Vaccine Safety Analysis of MMR/MMRV Vaccines Using VAERS Data (2014–2024)

Purpose

This project evaluated adverse event reports associated with measles-containing vaccines (MMR and MMRV) from 2014 to 2024 using VAERS data. The analysis aimed to identify symptom patterns, characterize the seriousness of reported events, and model predictors of serious outcomes. This work simulates real-world evidence (RWE) safety monitoring and pharmacovigilance practices.

Data Source

- Publicly available VAERS data from 2014–2024
- Integrated VAERSDATA, VAERSVAX, and VAERSSYMPTOMS datasets
- Data management performed in SQLiteStudio and SAS

Key Findings

Descriptive Analysis:

- The majority of reports were non-serious events.
- The most frequently reported clinical symptoms were:
    - Fever (Pyrexia)
    - Vomiting
    - Local swelling

- A substantial proportion of reports included non-clinical terms such as "No adverse event" or "Product storage error." These were excluded from clinical symptom summaries but reported separately for transparency.

Seriousness by Demographics:

- Serious adverse events were more commonly reported in infants under 1 year and in males, though the majority of all events across groups remained non-serious.
- Year-over-year trends showed stable reporting patterns, with no marked increase in serious reports over time.

Logistic Regression Results:

- Predictors of Seriousness:
    - Age <1 year was associated with higher odds of serious adverse events compared to older age groups.
    - Sex was not a statistically significant predictor in this model, though males had slightly higher reported odds.\
    - Odds Ratios were visualized using a forest plot, aligning with pharmacoepidemiology reporting standards.

Interpretation and Surveillance Implications:

- The analysis did not identify unexpected safety signals related to MMR/MMRV vaccines within the 2014–2024 VAERS dataset.
- Findings align with the known safety profile of measles-containing vaccines.
    - Mild symptoms (rash, fever) remain the most commonly reported events.
    - Serious adverse events are rare, but consistent monitoring remains essential.
- The project highlights the importance of passive surveillance data review, careful data cleaning (e.g., exclusion of non-adverse event terms), and stratified analysis for meaningful interpretation.

Conclusion:

This project demonstrates the integration of SQL-based data management, SAS statistical modeling, and real-world safety data analysis, aligning with the workflows of RWE analysts, pharmacoepidemiologists, and vaccine safety teams. The results support the continued safe use of MMR/MMRV vaccines while underscoring the value of ongoing pharmacovigilance.