Deaths Following MMR and MMRV Vaccination in the United States

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Abstract

Background: The measles–mumps–rubella (MMR) and measles–mumps–rubella–varicella (MMRV) vaccines are routinely administered in the United States beginning at 12–15 months of age. Given their near-universal use in early childhood, ongoing post-licensure safety surveillance is critical.

Methods: The Vaccine Adverse Event Reporting System (VAERS) was queried via the MedAlerts.org interface for death reports involving MMR and MMRV vaccines through August 29, 2025. U.S.-attributed death reports were analyzed descriptively. Variables examined included age at death, time-to-death following vaccination, sex, concomitant vaccine administration, reported clinical features, and healthcare utilization.

Results: A total of 536 deaths associated with MMR or MMRV vaccination were identified globally in VAERS, including 299 U.S. reports that comprised the analytic cohort. Among U.S. reports, a modest male predominance was observed (52.8% male, 41.1% female; 6% missing sex data). Deaths were heavily concentrated in early childhood. A total of 182 of 299 reports (60.9%) occurred in children under 2 years of age, with 156 deaths (52.2%) specifically in the 1.0–1.5 year age group corresponding to the routine first-dose window. Temporal clustering following vaccination was pronounced. A total of 120 deaths (40.1%) occurred within 7 days and 158 deaths (52.8%) within 14 days of vaccination. Among deaths occurring within the first week, 68.6% involved children aged 1.0–1.5 years. The majority of deaths (74.6%) occurred in the context of combination vaccination visits involving one or more additional concomitant vaccines, while 25.4% followed MMR/MMRV administration alone. Clinical presentations were heterogeneous but demonstrated recurring patterns. Sudden infant death syndrome (SIDS) or sudden unexplained death was the most frequently reported category (24%), followed by fever (15%), seizures (12%), cardiac arrest (8%), respiratory distress (7%), and encephalitis (3%). Emergency department visits were documented in 23.7% of reports and hospital admission in 25.4%, indicating substantial clinical severity preceding death. Since 1995, 193 U.S. MMR/MMRV-associated deaths with identifiable dates have been reported to VAERS, whereas only 7 measles infection–associated deaths have been documented during the same period—amounting to a 2,657% higher count of reported vaccine-associated deaths.

Conclusions: We identified a serious mortality safety signal following MMR/MMRV vaccination in the United States. A substantial number of reported deaths were documented, with patterns demonstrating pronounced alignment across age, temporality, routine-dose timing, concomitant vaccine exposure, and recurring clinical presentations—including fever, seizures, SIDS, and cardiac arrest. Reported deaths were predominantly concentrated in children under 2 years of age, and the majority occurred within the first 14 days following vaccination. The synchronization of age-specific clustering with immediate post-vaccination timing reflects a non-random pattern of mortality. This concern is further amplified by the stark contrast between reported vaccine-associated deaths and the exceedingly rare number of measles infection–associated deaths in the modern era. The magnitude, concentration, and temporal proximity of these reports demand rigorous, transparent, and fully independent evaluation. Future research should prioritize active surveillance cohort studies, detailed autopsies with virologic testing, and record-linked datasets capable of assessing background mortality and determining causal relationships.

Introduction

The measles–mumps–rubella (MMR) vaccine was introduced as a combined immunization in 1971, following prior use of monovalent measles vaccines first licensed in the United States in March 1963[1]. The transition to a combination vaccine was intended to simplify immunization schedules and improve population-level protection against three highly contagious viral diseases. According to the U.S. Centers for Disease Control and Prevention (CDC), the MMR is highly effective at preventing measles, mumps, and rubella, but is also associated with possible side effects ranging from mild reactions to serious adverse events such as febrile seizures, anaphylaxis, and immune thrombocytopenic purpura [2,3]. A quadrivalent formulation incorporating varicella (MMRV) was subsequently developed, with the U.S. Food and Drug Administration licensing the MMRV vaccine in September 2005 for use in children aged 12 months through 12 years [4]. At present, no monovalent (single-antigen) measles vaccine is licensed or routinely available for use in the United States; measles immunization is administered exclusively through combination vaccines, including MMR and MMRV.

While the MMR vaccine represents one of the most widely administered medical interventions in modern public health, it has also been one of the most frequently debated components of the childhood vaccination schedule since its implementation. At the center of this debate is the contention that the serious adverse events cited above are far rarer and less severe than complications from natural measles, mumps, or rubella infection. This scientific discourse reflects the importance of long-term safety surveillance to identify safety signals and trends that may be experienced after vaccination.

Vaccine Adverse Event Reporting System (VAERS), a national passive surveillance database established in 1990, is co-managed by the CDC and the Food and Drug Administration (FDA) [5]. Reports entered into VAERS by healthcare providers and members of the public help provide insight into potential patterns, demographic distributions, and emerging safety signals that warrant further safety monitoring and investigation. Healthcare providers take the initiative of reporting deaths to VAERS when they have determined vaccination has contributed to death, otherwise, such a report would not be filed. As a passive system, VAERS is subject to substantial underreporting; analyses from a CDC-funded pilot project utilizing electronic health record–based surveillance suggested that fewer than 1% of adverse events may be reported to national vaccine safety systems [6]. We queried the VAERS system to evaluate reported fatal outcomes following MMR and MMRV vaccination.

Methods

VAERS was queried using the MedAlerts.org interface to identify reports involving the MMR and MMRV vaccines [7]. Data were extracted from inception through August 29, 2025, with no beginning date restriction applied. Search parameters included MMR and MMRV vaccines and “All Locations.” No additional filtering criteria were imposed at the query stage to ensure comprehensive capture.

Global reports were initially identified; analyses were subsequently restricted to reports attributed to the United States. Inclusion criteria consisted of VAERS reports documenting death following administration of MMR or MMRV vaccines, with or without concomitant vaccines administered during the same visit.

Data fields extracted included sex, age at death, vaccination date, date of death, time-to-death following vaccination, reported clinical symptoms, emergency department (ED) visit, hospital admission, and documentation of sudden infant death syndrome (SIDS) or sudden unexplained death.

Time-to-death calculations were derived using vaccination date and date-of-death fields. When the "DATE OF DEATH" field was missing, the "VAX2DIED" interval field was used. In cases of discrepancy between structured fields and narrative text, the structured "DATE OF DEATH" field was prioritized. If structured date fields were unavailable, dates documented in the narrative "SYMPTOM" text were used when explicitly stated. Reports lacking sufficient information to determine time-to-death were excluded from time-interval analyses but retained for overall counts.

