergy Clinical Immunology 868 (2016)) to support the conclusion that, in the realm of vaccine-triggered anaphylaxis, the reaction could begin up to eight hours later, or even the following day. Exhibit 2 at 3.

Then Dr. Levy discussed Carson's living environment and how his exposure to cigarette smoke could have played a role in his response to his vaccinations. Exhibit 2 at 3. The studies on which he relied suggested that exposure to cigarette smoke affects the lungs' tolerance for allergens, which increases the likelihood that an allergic response would occur. See exhibit 3.11 (Katrien B. Moerloose et al., Cigarette Smoke Exposure Facilitates Allergic Sensitization in Mice, 7 Respiratory Res 49 (2006)); exhibit 3.13 (Yoav Arnson et al., Effects of Tobacco Smoke on Immunity, Inflammation and Autoimmunity, 34 J. Autoimmunology 258-65 (2010)).

Dr. Levy next described the process of diagnosing anaphylaxis postmortem as being based on exclusion of other explanations and the circumstances surrounding the death. Exhibit 2 at 3. In general, an allergic reaction could be suggested by the postmortem findings of "laryngeal edema, mucous plugging in the airways, erythematous skin rash and edema, eosinophilia in the mucosa and submucosa of the respiratory and the gastro-intestinal tracts, and marked pulmonary congestion and edema." Exhibit C, tab 15 (Shen) at 3. In this case, Dr. Levy found the findings of pulmonary edema, increased multi-organ eosinophils, and petechial hemorrhages of the thymus, pleural, and epicardium to be potential indicators of an allergic reaction. Exhibit 2 at 4.

Dr. Levy discussed the importance of eosinophils. Id. at 3. To begin, he noted that an accumulation of eosinophils in many organs has been associated with the occurrence of an anaphylactic reaction. Id. In general, eosinophils are phagocytic cells that play a role in modulating the body's reaction to an allergen. Id. The accumulation of eosinophils contribute to the severity of a disease. Id.

Dr. Levy ended his report stating that the evidence of inflammation, increased organ weight, and presence of eosinophils in multiple organs were enough to conclude that it was plausible Carson experienced a delayed anaphylactic reaction, caused by his vaccinations, which was a factor in his death. Id. He noted that although it was rare for vaccines to cause a bi-phasic or delayed anaphylaxis with the symptoms of multi-organ eosinophils and organ edema, there was no other clear diagnosis. Id.

6. Dr. Harris' Second Responsive Report (Exhibit E)

In his supplemental expert report, Dr. Harris provided comments on Dr. Levy's report and on Dr. Rostad's reply report. Exhibit E at 1.

First, Dr. Harris comments on Dr. Levy's expert report. Id. He notes that while Dr. Levy addresses many of the facts in the case, Dr. Levy does not acknowledge or incorporate into his opinion that Carson was not ill prior to death or that Carson was found lying face-down in a pile of clothes. Id.

Addressing the issue of the number of eosinophils in Carson's organs, Dr. Harris referenced a study by Kato et al., which examined 117 biopsies and autopsies and found the presence of eosinophils in several organs. Exhibit E at 2. Dr. Harris entered this study as exhibit E, tab 2 (Masahiko Kato et al., Eosinophil Infiltration and Degranulation in Normal Human Tissue, 252 Anatomic Record 418 (1998)). Dr. Harris notes that the organs Kato et al. identified were the same organs in which Carson was determined to have eosinophils present. Exhibit E at 2. Additionally, Dr. Harris stated that he would not be surprised if Carson had had blood hypereosinophilia based upon his diagnosis of atopic dermatitis given that atopic dermatitis and blood eosinophilia are associated in the literature. Id. To support this association, Dr. Harris pointed to exhibit E, tab 1 (Magnus P. Borres et al., Peripheral Blood Eosinophilia in Infants at 3 Months of Age is Associated with Subsequent Development of Atopic Disease in Early Childhood, 95 J. Allergy Clinical Immunology 694 (1995)) and exhibit E, tab 3 (Donald Y.M. Leung et al., New insights into atopic dermatitis, 113 J. of Clinical Investigation 651 (2004)). However, Dr. Harris still held the opinion that Carson's exposure to smoke was the most likely explanation for the increase in eosinophils. Exhibit E at 2.

Dr. Harris challenged Dr. Levy's use of medical literature in support of his explanation of a bi-phasic anaphylactic reaction and asserted that the articles Dr. Levy cited did not address the reaction in the context of vaccinations. Id. Dr. Harris then restated his opinion that Carson's medical records do not show any evidence of an anaphylactic reaction from the date of immunization to the time of his death. Id.

When addressing postmortem results, Dr. Harris noted that pulmonary edema is the only finding suggestive of the occurrence of anaphylaxis in the autopsy. Id. However, he notes that pulmonary edema is commonly found in autopsies and is not specific to an anaphylactic reaction. Id. Dr. Harris further remarked that Dr. Rostad and he observed the presence of multi-organ eosinophilia. However, the autopsy report did not say anything about eosinophilia. Dr. Harris appeared to be implying that the medical examiner either did not consider the number of eosinophils as atypical or that the eosinophilia was not useful in diagnosis.[5] Id. at 3.

Dr. Harris also addressed Dr. Rostad's second supplemental report. Id. Dr. Harris began by addressing Dr. Rostad's reliance on Carson's increased organ weights as an indicator of inflammation-related edema in his organs. Id. Dr. Harris stated that because Carson was in the 85th percentile for weight on his visit to the pediatricians on September 11, 2006, it is not surprising that Carson's organs were also above-average in weight. Referencing exhibit 1.32 (Jeremy W. Pryce et al., Reference Ranges for Organ Weights of Infants at Autopsy: Results of > 1,000 Consecutive Cases from a Single Centre, 14 BMC Clinical Pathology 18 (2014)), Dr. Harris pointed out that almost all of Carson's organs fell in a similar part of the weight distribution as his total body weight did. Exhibit E at 3. Ultimately, Dr. Harris found that the organ weights do not support a finding of "inflammation-related edema." Id.

