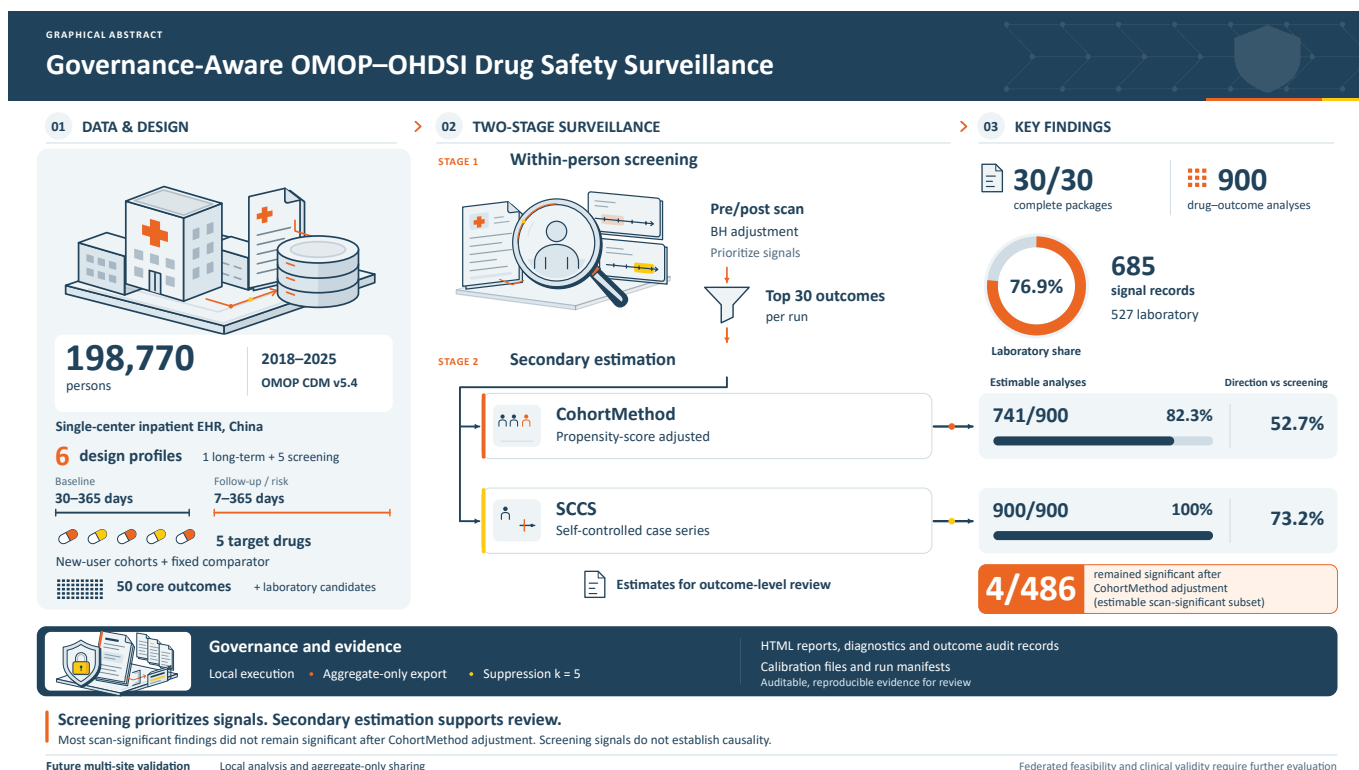


A Governance-Aware OMOP-OHDSI Pipeline With Standardized Evidence Packages for Postmarketing Drug Safety Surveillance: A Multi-Drug, Multi-Window Demonstration Study

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Background

Spontaneous-report pharmacovigilance remains essential for adverse drug event detection but lacks denominators and is vulnerable to under-reporting and reporting bias. OMOP Common Data Model (CDM)-based real-world data surveillance can complement spontaneous reporting by enabling explicit time-at-risk definitions, denominator-based monitoring, and reproducible estimation. However, routine surveillance across clinical sites is shaped by governance requirements, including behind-the-firewall execution, aggregate-only export, minimum cell-count suppression, and feasibility gates. These requirements affect what can be computed, shared, and reviewed. We implemented a governance-aware OMOP-OHDSI workflow that represents site requirements as pre-specified design profiles and exports a standardized evidence package for multi-drug, multi-window postmarketing safety monitoring.