Clinical presentation categories were constructed by grouping reported symptoms into standardized classifications (e.g., SIDS/sudden death, seizures, cardiac arrest, respiratory distress, encephalitis, fever) based on reported terminology.

Results are presented descriptively using summary statistics. No incidence rates, background-adjusted comparisons, or causal inferences were performed.

Results

A total of 536 deaths associated with MMR or MMRV vaccination were identified globally in the VAERS database. Of these, 299 reports were explicitly attributed to the United States and constitute the analytic focus of this study.

Sex

Among U.S. death reports, 158 (52.8%) occurred in males and 123 (41.1%) in females, while 18 reports (6%) lacked sex information. Thus, a modest male predominance was observed among reported deaths.

Age

Age at death was categorized in the following groupings: less than 12 months, 1 year to 1.5 years, 1.51 to 1.9 years, 2 years, 3 years, 4 years, 5 to 7 years, 8 to 10 years, 11 to 15 years, and greater than 15 years. Deaths were highly concentrated in early childhood, with a pronounced clustering around the recommended age of first MMR administration.

As illustrated in **Figure 1**, the 1.0–1.5 year age group accounted for 156 deaths (52.2%). When combined with deaths occurring before 12 months (n=8) and those occurring between 1.51–1.9 years (n=18), a total of 182 of 299 deaths (60.9%) occurred in children under 2 years of age.

Older pediatric age groups contributed comparatively fewer reports, with only 14 deaths at age 2, 4 deaths at age 3, 12 at age 4, 17 between ages 5–7, and 3 between ages 8-10. Adolescents (11–15 years) and individuals over 15 years collectively accounted for 30 deaths, while 37 reports lacked age information.

Overall, this age distribution demonstrates a strong, non-uniform concentration of reported deaths in children under two years of age, rather than a gradual or evenly distributed pattern across childhood.

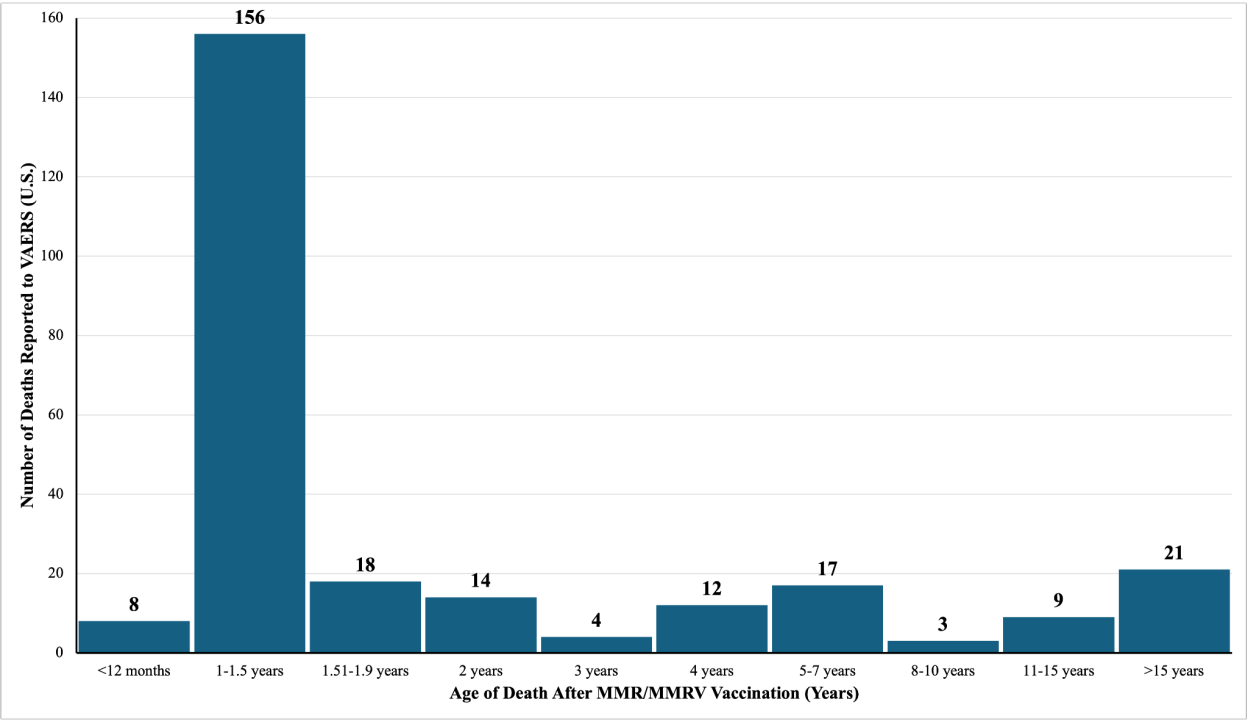

Figure 1. Age Distribution of Reported Deaths Following MMR/MMRV Vaccination. This figure shows the number of U.S. VAERS death reports stratified by age at death following MMR or MMRV vaccination. Bars represent the total number of reported deaths within each predefined age category. Reports with missing age information were excluded from this figure.

Time-to-death

Time-to-death after vaccination was categorized in the following groupings: Day 0 (day of vaccination), 1-7 days after vaccination, 8-14 days after vaccination, 15-30 days after vaccination, 31-60 days after vaccination, 60-90 days after vaccination, 91-180 days after vaccination, and greater than 365 days after vaccination. **Figure 2** illustrates the distribution of reported deaths across these post-vaccination time intervals.