Dr. Harris then revisited his previous statement, concurring with Dr. Rostad, that the eosinophils found in Carson's tissues were an "atypical finding." Id. Dr. Harris now stated that "in further researching the subject . . . it seems that there is some variability in the number of eosinophils found in autopsy tissues and biopsies. In support of this premise, Dr. Harris again cites exhibit E, tab 2 (Kato). On the basis of Kato et al., Dr. Harris indicated that he now believes that the eosinophils found in Carson were not atypical since the only tissue displaying substantial increases in eosinophils was Carson's lungs, and he continues to

[5] The autopsy report states that the slides were examined and that the "microscopic finding (sic) are considered in the overall review of the case." Pierce County Medical Examiner at 19. However, the term "eosinophilia" is never mentioned in the report.

associate the lung eosinophilia to the second-hand smoke that Carson experienced. Exhibit E at 3. Dr. Harris recognizes that no one has studied how smoking affects infants' lungs specifically. However, he notes that the report of the Surgeon General from 2006 (exhibit A, tab 8 at 264) did find that after exposure to second-hand smoke, children showed eosinophilia in their blood. Exhibit E at 4.

Dr. Harris concluded his report by stating the presence of multi-organ eosinophils is a non-specific finding and is not indicative of congestion or edema which would cause death. Id. Finally, Dr. Harris reiterated that the evidence does not support a finding of an anaphylactic reaction and that the medical examiner made the correct designation when he stated that Carson's death was "undetermined." Id.

7. Dr. Dreskin's Second Report (Exhibit F)

In his supplemental report, Dr. Dreskin addressed issues raised by Dr. Levy's report and provided additional information about the points he raised in his previous report. Exhibit F at 1. To begin, Dr. Dreskin agreed with Dr. Harris's assertion that smoke exposure was the most likely explanation for the increased eosinophils that were found. Id. Dr. Dreskin disagreed with Dr. Levy's assertion that exposure to smoke would lead to an enhancement of the allergic response. Id. Dr. Dreskin found that exposure to smoke may lead to an increased risk of rhinitis, but did not find a suggestion in the data that supported the conclusion that the risk of anaphylaxis was increased. Id.

Next, Dr. Dreskin discussed the McNeil article (exhibit 3.10) cited by Dr. Levy. Id. at 2. Dr. Dreskin pointed out that the article had reviewed 25,173,965 doses of vaccines and found only 33 cases of vaccine-triggered anaphylaxis. Id. He further noted that with the exception of four cases reporting uncertain timing, none of the cases reported a delay in reaction occurring more than 24 hours after administration of the vaccine. Id. Furthermore, none of these cases resulted in death — making an extreme vaccine-induced injury exceedingly rare. Id. Dr. Dreskin used this article as the basis for his statement that "for death from anaphylaxis triggered by a vaccine to become evident at 96 hours after vaccination is extraordinarily unlikely and not plausible." Id.

Dr. Dreskin then responded to Dr. Levy's opinion of vaccine causation. Id. Dr. Dreskin reiterated that he did not find evidence of an anaphylactic reaction in Carson's medical record. Id. Additionally, he noted that there were not any reports in the literature documenting the onset of anaphylaxis with no initial symptoms. Id. In the context of vaccine administration, Dr. Dreskin could not find any reports of a bi-phasic reaction occurring more than 96 hours after the

vaccination. Id. 2-3. Finally, he clarified that while exposure to cigarette smoke can enhance allergic inflammation in the airways, it does not enhance acute allergic reactions, like anaphylaxis. Id. at 3.

Dr. Dreskin concurred that a SUID – Accidental Suffocation and Strangulation in Bed is a reasonable alternative diagnosis and the most likely explanation for Carson's death based on the available evidence. Id.

8. Dr. Rostad's Final Reports (Exhibits 6-8)

Dr. Rostad filed three short reports during the beginning of 2017. The first two are responses to Dr. Harris and the third is a comment on the basis of Dr. Rostad's opinion in previously submitted reports.

In the first of these, Dr. Rostad began by replying to Dr. Harris' discussion of the weight of Carson's organs. Exhibit 6 at 1. Dr. Rostad commented upon the Pryce et al. article (exhibit 1.32) to explain why Carson's organ weights should be considered higher than a controlled population. Exhibit 6 at 1-2. Dr. Rostad explained that true normal infant weights are difficult to determine because most "normal infants usually do not die, with the exception of violent accidental or homicidal death." Exhibit 6 at 1. These deaths skew the norm higher, Dr. Rostad claims, than the true population because some organs in SIDS patients have been found to be heavier than average. Id. at 1-2. Therefore, Carson's already higher organ weights should be considered a much greater increase in comparison to the organ weights of a normal infant. Id.

Dr. Rostad then turned to a discussion of the presence of eosinophils in multiple organs. Exhibit 6 at 2. Dr. Rostad criticized Dr. Harris' conclusion that eosinophils are normally scattered throughout organs because the study Dr. Harris relied on, Kato et al. (exhibit E, tab 2), consisted of mostly adults. Exhibit 6 at 2. In addition, Dr. Rostad claims that the Kato study used a methodology that was better suited to identify eosinophils compared to a normal histological preparation, that the study sampled individuals without reporting on the patients' medical condition, that the number of studied organs is small, and that the authors insufficiently quantified the eosinophils in their preparations. Id. As such, Dr. Rostad concluded that this study should not serve as a basis to discredit multi-organ eosinophils as being an atypical finding and evidence of the cause of Carson's death. Id. Dr. Rostad restated his conclusion that multi-organ eosinophils cannot be attributed to Carson's smoke exposure. Id.

