Nephrotoxic Drug Event abstractor

The 20% Information That Solves 80% of the Case

Category	Key Data Element	Why It's High Yield
Patient context	Age, weight, baseline creatinine, baseline GFR	Pediatric renal risk varies significantly with age/weight and baseline function
Drug exposure	Start/stop dates, dose, route for nephrotoxic drug(s) (aminoglycosides, vancomycin, amphotericin, certain antivirals, NSAIDs, chemotherapeutics)	Confirms exposure and duration
Temporal link	Time from drug initiation to first creatinine change	Most nephrotoxic effects occur within predictable time windows
Renal function changes	Daily creatinine trend, GFR changes, urine output	Core criteria for event classification
Alternative explanations	Sepsis, dehydration, surgery with bypass, imaging contrast	Helps rule out drug as primary cause
Intervention	Dose adjustment, drug discontinuation, nephrology consult	Supports causality or mitigation actions taken

Interesting Questions

Area	Question	Purpose
Definition clarity	“Which nephrotoxic drugs are in-scope for monitoring?”	Ensures consistent case capture
Event criteria	“Do we define an event strictly by lab criteria, or also by clinical diagnosis/documentation?”	Impacts sensitivity/specificity
Overlap with other programs	“How should cases with sepsis or contrast exposure be classified?”	Prevents duplication/conflicting classification
Operational use	“Is the goal to prevent events prospectively or to meet reporting/compliance needs?”	Aligns abstraction approach with use case
Data availability	“Are all creatinine results, urine outputs, and med admin records reliably captured in Epic/Caboodle?”	Identifies feasibility gaps
Alerting thresholds	“Would real-time monitoring be valuable or is retrospective review sufficient?”	Guides automation vs manual review balance
Performance metrics	“Do we track nephrotoxic drug exposure rates per 1,000 patient-days or actual injury rates?”	Helps design dashboards/KPIs

Few Cases worth reviewing

Case Type	Why
Clear injury, single drug	Example: Vancomycin started, creatinine doubled in 72 hrs, no other insults → confirms positive case definition
Multiple potential causes	Example: Aminoglycoside + recent contrast + hypotension → tests attribution logic
Transient creatinine rise	Example: Amphotericin, creatinine up 0.3 mg/dL but resolves in 24 hrs → clarifies threshold for significance
Borderline timing	Example: Creatinine rises 10 days after drug stopped → tests causal window definition
High exposure, no injury	Example: Multiple nephrotoxic drugs, creatinine stable → reinforces that not all exposures cause events
Data gap case	Missing baseline creatinine or incomplete MAR data → shows abstraction challenges

Oracle Criteria – is it 1 or more?

Framework	Core Criteria for AKI	Notes for Pediatric Use
pRIFLE	Based on estimated creatinine clearance (eCCl) decrease or urine output: • Risk: ↓ eCCl by ≥25% or urine output <0.5 mL/kg/h for 8 hrs • Injury: ↓ eCCl by ≥50% or urine output <0.5 mL/kg/h for 16 hrs • Failure: ↓ eCCl by ≥75% or urine output <0.3 mL/kg/h for 24 hrs	Designed for children, uses Schwartz formula for eCCl
KDIGO	• Stage 1: ↑ serum creatinine (SCr) by ≥0.3 mg/dL in 48 hrs or ≥1.5–1.9× baseline • Stage 2: 2.0–2.9× baseline • Stage 3: ≥3× baseline or ≥4.0 mg/dL or initiation of RRT	More widely recognized globally; pediatric adaptation needed for size/weight
NINJA	Focuses on nephrotoxic exposure and daily creatinine monitoring for high-risk patients: • ≥3 nephrotoxic meds in 24 hrs OR ≥3 days of aminoglycoside therapy triggers daily SCr checks	Used operationally in >30 children's hospitals for prevention

How do we rule out

Step	Question / Check	Rule-Out if…
1. Exposure verification	Did the patient receive any nephrotoxic drug(s) of interest?	No documented exposure → Not a nephrotoxic drug event
2. Baseline renal status	Is there a valid baseline SCr or eCCl?	No baseline and no surrogate → Cannot confirm event (possible exclude or defer)
3. Timing match	Did AKI occur within the expected timeframe of drug exposure?	Injury occurred before drug start OR well after clearance period → Rule out
4. Objective AKI criteria met	Does patient meet pRIFLE or KDIGO change thresholds?	No qualifying change in SCr/eCCl or urine output → Rule out
5. Alternative causes	Was there a more likely primary cause? (sepsis, dehydration, surgery, contrast)	Stronger alternate etiology, documented by treating team → Rule out as drug-induced
6. Causality plausibility	Was the drug continued despite AKI without worsening, or stopped without improvement?	Weak/no causal relationship → Rule out
7. Data quality	Are labs, med records, and notes complete?	Missing critical data → Mark as “unable to determine,” not a confirmed event