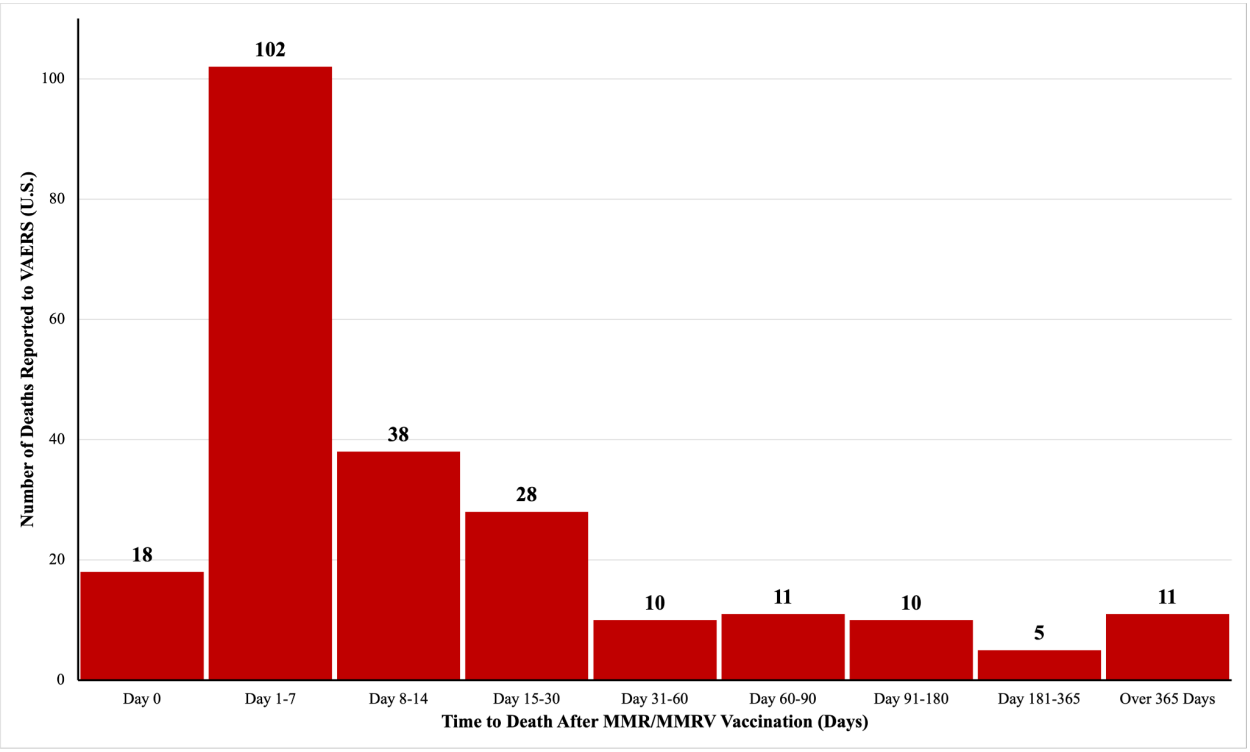

Figure 2. Distribution of Reported Deaths by Time Interval Following MMR/MMRV Vaccination. This figure displays the distribution of reported deaths by interval of time elapsed after MMR or MMRV vaccination among U.S. VAERS reports. Bars represent the number of reported deaths within each predefined post-vaccination time interval. Reports lacking sufficient information to determine time-to-death were excluded from this figure.

120 deaths (40.1%) occurred within the first 7 days following vaccination, including 18 deaths on the day of vaccination and 102 deaths within days 1–7. An additional 38 deaths (12.7%) occurred between days 8–14, resulting in a total of 158 deaths (52.8%) occurring within the first two weeks after vaccination.

Fewer deaths were reported at longer intervals, with 28 deaths between days 15–30, 21 deaths between days 31–90, and 26 occurring beyond 90 days, while 66 reports lacked sufficient date information to calculate time-to-death.

This temporal pattern demonstrates a strongly front-loaded distribution, with the highest concentration of reported deaths occurring shortly after vaccination.

Proportion involving MMR alone vs. combination visits

MMR/MMRV vaccines were administered both alone and alongside other vaccines. As illustrated in **Figure 3**, 76 of 299 deaths (25.4%) followed administration of MMR/MMRV alone, whereas 223 deaths (74.6%) occurred following combination vaccination visits involving one or more additional vaccines.

Specifically, 68 deaths (22.7%) followed MMR/MMRV administered with one additional vaccine, 67 deaths (22.4%) with two additional vaccines, and 51 deaths (17.1%) with three additional vaccines. Higher-order combinations were less frequent but still present, including 27 deaths (9.0%) with four additional vaccines, 7 deaths (2.3%) with five, and 3 deaths (1.0%) with six concomitant vaccines.

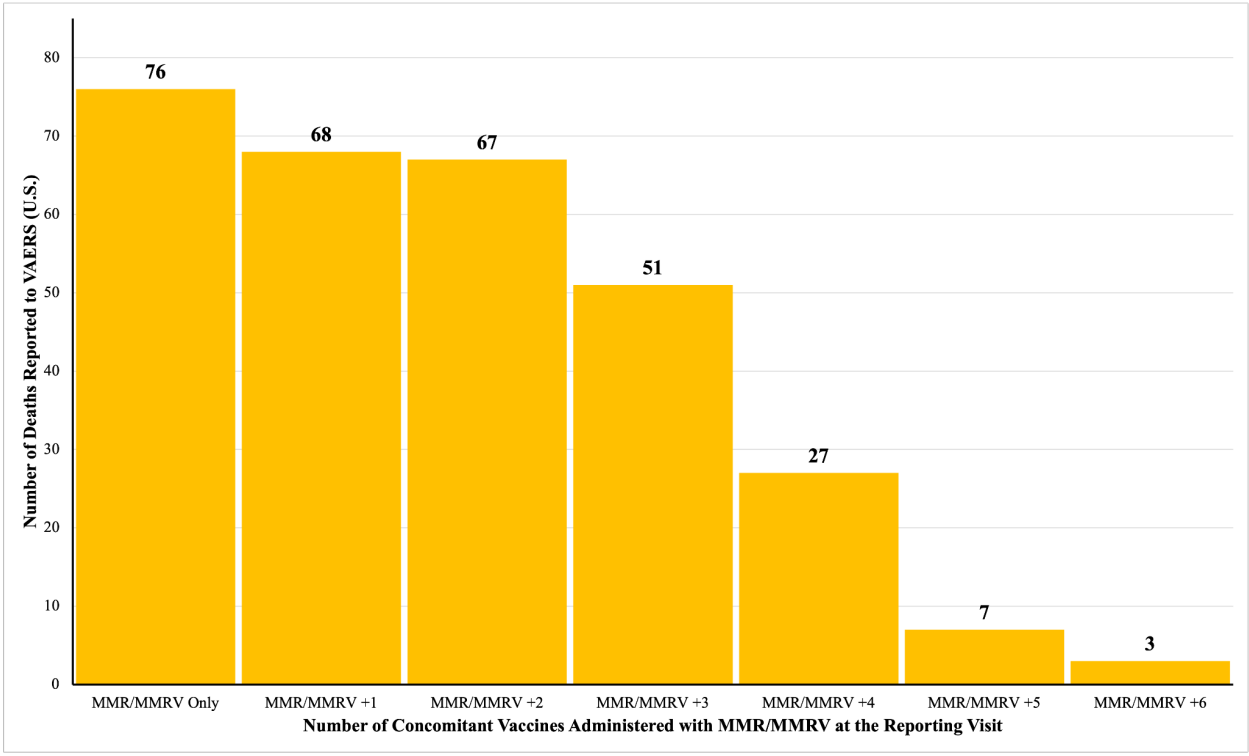

Figure 3. Distribution of Reported Deaths Following MMR/MMRV Vaccination by Number of Concomitant Vaccines Administered. This figure displays the distribution of reported deaths following MMR or MMRV vaccination stratified by the number of concomitant vaccines administered at the same visit among U.S. VAERS reports. Bars represent the number of reported deaths within each predefined category of additional vaccines given concurrently with MMR/MMRV.