Dr. Rostad concluded this report by stating that "given the constellation of features, the findings are supportive of a vaccine-induced reaction as a cause of death." Id. at 3.

In a one-paragraph reply report, Dr. Rostad produced several articles in support of his conclusion that the time for eosinophils to accumulate in tissue was on the order of hours and not minutes. Exhibit 7. As a result, Dr. Rostad states that the eosinophils are, themselves, not indicative of suffocation since there would not have been sufficient time for them to accumulate. Id.

In the final report, Dr. Rostad stated that his previous opinions were based "solely on the gross and microscopic findings of this autopsy." Exhibit 8 at 1. This report followed the Nicholses' decision to proceed without relying upon any evidence that Carson may have been demonstrating symptoms of anaphylaxis in the days before his death. Dr. Rostad stated that his "discussion of Carson's cause of death did not rely on or refer to any clinical findings (i.e. symptoms or physical signs), based on clinic notes, parent's or other caregiver's recollections or other forms of investigation." Id. Dr. Rostad addressed his previous reference to reports by Carson's father that Carson was fussier than normal following the vaccine as "merely correlative after-the-fact." Dr. Rostad concluded by stating that "the pathological findings stand alone" and that "Carson's increased organ weights, pulmonary edema and systemic eosinophilia are the compelling findings supporting an anaphylactic reaction; and these are indisputably supported by the histologic and pathologic diagnoses on autopsy. Id. at 2.

9. Dr. Harris' Final Responsive Report (Exhibit G)

Dr. Harris' final report addressed Dr. Rostad's final supplemental reports and associated references. Exhibit G. In his comment to Dr. Rostad's report filed as exhibit 7, Dr. Harris agrees with Dr. Rostad's conclusion that the eosinophilia is not attributable to suffocation. Id. at 1. However, Dr. Harris points out that Dr. Rostad does not discuss in his report Carson's chronic exposure to smoke and how that may have induced Carson's eosinophilia. Id.

Dr. Harris also commented on Dr. Rostad's report filed as exhibit 8. Here, Dr. Harris challenges Dr. Rostad's claim that his expressed opinions on the cause of death was based only on the autopsy findings. Id. Dr. Harris stated that forensic investigation of a suspected anaphylactic reaction contributing to death necessitates careful consideration of circumstantial information outside of the pathology report and that the clinician and pathologist must consider symptoms and timing very carefully to conclude that anaphylaxis was the cause of death. Id.Dr. Harris concludes by saying that while some of the autopsy findings are also found in cases of anaphylaxis, they are not specific to anaphylaxis and do not establish a diagnosis in this case. Id. at 2.

10. Dr. Dreskin's Final Responsive Report (Exhibit H)

In Dr. Dreskin's final report, he responded to Dr. Rostad's final supplemental reports filed as exhibits 7 and 8. Dr. Dreskin agreed with Dr. Harris that known smoke exposure was the most likely cause of Carson's eosinophilia. Exhibit H at 1. Dr. Dreskin further stated that Carson's eosinophilia was "highly non-specific" and that eosinophilia "is not diagnostic of, or even an indicator, of anaphylaxis." Id.

Furthermore, Dr. Dreskin pushed back on Dr. Rostad's claim that the pathological findings can stand alone. Id. Dr. Dreskin cited an article by Simon and Sampson and noted that while diagnosis in infants is challenging, symptoms that can provide a basis for diagnosis are still present. Id. This article was introduced as exhibit H, tab 1 (F. Estelle R. Simons and Hugh A. Sampson, Anaphylaxis: Unique Aspects of Clinical Diagnosis and Management in Infants (Birth to Age 2 Years), 135 J. Allergy Clinical Immunology 1125 (2015)). Specifically, Dr. Dreskin highlighted the part of the Simon and Sampson article noting that anaphylaxis in infants is accompanied by presentation in the skin and subcutaneous tissue in 98% of cases, the respiratory system in 59% of cases, and the gastrointestinal system in 56% of cases. Exhibit H, tab 1 (Simon and Sampson) at 2.

Dr. Dreskin concluded his report by stating that there was "no logical sequence that can connect Carson's death on September 16, 2006 to anaphylaxis from the vaccines he received on September 11, 2006." Exhibit H at 1. Dr. Dreskin went on: "Carson did not have sudden onset symptoms of anaphylaxis. Without having symptoms of anaphylaxis, he could not have had anaphylaxis and, without anaphylaxis, he could not have either prolonged or biphasic anaphylaxis." Id.

IV. Standards for Adjudication

Compensation under the Vaccine Act is available in two major forms. Table injuries, which presume causation, can be established if a prescribed injury occurs during a set period of time following a specific vaccination. 42 U.S.C.A. § 300aa-11(c)(1)(C)(i). Alternatively, petitioners can receive compensation for injuries not provided for in the Vaccine Injury Table by bringing a successful petition for compensation under 42 U.S.C.A. § 300aa-11(c)(1)(C)(ii) of the Vaccine Act.

Here, petitioners do not claim that Carson's death constitutes a Table injury under the Vaccine Act. As an "off-Table Injury," petitioners must themselves demonstrate that the vaccine caused petitioners' injury.

Petitioners' burden of proof as an off-Table injury is explicitly defined by Congress. The Act provides that a petitioner must show, by a preponderance of the evidence, that the vaccine sustained or significantly aggravated her illness or injury. See 42 U.S.C. § 300aa–13(a)(1) and 42 U.S.C.A. § 300aa-11(c). As for what is specifically required to meet this burden, the only requirement of the statute is that the conclusion of the court or special master may not be "based on the claims of a petitioner alone, unsubstantiated by medical records or by medical opinion." 42 U.S.C.A. § 300aa-13. The statute does not speak to the strength or reputability of the medical opinion, just that a medical opinion or medical records are necessary for a claim to be meritorious. Id.