Quick Cheatsheet

Rule-Out Reason	Example
No nephrotoxic exposure	SCr rise after contrast only, no listed nephrotoxic meds
Pre-existing renal injury	Chronic kidney disease baseline
AKI precedes exposure	SCr doubled before aminoglycoside started
Competing etiology	Severe septic shock + hypotension day before AKI
No objective AKI	Creatinine rose 0.1 mg/dL only
Non-overlapping time window	AKI 10 days after drug stopped, drug half-life short
Data insufficiency	Missing med administration record or baseline labs

Notes to Pull – High Yield

Note type (Caboodle `ClinicalNoteFact.Type`)	Author type	Window	Why
H&P, Progress, Significant Event	Attending/Resident/APP	**Baseline −7d → Last exposure +72h**	Baseline SCr/eGFR, dehydration, hypotension, timing narrative (KDIGO).
Nephrology consult	Nephrologist	Exposure → +14d	Causality assessment, dose changes, RRT.
Pharmacy / Therapeutic drug monitoring	Pharmacist	Exposure → +7d	Doses, troughs/peaks (vanc/AG), dose holds.
Procedure/Anesthesia/OR notes	Surgeon/Anesthesiologist	−24h → +72h	Bypass, hypotension, fluid losses (confounders).
ED notes	ED Provider	−24h → +24h	Sepsis, volume status, first doses.
Nursing IPOC / Flowsheet summary notes	RN	Exposure → +7d	UOP documentation gaps, fluid balance.

Flowsheets (map FlowsheetRowEpicId→label, derive `MeasurementValue`, constrain by **EncounterKey** + **DateKey window**.)

Measurement (friendly)	Source (typical)	Filter/format	Why
Urine output (mL/kg/hr)	Flowsheet row(s) for UOP/I&O	keep rows with numeric; compute rolling **8h** minima	pRIFLE: UOP <0.5 × ≥8h.
Intake/Output totals	I&O rows	daily totals	Fluid balance context.
Weight	Vitals	most recent per day	Normalize UOP (mL/kg/hr).
MAP / BP	Vitals	MAP ≤65 (older kids) or age-norm cut	Hypotension confounder.
Temp	Vitals	>38°C or <36°C	Sepsis confounder.
SpO_2 / FiO_2 / O_2 device	Respiratory rows	as-is	Critical illness context.
Dialysis/RRT start	LDA/Device rows	first start/stop instants	AKI Stage 3 criteria; outcome.

Labs & levels (AKI + drug causality)

Lab	Caboodle hints	Window	Why
Serum creatinine (SCr)	`LabComponentResultFact` (SCr component keys)	**Baseline −7d → +14d**	KDIGO staging (Δ≥0.3/48h or ≥1.5×/7d).
BUN	component keys	same	Context (pre-renal vs intrinsic).
Cystatin-C *(if available)*	component keys	same	Pediatric GFR adjunct.
Vancomycin trough/peak	pharmacy/TDM components	exposure ±24–48h	Exposure intensity/causality.
Aminoglycoside levels	gent/tobra/amikacin	exposure ±24–48h	NINJA risk corroboration.
UA (protein, blood, casts)	UA component panel	exposure window	GN vs ATN clues.
Urine sodium / FENa	if recorded	exposure window	Pre-renal vs intrinsic.