Symptoms/clinical presentation

Reported clinical features preceding death were heterogeneous and frequently overlapping. As shown in **Figure 4**, the most commonly documented category was SIDS or sudden death, reported in 24% of cases (n=72). Notably, 68% (n=49) of SIDS cases occurred in the 1.0–1.5 year age group, closely aligning with the first-dose MMR window. Fever was noted in 15% (n=45), seizures in 12% (n=35), and cardiac arrest in 8% (n=24) of reports. Respiratory symptoms were reported in 7% (n=20), while encephalitis was documented in 3% (n=10) of cases. Collectively, these findings demonstrate a predominance of neurologic, febrile, and cardiopulmonary presentations, consistent with acute systemic and/or central nervous system involvement in a substantial subset of reported deaths.

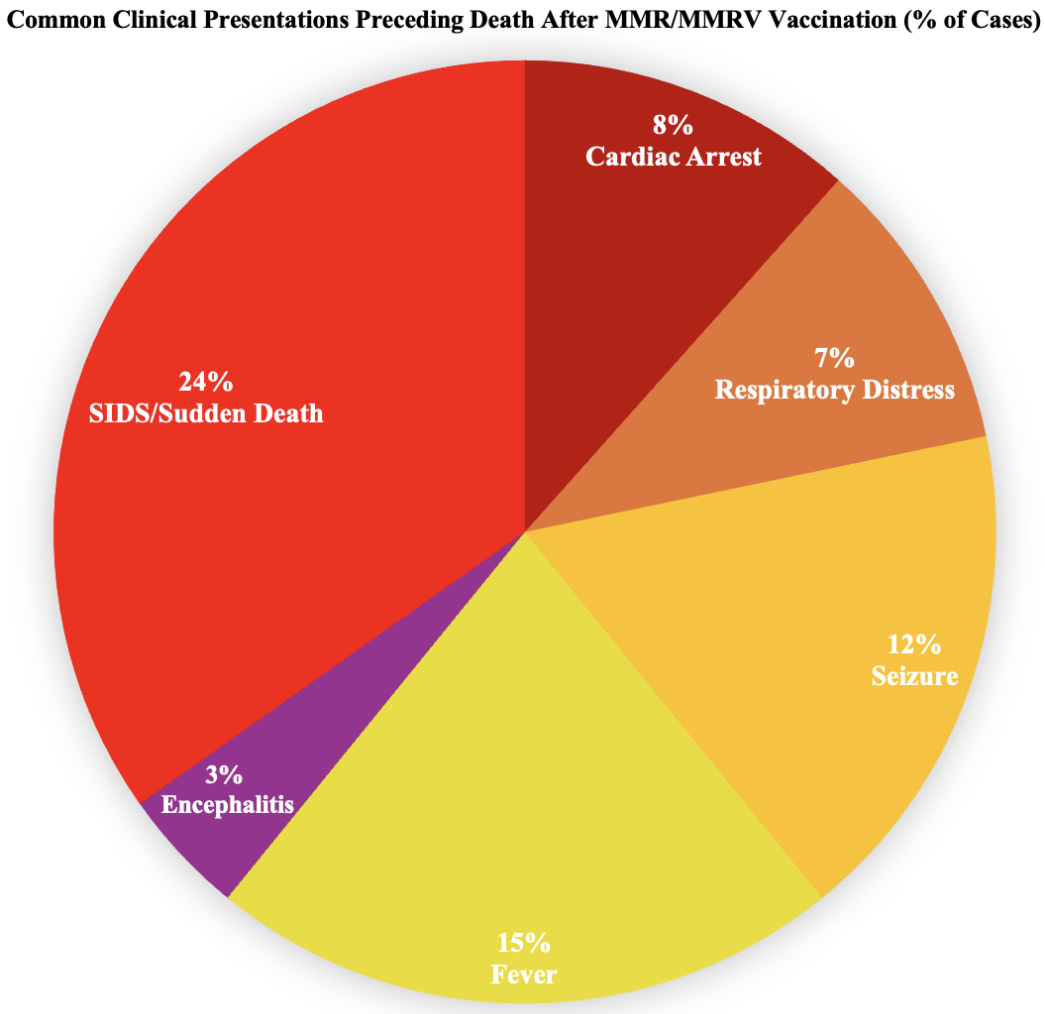

Figure 4. Common Clinical Presentations Preceding Death After MMR/MMRV Vaccination (% of cases). This figure displays the distribution of commonly reported clinical presentations documented prior to death among U.S. VAERS reports following MMR or MMRV vaccination. Percentages represent the proportion of total reports in which each clinical presentation was recorded. Categories are not mutually exclusive; individual reports may include multiple clinical presentations.

ER visit or hospital admission

Healthcare utilization at the time of death was frequently documented among U.S. reports. Of the 299 deaths analyzed, 71 cases (23.7%) involved an emergency department visit, and 76 cases (25.4%) involved hospital admission at or near the time of death. These findings indicate that over one-quarter of reported deaths were associated with acute medical evaluation, reflecting a substantial level of clinical severity preceding death. Because VAERS reports may document more than one care setting, these categories are not mutually exclusive.

Measles vaccine versus measles infection: A contextual comparison

As highlighted in this paper, 299 deaths were reported in the US after measles vaccination in the VAERS database. Since 1995, 193 MMR/MMRV vaccine-associated deaths with identifiable dates of death have been reported to VAERS. In contrast, measles infection–associated mortality in the US has been exceedingly rare in the modern era. CDC surveillance and mortality analyses document 7 measles-related deaths since 1995, including one death in 1996 identified through National Center for Health Statistics review and six additional deaths reported in 2003 (n=2), 2015 (n=1), and 2025 (n=3) [8,9].