In drawing conclusions on causation, the Federal Circuit has noted that special masters must be careful to not impermissibly raise petitioners' burden by establishing tests that create requirements not in the statute itself. Capizzano v. Sec'y of Health & Human Servs., 440 F.3d 1317, 1325 (Fed. Cir. 2006) (rejecting a test that required "epidemiologic studies, rechallenge, the presence of pathological markers or genetic disposition, or general acceptance in the scientific or medical communities"); Althen v. Sec'y of Dep't of Health & Human Servs., 418 F.3d 1274, 1279 (Fed. Cir. 2005) (rejecting a test requiring "confirmation of medical plausibility from the medical community and literature" in order to prove causation-in-fact); Knudsen by Knudsen v. Sec'y of Dep't of Health & Human Servs., 35 F.3d 543, 549 (Fed. Cir. 1994) ("to require identification and proof of specific biological mechanisms would be inconsistent with the purpose and nature of the vaccine compensation program").

Instead, special masters must consider all the evidence and decide whether the causal link between the vaccine and the injury was logical and legally probable. See Knudsen by Knudsen, 35 F.3d at 549 ("The sole issues for the special master are, based on the record evidence as a whole and the totality of the case, whether it has been shown by a preponderance of the evidence that a vaccine caused the [] injury."); Grant v. Secretary of Dep't of Health & Human Servs., 956 F.2d 1144, 1148 (Fed. Cir. 1992) ("Causation in fact requires proof of a logical sequence of cause and effect showing that the vaccination was the reason for the injury."); Hines on Behalf of Sevier v. Sec'y of Dep't of Health & Human Servs., 940 F.2d 1518, 1525 (Fed. Cir. 1991) ("causation in fact requires proof of a logical sequence of cause and effect showing that the vaccination was the reason for the injury.").

In determining whether preponderant evidence exists, the Federal Circuit has set forth a three-part framework for evaluating claims of vaccine injury causation. As explained in Althen, and subsequent decisions, the petitioners must put forth: "(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.

These analyses are not completely independent. The Federal Circuit has pointed out, for instance, that the second and third prongs of the Althen analysis may very well overlap. Capizzano 440 F.3d at 1326 (Fed. Cir. 2006) ("We see no reason why evidence used to satisfy one of the Althen III prongs cannot overlap to satisfy another prong. In other words, if close temporal proximity, combined with the finding that [the] vaccine can cause [a disease], demonstrates that it is logical to conclude that the vaccine was the cause of the [disease] (the effect), then medical opinions to this effect are quite probative."). That these analyses overlap only makes sense given the importance of temporal proximity in making conclusions regarding whether a sequence of cause and effect is "logical." Temporal proximity (or the lack thereof) is usually one of the most salient pieces of evidence used in concluding causation and is also one of the few pieces of evidence that can serve as a *sine qua non* in establishing causation-in-fact. See Locane v. Sec'y of Health & Human Servs., 685 F.3d 1375, 1381 (Fed. Cir. 2012) (citing Locane, 99 Fed. Cl. 715, 729 (2011)) ("[n]owhere in the statutory scheme or Federal Circuit precedent emerges a requirement that the special master conduct a causation analysis once the special master has determined that a preponderance of the evidence shows that the onset of the illness predates the vaccination.").

Though the second and third prong of the Althen analysis overlap, the Federal Circuit has identified a reason for separating the analyses. The bifurcation highlights the important limitation that, under the Vaccine Act as interpreted by the Federal Circuit, temporal proximity may be necessary, but is never sufficient for proving causation. Althen, 418 F.3d at 1278 (citing Grant, 956 F.2d at 1149 ("[a]lthough probative, neither a mere showing of a proximate temporal relationship between vaccination and injury, nor a simplistic elimination of other potential causes of the injury suffices, without more, to meet the burden of showing actual causation.") In Capizzano, the Federal Circuit further expounded upon the importance of evaluating whether a logical sequence of cause and effect exists independently of the timing analysis. Specifically, Capizzano stated "There may well be a circumstance where it is found that a vaccine can cause the injury at issue and where the injury was temporally proximate to the vaccination, but it is illogical to conclude that the injury was actually caused by the vaccine." 440 F.3d at 1327.

V. Analysis

A. Althen Prong One: Petitioners' Medical Theory

Petitioners allege that Carson's death was the result of a vaccine-triggered anaphylactic reaction. Anaphylaxis is an acute, systemic, and potentially lethal hypersensitivity reaction that can occur after exposure to an allergen. See, e.g. exhibit H, tab 1 (Simons and Sampson) at 1. Almost any foreign substance can cause an anaphylactic response. Id. at 1-2. This includes vaccines. Id. at 2. Based on the expert reports and medical literature filed, there appears to be no debate that vaccine-triggered anaphylaxis is a recognized, though rare, medical condition.[6] Consistent with its widespread acceptance, anaphylaxis is recognized throughout the Vaccine Injury Table when occurring within 4 hours of vaccination. See 42 C.F.R. § 100.3. Accordingly, the undersigned finds that vaccine-triggered anaphylaxis is a plausible medical theory linking Carson's vaccination and death. By presenting a reputable theory of the case—anaphylaxis—it is possible to assess whether the timing between the vaccination and the injury is appropriate and whether there exists a logical sequence of cause and effect between the two. See Langland v. Sec'y of Health & Human Servs., 109 Fed. Cl. 421, 443 (2013) (analyzing prong three of Althen depends on having a "reputable theory as to how the vaccination could cause the injury.").