Methods

This retrospective demonstration used inpatient electronic health record data from a tertiary academic medical center in China mapped to OMOP CDM v5.4. The OMOP instance covered 198,770 persons and inpatient extracts from 2018-2025 with dense laboratory and medication-order capture. Analyses were executed within the hospital; only aggregate outputs were exported under $k=5$ minimum cell-count suppression. Drug exposure start dates were derived from medication orders mapped to DRUG_EXPOSURE. We evaluated five target drugs defined by OMOP standard concept sets and executed six design profiles: one regulatory-style 365-day baseline/365-day follow-up/365-day risk-window profile and five screening profiles with progressively shorter baseline, follow-up, and risk windows. For each target drug, the workflow constructed new-user cohorts with a fixed comparator, ran automated temporal plausibility and concept-set completeness checks, and performed a within-person pre/post screening scan. Candidate outcomes combined a curated 50-outcome core library with run-specific laboratory measurement candidates discovered from MEASUREMENT. Benjamini-Hochberg adjustment was applied within each run to reportable outcomes after suppression. The top 30 prioritized outcomes per run were then evaluated using CohortMethod and self-controlled case series (SCCS), with propensity-score adjustment estimated using Cyclops for CohortMethod. Each run exported an evidence package including an HTML report, machine-readable screening and estimation outputs, outcome-level audit records, diagnostics, optional calibration artifacts, session information, and a run manifest. Ethical review and informed consent were waived because de-identified data were analyzed inside a secure hospital environment and no person-level data left the host site.

Results

All 30 runs completed and produced complete evidence packages; no runs were hard-gated. Across the five drugs, valid exposure records ranged from 6,681 to 9,305, and data coverage spanned 2018-02-12 to 2025-09-25. Across the 25 screening runs, a median of 66 outcomes were evaluated per run and a median of 34 remained reportable after $k=5$ suppression. The merged outcome-level audit record contained 685 increased-risk graded signals, of which 527 (76.9%) were laboratory measurements. Secondary estimation was attempted for 900 prioritized drug-outcome analyses. CohortMethod produced estimable results for 741 of 900 analyses (82.3%); the main non-estimability reasons were sparse outcomes with zero comparator events, unavailable p values, and propensity-score model non-convergence. SCCS returned estimable results for all 900 prioritized analyses under the implemented specification. Among outcomes with a screening direction and estimable secondary estimate, direction agreement was 52.7% for CohortMethod and 73.2% for SCCS. Only 4 of 486 scan-significant outcomes with estimable CohortMethod results remained significant after confirmatory adjustment. Calibration artifacts were generated for all 30 runs.

Conclusions

Pre-specifying governance rules as design profiles and exporting standardized evidence packages enabled auditable multi-drug, multi-window monitoring in an OMOP-OHDSI stack. In this inpatient EHR demonstration, rapid within-person screening generated many candidate signals, especially laboratory measurement outcomes, but most did not persist under comparator-based estimation. The workflow therefore supports screening as a prioritization layer rather than a causal inference layer. This approach provides a practical template for governance-compliant, behind-the-firewall postmarketing surveillance that preserves aggregate-only export, transparent diagnostics, reproducibility, and reviewability for future federated deployment.

Keywords: OMOP CDM; OHDSI; real-world evidence; pharmacovigilance; postmarketing surveillance; CohortMethod; self-controlled case series; governance; evidence package; federated analytics.

Table 1. Governance design profiles used in the multi-window demonstration

Design profile	Baseline (days)	Follow-up (days)	Risk window (days)	Intended use
regulatory_365_365	365	365	365	Regulatory-style longer-term monitoring requiring longitudinal coverage
screening_365_90	365	90	90	Screening with 1-year baseline and shorter follow-up
screening_180_90	180	90	90	Screening when only 6-month baseline is available
screening_90_30	90	30	30	Short-term inpatient or acute-setting screening
screening_30_14	30	14	14	Very-early monitoring, sensitive to testing and coding patterns
screening_30_7	30	7	7	Rapid-cycle analysis for acute risks

Table 2. Profile-level feasibility, reportability, and estimability

Profile	Packages	Median cohort size (exposed/comparator)	Outcomes evaluated (median)	Reportable screening estimates (median)	CohortMethod / SCCS estimable
regulatory_365_365	5/5	1237/259	73	21	121/150; 150/150
screening_365_90	5/5	1641/296	66	34	114/150; 150/150
screening_180_90	5/5	1870/338	67	31	125/150; 150/150
screening_90_30	5/5	2204/414	64	36	128/150; 150/150
screening_30_14	5/5	2571/464	67	34	127/150; 150/150
screening_30_7	5/5	2729/488	65	25	126/150; 150/150

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