This corresponds to 2,657% more measles vaccine-associated deaths than measles infection–associated deaths since 1995 (193 vs 7). An additional 65 VAERS death reports lacked sufficient date information to assign them to the post-1995 period and were therefore excluded from the time-anchored comparison. **Figure 5** illustrates this contrast in reported deaths since 1995.

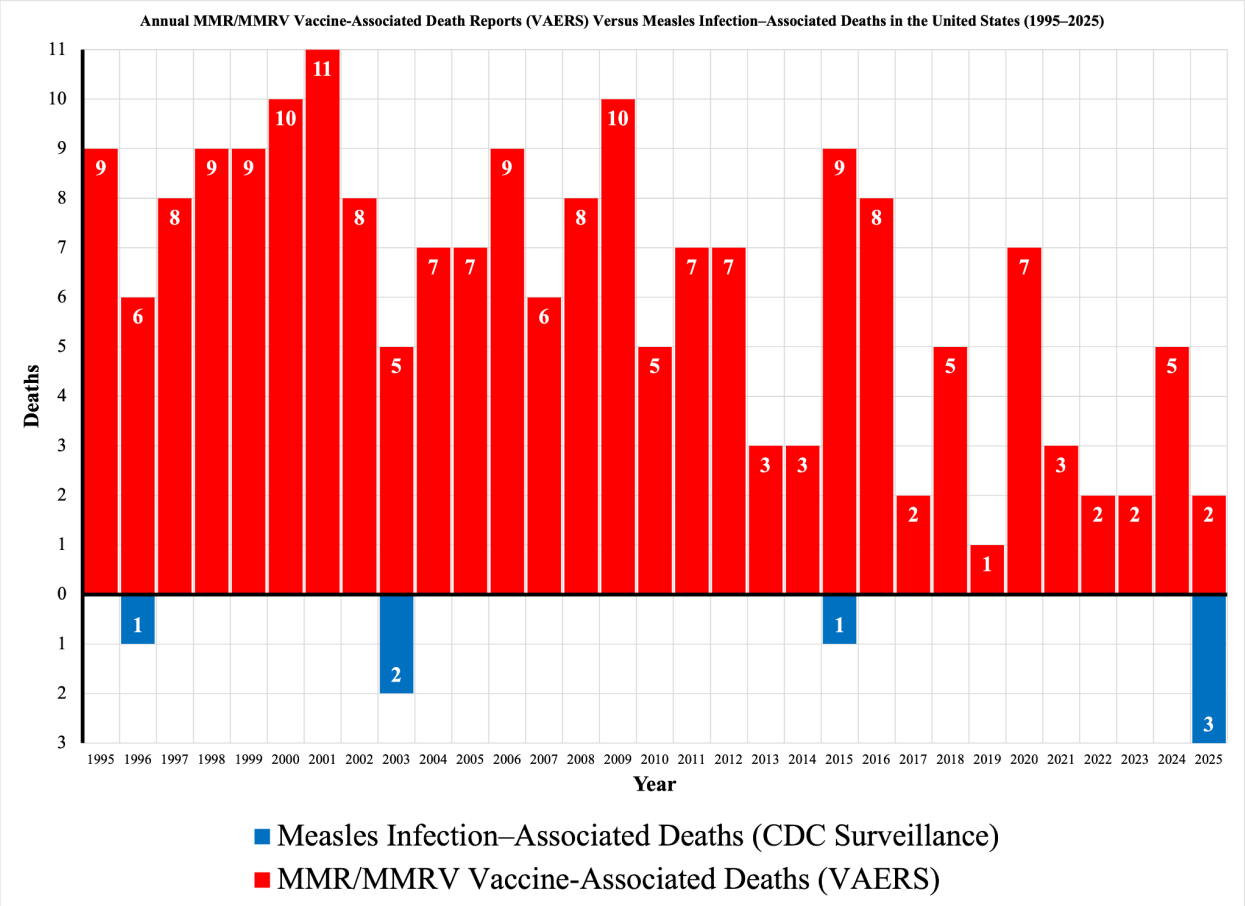

Figure 5. Annual MMR/MMRV Vaccine-Associated Death Reports (VAERS) Versus Measles Infection–Associated Deaths in the United States, 1995–2025. This figure displays the annual number of U.S. VAERS reports involving death following MMR or MMRV vaccination compared with documented measles infection–associated deaths identified through CDC surveillance from 1995 through 2025. Red bars represent vaccine-associated death reports submitted to VAERS (n=193). Blue bars represent measles infection–associated deaths recorded through CDC surveillance systems[8, 9] (n=7). Values are shown for each calendar year.

Discussion

We found an alarming number of deaths among infants and toddlers within days of receiving MMR/MMRV vaccines. Most fatalities appeared to involve acute deterioration following vaccination, with manifestations including fever, seizures, and cardiopulmonary arrest at home, frequently culminating in classification as SIDS or sudden unexplained death. A small proportion survived hospitalization but were unable to be resuscitated. We identified 299 U.S. death reports following MMR/MMRV vaccination, with deaths heavily concentrated in early childhood: 182 of 299 (60.9%) occurred in children under 2 years of age, including 156 (52.2%) in the 1.0–1.5 year age group corresponding to the routine first-dose window. Temporal clustering was pronounced. A total of 120 deaths (40.1%) occurred within 7 days of vaccination, and 158 (52.8%) occurred within 14 days. Among first-week deaths with available age data, 68.6% occurred in children aged 1.0–1.5 years. Compared with measles infection–associated deaths in the United States since 1995, reported deaths following vaccination were 2,657% higher and represent a much larger public health concern at this time.

Our findings are consistent with and corroborated by another VAERS analysis by Miller, who examined 2,605 infant deaths reported between 1990 and 2019 and demonstrated a highly non-random temporal clustering of deaths following routine childhood vaccination [10]. In that study, 58% of infant deaths occurred within 3 days of vaccination and 78.3% within 7 days ($p < 0.00001$), and among SIDS-classified cases specifically, 51% occurred within 3 days and 75.5% within 7 days. This pronounced early clustering mirrors the temporal concentration observed in our MMR/MMRV analysis, in which 40.1% of deaths occurred within 7 days and 52.8% within 14 days, with the highest vulnerability concentrated in the immediate post-vaccination window and aligned with the routine first-dose age. The consistency of these front-loaded mortality distributions across different vaccine types and age cohorts strengthens the inference that these events are not randomly distributed over time but reflect a reproducible temporal pattern detectable in large passive surveillance datasets.