B. Althen Prong Three: Temporal Relationship between the Vaccination and the Injury

Determining whether a proximate temporal relationship exists between the vaccination and the injury logically requires two different steps. First, petitioners must establish a timeframe for which it is medically acceptable to infer causation under their medical theory. Second, petitioners must show that the onset of the injury was consistent with the expected timeframe. See Shapiro v. Sec'y of Health & Human Servs., 101 Fed. Cl. 532, 542-43 (2011) (adopting this two part analysis), recons. denied after remand on other grounds, 105 Fed. Cl. 353 (2012), aff'd without op., 503 F. App'x 952 (Fed. Cir. 2013).

1. Expected Time between Vaccination and Anaphylaxis

Rapid onset is a hallmark of anaphylaxis. Exhibit C, tab 2 (Ruggeberg) at 5 (noting that for all levels of diagnostic certainty, anaphylaxis is characterized by

[6] Specifically, as noted in the McNeil et al. article, vaccine-triggered anaphylaxis was observed in 33 cases in a study of 25 million vaccine doses (though none resulted in death). Exhibit F, tab 1 (McNeil) at 871.

sudden onset). However, it is not universal. Delayed anaphylactic reactions, while rare, are reported in the literature. The exact prevalence of delayed reactions and the length of the delay shows some variation across the articles petitioners and respondent cite. However, no article supports the conclusion that a delay of approximately 100 hours between a vaccine and an anaphylactic reaction is even remotely likely. In fact, a delay of that length appears unheard of.

In the context of anaphylaxis, petitioners' experts rely on a 2007 review of pediatric anaphylaxis by Lane and Bolte to support the likelihood of a delayed onset in Carson's case. Exhibit 1 at 6, citing exhibit 1.23 (Lane & Bolte). While the article does note that "[d]elayed reactions, developing as late as 72 hours after the initial reaction, occur in children", it also makes clear that "[s]ymptoms can occur in as little as seconds or rarely several hours after exposure to an antigen." Exhibit 1.23 (Lane and Bolte) at 51. The authors further note that this is highly dependent on the route of administration, noting that parenteral administrations of the antigen (meaning that the antigen was injected directly into the body, as was the case here) are "associated with shorter latency periods (seconds to minutes)." Id. Petitioners' other expert, Dr. Ofer Levy, also cites the Muraro et al. article in support of his conclusion that delayed anaphylaxis is a well-described phenomenon. Exhibit 3 at 2-3; exhibit C, tab 7 (Muraro). However, the Muraro et al., article appears to reference only biphasic reactions and with regards to them states that the "evidence for [biphasic reactions] is of low quality" and that the reaction reactions usually occur within 4-12 [hours] of the first symptoms or signs." Exhibit C, tab 7 (Muraro) at 1027.[7]

Experts from both parties describe several empirical studies on the timing of anaphylaxis. Greenberger et al. examined 25 fatalities resulting from anaphylaxis, though in only 22 of these cases was the timing of the presentation of the antigen known. Exhibit C, tab 14 (Greenberger) at 254. Of these, 21 individuals had the onset of symptoms occur 30 minutes or less after exposure to the antigen and one had the onset occur 31-60 minutes after exposure. Id. Four of the 22 cases resulted in death more than 24 hours after exposure, with one 96 hours after exposure. Id. However, the authors are careful to note that the "4 patients who experienced a delayed death (24-96 hours) each developed an immediate and severe anaphylactic reaction that required mechanical ventilation and admission to the intensive care unit." Id. at 255.

[7] Any discussion of biphasic anaphylactic reactions is particularly misplaced in this case because no reliable evidence indicates that Carson suffered an initial reaction. See supra p. 10-11)

Brown et al. identified delayed deteriorations that were severe enough to require treatment with epinephrine in 29 of 315 anaphylactic reactions studied (9.2%). Exhibit C, tab 3 (Brown) at 1143. Of the 29 delayed deteriorations, 20 (70%) occurred in under 3 hours from the time of onset, all but one occurred within 13 hours of the time of onset, and one occurred 30 hours after the time of onset. Id. at 1149 (table E1).

McNeil et al. examined the incidence of anaphylaxis after vaccination using data from the Vaccine Safety Datalink. Exhibit 3.10 (McNeil). This large scale study identified 33 confirmed cases of vaccine-triggered anaphylaxis following 25 million doses of vaccine, 29 of which had a documented timeline. Id. at 871. Of these, onset of symptoms was fewer than four hours in 26 (90%) cases. Id. at 872. The longest delay between the onset of anaphylaxis and the vaccine administration was 20 hours.[8] Id. Furthermore, none resulted in death. Id.

In sum, the time of onset for anaphylaxis is, in the vast majority of cases, measured as a matter of minutes, sometimes hours, but not days. While some evidence indicates that, in rare cases, death from anaphylaxis can occur as long as 96 hours after the antigen is presented, the Nicholeses did not present any persuasive evidence showing that the onset of symptoms begins more than 36 hours from the time the antigen is presented.

2. Time between Vaccination and the Putative Anaphylaxis in this Case

Carson received the vaccinations in question at a well-child visit on September 11, 2006, and was reported as being healthy up and until his death in the early morning of September 16, 2006. Emergency Bridge Emergency Room at 5. As a result, at least 100 hours passed between the vaccination and the onset of Cason's symptoms.

It is true that Dr. Rostad incorporated an account of Carson as being "fussier than normal" on September 13 and 14, 2006 in his initial report. Exhibit 1 at 3. This report was provided by Carson's dad to Dr. Rostad in an email. Email from Jeff Nichols, dated Jan. 19, 2014. Mr. Nichols's communication with Dr. Rostad

[8] The McNeil authors limited their search criteria to cases of anaphylaxis within 48 hours of vaccine administration. Id. at 869. As such, there is some circularity to the logic concluding on the basis of this data that anaphylaxis does not occur more than 48 hours after vaccine administration. Nonetheless, the data from McNeil are clear: anaphylactic reactions are highly clustered around the time of exposure and then trail off. Even though the authors included cases of anaphylaxis up to 48 hours after the administration of the vaccine, no case occurred more than 20 hours after vaccination.

served as the basis for Dr. Rostad's conclusion of a biphasic anaphylactic reaction, wherein an initial reaction is followed by another as long as 72 hours after the initial event. See exhibit 1 at 3. Specifically, Dr. Rostad proposed that Carson's fussiness on September 13 and 14, 2016 constituted the initial anaphylactic event. Id. at 9. As noted above, Carson's father's recollection of Carson, which was memorialized in a 2014 email, was not consistent with the medical and police records collected at the time of Carson's death indicating, by means of his father, that Carson was normal and healthy prior to his death. The undersigned proposed a hearing to resolve this factual dispute. Order, filed May 25, 2017. Petitioners declined the opportunity to have a fact hearing on this matter and instead decided to proceed with the email from Carson's father excluded from the record. See exhibit 8 at 1 (Dr. Rostad's report stating: "My discussion of Carson's cause of death did not rely on or refer to any . . . parent's . . . recollections").

Accordingly, because the medical records indicate Carson was healthy up and until the time of his death, 100 hours following the vaccination, the undersigned finds that there does not exist a proximate temporal relationship between the vaccination and the injury.

C. Althen Prong Two: Logical Sequence of Cause and Effect Showing that the Vaccination was the Reason for Carson's Death.

The lack of a proximate temporal relationship between the vaccination and the injury in this case weighs strongly against finding a logical sequence of cause and effect between the vaccination and the injury. In this second step of the Althen analysis, it is appropriate to consider the presence or absence of other evidence that tends to establish (or refute) a causal relationship between the vaccine and the injury. As noted in Capizzano, examples of some of the evidence that special masters may consider here are the opinions of treating physicians and medical experts, evidence of rechallenge, epidemiological studies, and the probability of coincidence or another cause. See 440 F.3d at 1327. The evidence available to be weighed will, of course, depend on the facts of the case.

Here, in addition to the timing, two lines of evidence weigh against the conclusion that there is a logical sequence of cause and effect between Carson's vaccinations and his death. First, the evidence does not support the conclusion that Carson died as a result of anaphylaxis. Second, there is a logical alternate cause of Carson's death.

1. Diagnosis of Anaphylaxis

Petitioners' expert, Dr. Rostad, states that the pathological record leaves anaphylaxis as the most likely explanation for why Carson died. He cites three features present at Carson's death in support of his conclusion: Carson's increased organ weights, pulmonary edema, and multi-organ eosinophilia. Exhibit 8 at 2. However, examining each of these three in detail, in conjunction with the signs and symptoms not present, leads to the conclusion that no persuasive evidence supports the conclusion that anaphylaxis was the cause of Carson's death.

a) Organ Weights

As Dr. Rostad highlights in his initial report, Carson's organ weights at the time of his autopsy were high when compared with the reference normal weights of a boy of his age. Exhibit 1 at 4-5. However, as Dr. Harris later identified, Dr. Rostad failed to mention that Carson was significantly larger than the reference class to which he was compared. Given his weight of 7.8kg, at 4 months old, Carson was at the 85th percentile of the weight distribution. Exhibit E at 3 (citing Evergreen Children's Clinic at 2). Accordingly, Carson's organs were at or near the reference weight for boys of his size. Exhibit E at 3.[9] That Carson had normally sized organs is consistent with the contemporaneous impressions made by physicians in Carson's medical records. The medical examiner noted nothing abnormal in the size or weight of Carson's organs.[10] Pierce County Medical Examiner at 17-19. Furthermore, Dr. Woolard, who managed Carson's emergency treatment noted that she "did not appreciate any organomegaly." Exhibit 8 at 5. Accordingly, the undersigned finds that the evidence weighs against Dr. Rostad's assertion that Carson's organ weights were abnormally large at the time of Carson's death.

[9] The undersigned considered Dr. Rostad's critique of the Pryce et al., article, which is the basis for Dr. Harris' conclusion that Carson's weights were largely within the realm of normal for an infant of his size. See exhibit E at 2 (Dr. Harris' reliance on Pryce et al.); exhibit 6 at 1 (Dr. Rostad's critique of this reliance). However, the critique provided by Dr. Rostad is highly speculative and relies on numerous unfounded assumptions. As such, the undersigned gives it little probative value.

[10] While the report of the medical examiner is not a record from a treating physician, "[a]n autopsy report by a medical examiner is without question a contemporaneous medical record." Nordwall ex rel. Tori v. Sec'y of Health & Human Servs., 83 Fed. Cl. 477, 488 (2008) (further noting that "[w]hile such records may not have been created in the context of diagnosing and treating a patient, they are contemporaneous records made by a health professional outside the context of litigation, and should be given the same probative weight as other medical records.")

b) Pulmonary Edema

Dr. Rostad relies upon the autopsy finding of pulmonary edema as a basis for his opinion that Carson suffered an anaphylactic reaction. Exhibit 1 at 8. Both experts acknowledge that pulmonary edema is a non-specific finding. Specifically, petitioners' expert, Dr. Rostad, notes that "[a]lthough the pulmonary findings in this case are not specific to anaphylaxis they are not explained by any other etiology such as sepsis, pneumonia, primary heart failure or other forms of shock such as massive hemorrhage." Exhibit 1 at 8. However, Dr. Harris points out in his first report that there is a plausible, if not likely, explanation found in Carson's medical history: the resuscitation efforts from CPR, including the placement of an endotracheal tube and the administration of epinephrine. Exhibit A at 6. For his part, Dr. Rostad implicitly acknowledges the resuscitation as an explanation for the pulmonary edema, but argues that the pulmonary edema is not a "diagnostic pathologic criteria for resuscitation, i.e. features whose presence means that [resuscitation] was present beyond any doubt. One can see these features in a number of conditions including individuals who were not resuscitated." Exhibit 1 at 6. It seems, based on this quote, that petitioners' expert misunderstands the relevant analysis. The objective here is not to prove "beyond any doubt" that resuscitation efforts were performed on Carson — the medical records show they were. Exhibit 8 at 5. The relevant question is how to interpret the finding of pulmonary edema. Given that resuscitation was performed on Carson, and given that resuscitation is known to often cause pulmonary edema, it appears that resuscitation is a likely explanation for this observation.