Public health science upholds the precautionary principle: when a well-defined factor or activity raises threats of serious or irreversible harm to human health, precautionary measures should be taken even if some causal relationships are not fully elucidated scientifically. When VAERS or similar passive surveillance detects a major signal—such as multiple reported deaths temporally associated with vaccination—authorities must immediately treat it as a high-priority alert requiring urgent investigation. Although VAERS cannot prove causation and is subject to reporting biases, dismissing or downplaying such signals without rigorous follow-up studies can result in overlooking genuine rare harms and placing the public at further risk.

Importantly, the majority of reported deaths (74.6%) occurred in the context of combination vaccination visits involving one or more additional concomitant vaccines. Only 25.4% followed administration of MMR/MMRV alone. This pattern raises critical questions regarding cumulative immune stimulation, antigenic load, adjuvant exposure, and physiologic stress associated with multi-vaccine visits during a narrow developmental window. The distribution across increasing numbers of concomitant vaccines further suggests that these events are not isolated occurrences but occur within the broader context of clustered pediatric immunization

schedules. The potential interaction between simultaneous vaccine exposures and developmental immunobiology warrants systematic investigation.

Independent registry-based analysis has similarly identified short-interval mortality clustering following early childhood vaccination [11]. In a Louisiana birth–death–immunization dataset, infants vaccinated between 60–90 days of life were 29%–74% more likely to die in their third month compared with unvaccinated peers, depending on the vaccine administered. Infants receiving all recommended vaccines at the 2-month visit were 60%–68% more likely to die (OR=1.60–1.68) than those receiving fewer or no vaccines. These findings of elevated short-interval mortality and increased risk with clustered dosing parallel the age-specific concentration and concomitant vaccine patterns observed in the present MMR/MMRV analysis, reinforcing the concern that these mortality distributions are not randomly distributed events.

Clinical presentation patterns add further weight to these observations. SIDS and sudden unexplained death constituted the most frequently reported clinical category, with a substantial proportion occurring in the same 12–15 month age window. Cardiac arrest, seizures, fever, and encephalitis were also repeatedly documented. The predominance of neurologic and cardiopulmonary presentations, combined with abrupt clinical deterioration in a subset of cases, suggests a consistent physiologic phenotype rather than heterogeneous, unrelated causes. While passive reporting systems cannot establish mechanistic pathways, the repetition of similar clinical endpoints in a defined age and temporal window strengthens the concern that these patterns are not random.

Per the routine childhood immunization schedule, the first MMR dose is typically administered between 12 and 15 months of age. The alignment of peak reporting across age, time-to-death, concomitant vaccine exposure, and clinical presentation represents a significant mortality safety signal that warrants further scrutiny of MMR administration practices, combination vaccine timing, and potential biological or developmental factors contributing to these observed patterns.

Informed consent, safety monitoring, post-licensure surveillance are paramount to any medical intervention such as vaccination. Several steps are involved in the informed consent process including disclosure of benefits and risks, alternatives, clinical safety study data supporting the vaccine approval, etc. The U.S. FDA-approved package insert for M-M-R® II (MMR) lists encephalitis (and related neurologic conditions) in the Adverse Reactions – Postmarketing Experience section; however, it does not indicate that these events can be fatal [12]. Death is listed elsewhere in the package insert but does not indicate that it can occur within days of receiving the vaccine. Our findings indicate that the package insert should be updated and provided to parents at the time of informed consent before vaccination.

VAERS is a passive surveillance system and is widely recognized to substantially under capture adverse events from vaccinations, including deaths. A federally funded investigation led by Lazarus et al. for the U.S. Agency for Healthcare Research and Quality found that fewer than 1% of vaccine adverse events are reported to VAERS, implying a potential underreporting magnitude approaching 100-fold or greater when relying on spontaneous reporting alone [6]. Using a deliberately conservative assumption, Rose et al. proposed an underreporting factor (URF) of approximately 31-fold for serious vaccine adverse events [13]. Applying this conservative URF to the 193 MMR/MMRV-associated deaths reported since 1995 yields an adjusted estimate of

approximately 5,983 deaths temporally associated with MMR/MMRV vaccination (31 × 193). When compared with the 7 documented measles infection–associated deaths since 1995, this extrapolated estimate corresponds to an approximately 85,371% higher number of measles vaccine-associated deaths than measles infection–associated deaths over the same period.

In 2025, the United States experienced a record-breaking number of measles cases for the 21st century. A total of 2,255 cases were reported, including three deaths, all occurring in unvaccinated individuals [8,14]. A major limitation in monitoring vaccination status during outbreaks is that the CDC does not distinguish between individuals who are unvaccinated and those whose vaccination status is unknown. This lack of distinction promotes a misleading narrative that unvaccinated individuals are far more likely to contract measles, when in fact the true number of unvaccinated cases is unknown. The importance of measles outbreaks demands the CDC to ascertain vaccination status in each and every case, leaving no ambiguity in public reporting.

The live attenuated measles component of the MMR (measles, mumps, and rubella) vaccine can result in measurable viral RNA shedding following inoculation, with vaccine-strain measles RNA detected in respiratory specimens for up to approximately 29–30 days post-vaccination [15]. This extended shedding window has important implications for outbreak investigations, as the clinical presentations of wild-type measles and vaccine-associated measles (VAM) are virtually indistinguishable based on symptoms alone. Differentiation therefore requires molecular testing. The Measles Virus Genotype A RT-qPCR (MeVA RT-qPCR) assay is the confirmatory genetic sequencing modality recommended by the CDC when routine serologic testing is positive in recently vaccinated individuals [16]. According to CDC guidance, MeVA testing should be ordered as a reflex test following positive serology in cases involving suspected reaction to live measles vaccination within 21 days of inoculation and when there is a history of potential exposure to wild-type measles. The reliance on genotype-specific testing to distinguish vaccine strain from circulating wild-type virus underscores the diagnostic complexity in the post-vaccination period and the necessity of precise molecular surveillance during measles investigations.

Of note, VAM is listed as an adverse effect in the package insert for the MMR vaccine [12]. Another important point is that, in patients with confirmed measles-related deaths, the CDC did not report the treatments those patients received. This omission is notable, as effective interventions exist for confirmed cases and for post-exposure prophylaxis, including immunoglobulins, nebulized therapies, vitamin A, corticosteroids, secondary antibiotics, and supportive care [17,18]. Such therapies are live saving in severe measles cases and should be reported for hospitalized and fatal cases.