c) Multi-organ Eosinophilia

The histological examination of Carson's organ tissue revealed the presence of eosinophils in multiple organ systems, specifically Carson's lungs, kidney, thymus, spleen, intestine, liver, and heart. Exhibit 1 at 4-5. Though not quantified, Dr. Rostad qualitatively described the number of eosinophils as being "scattered" in the case of the heart, kidneys, thymus, spleen, and liver. Id. In the gastrointestinal system, he characterizes them as "increased". Id. at 5. No characterization of the level of eosinophils in the lungs is provided ("[t]here was evidence of eosinophils."). Id. at 4-5. Dr. Harris, the respondent's expert, characterized the lungs as having "diffusely . . . scattered eosinophils." Exhibit A at 5. In a later report he referred to this as being the organ system with the "most noticeable" increase in eosinophils. Exhibit E at 3. For the other tissues he noted that liver, heart, thyroid, and kidney had only "occasional scattered eosinophils" though stated that thymus and lymph had "quite a few" eosinophils. Id.

The experts disagreed on the significance of the level of eosinophils found in Carson's organs. Dr. Rostad states that eosinophils "can be associated with life-threatening systemic reactions." Exhibit 1 at 7. Dr. Harris, in his first report, states that "the finding of increased eosinophils in multiple organs is an atypical finding . . . ." Exhibit A at 5. However, in a subsequent report, Dr. Harris shifts his position after evaluating an article by Kato et al. Exhibit E at 2 (citing exhibit E, tab 2 (Kato)). Dr. Harris cites Kato to support the proposition that eosinophils are present in many organs—at least to some degree—under normal conditions. Exhibit E at 2. The Kato article examined the prevalence of eosinophils in histological preparations of normal human tissue. Exhibit E, tab 2 (Kato) at 1. With the exception of thyroid, all of the tissues that were found to have resident eosinophils in Carson's tissue also had eosinophils in the sampled "normal" tissues. Compare exhibit 1 at 4-5 (Dr. Rostad's histological observations) with exhibit E, tab 2 (Kato) at 420 (noting the prevalence of eosinophils in normal tissue samples). According to Dr. Harris, the most notable increase in eosinophils was found in Carson's lungs. Exhibit E at 3. Both experts appear to agree that the lung findings were atypical and the Kato article concurs. The authors in Kato found that the level of eosinophil infiltration in normal lung tissue was "none to occasional." Exhibit E, tab 2 (Kato) at 420.

For his part, Dr. Rostad challenges the Kato article's relevance to interpreting the significance of Carson's histological samples. Exhibit 6 at 2. Dr. Rostad argues that the article is inapposite to this case given that, amongst other things, it was a study mostly of adults and the methods of the paper were either not sufficiently specified, under-powered, or performed in a manner that makes a comparison with Carson's histological samples difficult, if not, impossible. Id. While the undersigned recognizes that the Kato article may not be perfect, the flaws identified by Dr. Rostad do not seem to detract from the general conclusion Dr. Harris draws from the article: eosinophils are present in normal tissue, at least to an extent.

What explains Carson's heightened eosinophils, to the extent they are heightened at all? Dr. Rostad concludes that "Carson's autopsy finding of tissue eosinophils links the vaccination to a systemic response which caused his death." Exhibit 1 at 7. However, Dr. Harris and Dr. Dreskin rebut this conclusion as being an unlikely explanation when compared to what is known from the record about Carson's medical history. Specifically, both experts identify Carson's known exposure to smoke as being the most likely explanation since second-hand smoke is associated with eosinophilia. Carson's exposure to smoke during his young life was noted from the initial medical records as well as from the examination of the scene of his death. See Puyallup Valley Pediatrics at 2 (noting that Carson was not

in a smoke-free environment); Pierce County Medical Examiner at 3 (noting that the home smelled like cigarette smoke and the presence of ash tray full of cigarette butts on the night stand next to the bed where Carson slept). That Carson's body actually ingested the second-hand smoke is confirmed by the toxicology analysis of his blood indicating he tested positive for nicotine. Pierce County Medical Examiner at 21.

d) Signs and Symptoms of Anaphylaxis Not Present in Carson

Though Carson's signs and symptoms are important, just as critical are the signs and symptoms not present at the time of Carson's death. Most notable is the lack of any dermatological abnormality at the time of Carson's death. Mary Bridge Emergency Room at 5; Pierce County Medical Examiner at 16. While there is no universally accepted diagnostic criteria for anaphylaxis, the various criteria proposed in the literature are consistent in requiring more evidence than is present in Carson's case. For example, Ruggeberg et al. requires, at the first level of diagnostic certainty, a major dermatological symptom in order to diagnose anaphylaxis. Exhibit C, tab 2 (Ruggeberg) at 5. Ruggeberg et al is consistent with data presented in Simons and Sampson indicating that 98% of anaphylaxis cases present with dermatological symptoms. Exhibit H, tab 1 (Simons and Sampson) at 2. Under another criteria, Simons et al. notes that anaphylaxis is "highly likely" when there is an acute onset of an illness with involvement of the skin, mucosal tissue, or both. Exhibit C, tab 6 (Simons) at 593. Alternatively, anaphylaxis is "likely" if two or more of the following systems have symptoms after exposure to the allergen: skin, respiratory, cardiovascular, and gastrointestinal. Id. Carson only had evidence of cardiovascular failure. Exhibit C at 2. Similarly, Muraro et al. defines anaphylaxis as potentially life-threatening systemic hypersensitivity reaction characterized by life-threatening airway, breathing, or circulatory problems that is usually, though not always, associated with skin and mucosal changes. Exhibit C, tab 7 (Muraro) at 1027. Carson did not present with skin or mucosal changes. Mary Bridge Emergency Room at 5; Pierce County Medical Examiner at 16. Accordingly, there appears to be no criterion that results in a finding that Carson experienced an anaphylactic reaction.

e) Views of Treating Physicians

That Carson's symptoms were inconsistent with a diagnosis of anaphylaxis is also reflected in the opinions provided both by his treating physician and the autopsy report. Dr. Woolard, the treating emergency room physician, did not make any indications of anaphylaxis as a possible cause of Carson's death. See Mary

Bridge Emergency Room at 5-6. Instead, she concluded that Carson died as a result of sudden unexplained infant death. Id. at 6. Dr. Ramoso, the medical examiner, also did not indicate that anaphylaxis was a possible cause of Carson's death. Instead, Dr. Ramoso also concluded Carson died due to death during infancy with no identifiable cause.[11] Pierce County Medical Examiner at 15.

f) Summary on Diagnosis of Anaphylaxis

On the whole, very little evidence suggests that Carson's death was the result of anaphylaxis. The positive evidence that is proposed by the petitioners to link Carson's death to anaphylaxis is easily attributed to causes unrelated to an anaphylactic reaction. Furthermore, Carson failed to meet any diagnostic criteria for anaphylaxis, and most notably, did not express any dermatological symptoms, which are highly correlated with anaphylaxis. That Carson's symptoms were incongruent with a diagnosis of anaphylaxis is further evidenced by the opinions of Carson's treating physicians. The undersigned is cognizant of the fact that diagnostic criteria are not perfect, and that treating physicians may err in their diagnoses. This is especially true in the case of anaphylaxis in infants. Accordingly, it is not the undersigned's finding that it is impossible that Carson experienced anaphylaxis, he may have. However, it is the undersigned's finding that the evidence presented in this case weighs strongly against a conclusion of anaphylaxis, which likewise weighs against a conclusion that the vaccine was the logical and legally probable cause of Carson's death.

2. The Presence of an Alternate Explanation for Carson's Death

The Federal Circuit has endorsed special masters' consideration of alternate causes in determining whether petitioners have established their prima facie case. Doe v. Sec'y of Health & Human Servs., 601 F.3d 1349, 1357 (Fed. Cir. 2010) (stating that the government can provide and the special master can consider evidence of "factors unrelated" in determining whether the petitioner established a prima facie case).

In a country of over 300 million people, the improbable happens every day. This fact makes drawing conclusions based on the evidence presented in individual

[11] The undersigned appreciates that the filed medical literature states that anaphylaxis is underdiagnosed in infants and, for this reason, does not rely solely on the opinions of the treating physicians. See exhibit 2 at 4 (Dr. Rostad noting why identifying anaphylaxis is difficult in infants); see also exhibit H, tab 1 (Simons and Sampson) at 1125 (noting that anaphylaxis remains "underdiagnosed).

cases such as these particularly challenging. As discussed above, the symptoms Carson presented with are inconsistent with the vast majority of anaphylaxis cases. Furthermore, the timing between the vaccine and the onset is virtually unheard of for an anaphylactic reaction. Nonetheless, it would be logically fallacious to conclude on this evidence alone that the Nicholses' theory of the case is, accordingly, equally unlikely of being true. Though the facts may be highly improbable, we know that the improbable does occur. And, in fact, given that Carson—an otherwise healthy child—died in the middle of the night at four months of age, we furthermore know that the improbable *did* occur on the night of September 16, 2006.

As a result, if there were no other evidence about what may have happened to Carson that night, an explanation involving vaccine-triggered anaphylaxis would be conceivable, though wildly improbable. However, the record shows that Carson was found unresponsive on the morning of September 16, 2006, face-down in a pile of clothes on the floor. Given this, the Secretary's experts found the circumstances surrounding Carson's death, including his face-down position, to be supportive of Carson dying as a result of accidental suffocation and strangulation in bed. The undersigned finds this to be a reasonable, if not probable, conclusion based on the facts of this case. Accordingly, the undersigned is particularly hesitant to entertain the improbable explanation of a vaccine-triggered anaphylactic reaction.

Given the evidence regarding the timing between the vaccine and the injury, the lack of evidence supporting a diagnosis of anaphylaxis, and the presence of a reasonable alternate explanation, the undersigned finds no logical sequence of cause and effect between the vaccine and Carson's death.

VI. Conclusion

In consideration of the findings presented above, the undersigned concludes that the petitioners have not met their burden of proof under the Vaccine Act. The evidence does not support, by a preponderance of the evidence, that Carson's vaccinations caused his death. Though all the evidence discussed above contributed to this conclusion, the undersigned notes that the finding that Carson did not experience anaphylaxis and the finding that the timing was inconsistent with anaphylaxis are, by themselves, independently sufficient to preclude a finding of causation.

Carson's death was a tragedy. The lack of an obvious explanation for what happened to Carson can only augment the pain and suffering experienced by the Nicholses. However, to be provided compensation under the Vaccine Program,

Congress required that the petitioners demonstrate that it is more likely than not that the vaccine caused Carson's death. Petitioners have simply failed to carry their burden and as a result they are not entitled to compensation.

The Clerk's Office is instructed to enter judgment in accord with this decision.

IT IS SO ORDERED.

s/ Christian J. Moran
Christian J. Moran
Special Master