It is possible that not all infants can tolerate MMR/MMRV products. MMR vaccine responses are not biologically uniform but are governed by inter-individual genomic, transcriptomic, and proteomic variation that can predispose a subset of individuals to severe immune dysregulation, impaired antiviral control, and life-threatening neuroimmune injury following live-attenuated vaccination [19-24]. This evidence undermines the n-of-all vaccination assumptions and demonstrates that failing to perform molecular risk stratification exposes vulnerable individuals to preventable, potentially catastrophic harm. Evidence from vaccinomics and adversomics demonstrates that immune responses to the measles–mumps–rubella (MMR) vaccine are highly

heterogeneous and shaped by inter-individual variation across genomic, transcriptomic, and proteomic layers (**Figure 6**) [19,20].

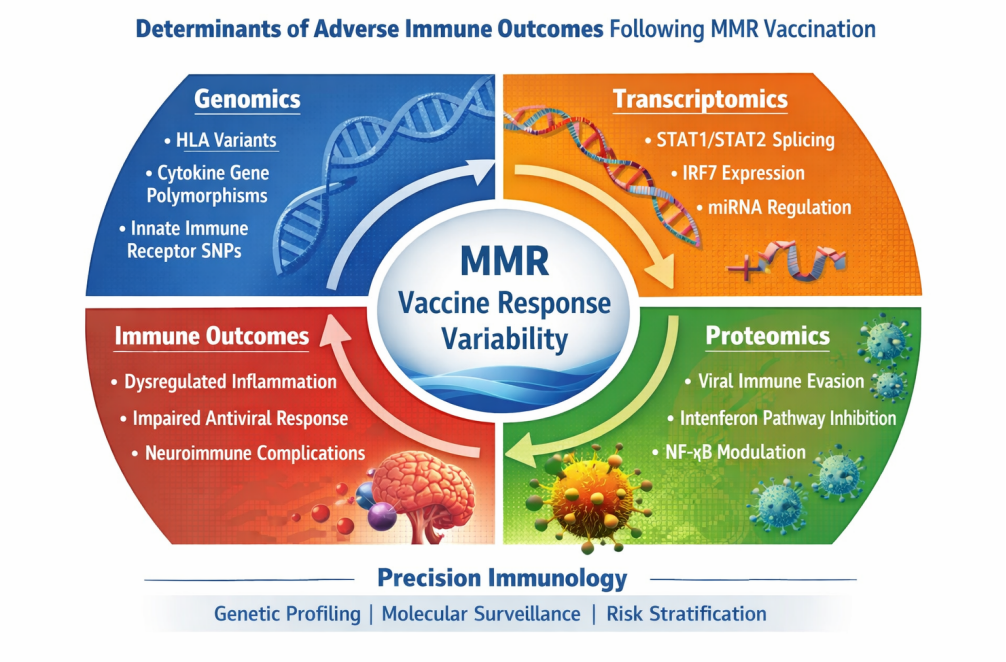

Figure 6. Multi-omic determinants of variability in MMR vaccine response. The figure depicts how interactions among genomic, transcriptomic, and proteomic factors drive heterogeneous immune responses to the MMR vaccine, resulting in immune trajectories that range from dysregulated inflammation and impaired antiviral control to neuroimmune complications in susceptible individuals.

Polymorphisms in HLA class I/II loci, cytokine and interferon-pathway genes (e.g., *IL2*, *IL10RA*, *TNF*, *STAT1/2*), and innate immune sensors (*TLR4*, *TLR7*, *DDX58*) alter antigen presentation, interferon kinetics, and inflammatory amplitude, creating a spectrum of aberrant signaling and susceptibility to dysregulated immune responses [21]. Transcriptomic regulation, including alternative splicing, intron retention, and miRNA-mediated feedback, further modulates immune timing and resolution, while attenuated measles virus retains proteomic immune-evasion mechanisms that suppress interferon signaling, modulate NF-κB activity, and induce transient lymphoid suppression [22,23]. Severe risk and harm outcomes, including persistent vaccine-strain infection and measles inclusion-body encephalitis in immunocompromised individuals, highlight the clinical relevance of these multi-omic vulnerabilities [24]. Collectively, these data demonstrate the limitations of n-of-all vaccination paradigms, given their risk of aberrancy, and support a shift toward n-of-1 precision immunology that incorporates immunogenetic profiling, interferon-pathway assessment, and longitudinal molecular surveillance [19].

The limitations of this study are those inherent to the CDC/FDA's VAERS database. The system is subject to substantial underreporting, variable reporting rates, and inconsistent or incomplete data quality. A limited proportion of healthcare professionals are familiar with VAERS or its reporting requirements, which may further contribute to under-ascertainment. While VAERS reports imply causality by proxy of reporting, they are not independently adjudicated with final

causality assessments documented in a systematic manner. Clinical details may be incomplete or heterogeneously documented; however, the CDC is provided with provider and patient (parent) contact information, so the agency is at liberty to make contact and gather additional information. Passive surveillance systems are specifically designed to detect early safety signals and temporal clustering that may warrant further investigation. While incidence rates cannot be calculated from VAERS data alone, the magnitude and consistency of the descriptive patterns observed in this analysis underscore the need for more rigorous evaluation using active surveillance systems and linked medical record datasets capable of validating outcomes and assessing background-adjusted risk.

Conclusion

We identified a serious mortality safety signal following MMR/MMRV vaccination in the United States. A substantial number of reported deaths were documented, with patterns demonstrating pronounced alignment across age, temporality, routine-dose timing, concomitant vaccine exposure, and characteristic clinical presentations—including fever, seizures, SIDS, and cardiopulmonary arrest. Reported deaths were predominantly concentrated in children under 2 years of age, particularly within the 12–15 month first-dose window, and a clear majority occurred within the first 14 days following vaccination. The synchronization of age-specific clustering with immediate post-vaccination timing reflects a non-random pattern of mortality. Vaccine-associated death reports are contrasted with exceedingly rare number of measles infection–associated deaths in the modern era, representing a 2,657% higher count of reported vaccine-associated deaths since 1995.

Healthcare providers reported deaths following MMR/MMRV vaccination likely because they suspected that vaccination may have played a causal role in the child's demise. Without independent adjudication, our data cannot establish causality; however, the magnitude, concentration, and temporal proximity of these reports warrant rigorous, transparent, and fully independent investigation. Given the central role of MMR vaccination in the childhood immunization schedule, a comprehensive and transparent evaluation of these observed patterns is not only justified but essential to uphold public trust, strengthen post-licensure safety monitoring, and ensure the highest standards of informed consent and patient protection.

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Ethics Statement: This study utilized publicly available, de-identified data from the Vaccine Adverse Event Reporting System (VAERS). Because the dataset contains no identifiable private information and does not involve direct interaction with human subjects, institutional review

board (IRB) approval and informed consent were not required in accordance with federal regulations governing research involving publicly available data.

Informed Consent Statement:
Not applicable. This study analyzed publicly available, de-identified VAERS data and did not involve direct patient contact or identifiable human subjects.

Conflicts of Interest Statement:
The authors declare no competing financial interests, commercial affiliations, or conflicts of interest related to this work.

Acknowledgements: None

Data Availability Statement:
All data analyzed in this study were obtained from the publicly accessible VAERS database (https://vaers.hhs.gov).

References

1. Hendriks J, Blume S. Measles vaccination before the measles-mumps-rubella vaccine. Am J Public Health. 2013;103(8):1393-1401. doi:10.2105/AJPH.2012.301075
2. Centers for Disease Control and Prevention. *Measles Vaccines*. https://www.cdc.gov/measles/vaccines/index.html. Accessed February 16, 2026.
3. Centers for Disease Control and Prevention. *MMR Vaccine Safety*. https://www.cdc.gov/vaccine-safety/vaccines/mmr.html. Accessed February 16, 2026.
4. Marin M, Broder KR, Temte JL, Snider DE, Seward JF; Centers for Disease Control and Prevention (CDC). Use of combination measles, mumps, rubella, and varicella vaccine: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep. 2010;59(RR-3):1-12.
5. Vaccine Adverse Event Reporting System (VAERS) About Us. U.S. Department of Health & Human Services; Centers for Disease Control and Prevention; Food and Drug Administration. https://vaers.hhs.gov/about.html. Accessed January 27, 2026.
6. Lazarus R. Electronic Support for Public Health–Vaccine Adverse Event Reporting System (ESP:VAERS) – Final Report. Prepared by Harvard Pilgrim Health Care, Inc. under Grant No. R18 HS017045; Rockville, MD: Agency for Healthcare Research and Quality; 2010.
7. National Vaccine Information Center. MedAlerts VAERS database search interface. https://www.medalerts.org/. Accessed August 29, 2025.
8. Mathis AD, Raines K, Filardo TD, et al. Measles Update - United States, January 1-April 17, 2025. MMWR Morb Mortal Wkly Rep. 2025;74(14):232-238. Published 2025 Apr 24. doi:10.15585/mmwr.mm7414a1
9. Gindler J, Tinker S, Markowitz L, Atkinson W, Dales L, Papania MJ. Acute measles mortality in the United States, 1987-2002. J Infect Dis. 2004;189 Suppl 1:S69-S77. doi:10.1086/378565

10. Miller NZ. Vaccines and sudden infant death: An analysis of the VAERS database 1990-2019 and review of the medical literature. *Toxicol Rep*. 2021;8:1324-1335. Published 2021 Jun 24. doi:10.1016/j.toxrep.2021.06.020
11. Hooker BS, Jablonowski C. Increased mortality associated with 2-month old infant vaccinations. Published online 2026. Zenodo. doi:10.5281/zenodo.18262930
12. Merck Sharp & Dohme LLC. *Package Insert – Measles, Mumps, and Rubella Virus Vaccine Live (M-M-R® II)*. Revised November 2025. https://www.fda.gov/media/75191/download. Accessed February 16, 2026.
13. Rose J. Critical appraisal of VAERS pharmacovigilance: Is the U.S. Vaccine Adverse Events Reporting System (VAERS) a functioning pharmacovigilance system? Sci Public Health Policy Law. 2021;3:100-129.
14. Centers for Disease Control and Prevention. *Measles Cases and Outbreaks*. CDC; 2026. https://www.cdc.gov/measles/data-research/index.html. Accessed February 16, 2026.
15. Washam MC, Leber AL, Oyeniran SJ, Everhart K, Wang H. Shedding of measles vaccine RNA in children after receiving measles, mumps and rubella vaccination. *J Clin Virol*. 2024;173:105696. doi:10.1016/j.jcv.2024.105696
16. Centers for Disease Control and Prevention. *Measles Virus Genotype A RT-qPCR (MeVA RT-qPCR)*. https://www.cdc.gov/measles/downloads/measles-virus-genotype.pdf. Accessed February 16, 2026.
17. Montroy J, Yan C, Khan F, et al. Post-exposure prophylaxis for the prevention of measles: A systematic review. *Vaccine*. 2025;47:126706. doi:10.1016/j.vaccine.2025.126706
18. Centers for Disease Control and Prevention. *Measles Treatment Overview: Information for Healthcare Providers*. May 2025. https://www.cdc.gov/measles/media/pdfs/2025/05/hcp-caring-for-patients-measles-fact-sheet.pdf. Accessed February 16, 2026.

19. Omeršel J, Karas Kuželički N. Vaccinomics and Adversomics in the Era of Precision Medicine. J Clin Med. 2020;9(11):3561.
20. Whitaker JA, Ovsyannikova IG, Poland GA. Adversomics: a new paradigm for vaccine safety and design. Expert Rev Vaccines. 2015;14(7):935–947.
21. Ovsyannikova IG, Haralambieva IH, Vierkant RA, Pankratz VS, Jacobson RM, Poland GA. Extended LTA, TNF, LST1, and HLA Gene Haplotypes and Their Association with Rubella Vaccine-Induced Immunity. PLoS ONE. 2010;5(7):e11806. doi:10.1371/journal.pone.0011806
22. Tanaka T, Narazaki M, Kishimoto T. IL-6 in inflammation, immunity, and disease. Cold Spring Harb Perspect Biol. 2014;6:a016295. doi:10.1101/cshperspect.a016295.
23. Ni T et al. Global intron retention mediated gene regulation during CD4+ T cell activation. Nucleic Acids Res. 2016;44:6817–6829. doi:10.1093/nar/gkw591.
24. Wendorf KA et al. Subacute Sclerosing Panencephalitis: Updated Epidemiology. Clin Infect Dis. 2017;65(2):226–232. doi:10.1093/cid/cix302.