Event Confirmation Questions (Directly map to your rule-in/rule-out algorithm)

Category	Preloaded KG Question	Insight Returned
Drug Exposure	“List all nephrotoxic drugs given in this admission, with start/stop dates, doses, and routes.”	Drug exposure timeline
Renal Baseline	“What was the baseline serum creatinine and eCCl before first nephrotoxic drug exposure?”	AKI baseline reference
Temporal Link	“What is the time between nephrotoxic drug start and first abnormal creatinine?”	Checks causal window
Renal Change Severity	“Does the creatinine change meet pRIFLE or KDIGO criteria?”	Auto-staged AKI
Urine Output	“What is the lowest urine output (mL/kg/hr) recorded during exposure?”	Matches pRIFLE thresholds

2. Rule-Out & Confounder Questions - (Help abstractor quickly dismiss non-cases)

Category	Preloaded KG Question	Insight Returned
Alternate Causes	“List other events within 48 hrs of AKI: sepsis, hypotension, surgery, contrast exposure.”	Competing etiology list
Timing Conflict	“Did the AKI occur before nephrotoxic drug administration?”	Early onset check
Recovery Pattern	“Did creatinine return to baseline despite continuing the drug?”	Weak causality indicator
Missing Data	“Which key labs or med administration records are missing?”	Data quality flags

3. Clinical Context Insights
(Give richer understanding without extra clicks)

Category	Preloaded KG Question	Insight Returned
High-Risk Combinations	“Were ≥3 nephrotoxic drugs given in any 24-hour window?”	NINJA exposure trigger
Cumulative Dose Risk	“Total cumulative dose of each nephrotoxic drug in this encounter.”	Dose-related toxicity risk
Trend Visualization	“Generate creatinine and urine output trend chart aligned to drug exposure timeline.”	Visual causal signal
Care Actions	“Was nephrology consulted within 24 hrs of AKI detection?”	Response timeliness
Patient Outcomes	“Was renal replacement therapy required during admission?”	Severity outcome

Event Trigger Pipeline

1	Trigger	New nephrotoxic med ordered, ≥3 nephrotoxic meds/24h, or ≥3 days aminoglycoside (NINJA)	Start job; set lookback window. (NephJC, ScienceDirect)
2	Gather baseline	Lowest SCr in prior 7d; compute eCCl (Schwartz)	Baseline SCr/eCCl card. (KDIGO, Renaissance School of Medicine)
3	Build exposure timeline	Meds (start/stop/dose/route) from Caboodle/Clarity feed	Drug timeline chip list. (UC Davis Health, ehealth.connect-care.ca)
4	Detect AKI by rules	KDIGO: SCr ↑ ≥0.3 mg/dL/48h or ≥1.5×/7d; pRIFLE: eCCl↓≥25% or UOP <0.5 mL/kg/h ≥8h	Stage badge (KDIGO/pRIFLE). (KDIGO, PubMed)
5	Time plausibility	Align first abnormal SCr/UOP vs exposure & drug half-life window	"Plausible timing" tag. (KDIGO)
6	Confounder sweep	Sepsis, shock, surgery/bypass, contrast within ±48h	"Competing etiology" ribbon if present. (PMC)
7	Response pattern	Did SCr improve after dose stop/reduce? nephrology consult?	"Causality pattern" chip. (PMC)
8	Relevance rank	Score tiles (see logic table). Only show tiles > threshold; collapse others	Top 3 insights + one-click expand.
9	One-glance summary	20% snapshot auto-filled; rule-in/out suggestion	Green (rule-in), red (rule-out), gray (insufficient). (KDIGO, Renaissance School of Medicine, NephJC)

KG – Auto Summary

KG query	Auto-summary tile	When shown
“List nephrotoxic meds with start/stop/dose/route”	Exposure timeline	Always; condensed if low risk. (UC Davis Health)
“Baseline SCr/eCCl before first exposure”	Baseline card	Always; red if missing. (KDIGO, Renaissance School of Medicine)
“Does change meet KDIGO/pRIFLE?”	AKI stage badge	If criteria met. (KDIGO, PubMed)
“Confounders ±48h?”	Competing etiology ribbon	If found. (PMC)
“Nephrology consult within 24h?”	Response/care action chip	If present. (PMC)
“Prior AKI in past admissions?”	Recurrence alert	If prior event exists. (Pediatrics)

Relevance scoring (to auto-hide noise) -

This matrix is UI-ready: render each row as a tile; show only tiles with nonzero relevance; color-code: green (rule-in), red (rule-out), gray (missing).

Signal	Rule	Score
KDIGO met	SCr ↑ ≥0.3/48h or ≥1.5×/7d	+5 renalcareus.baxter.com
pRIFLE met	eCCl↓≥25% or UOP <0.5 mL/kg/h ≥8h	+4 PMC
NINJA high-risk	≥3 NTMs/24h **or** ≥4 days IV aminoglycoside	+3 PMC
Timing fits	Injury during/≤72h post exposure	+2 renalcareus.baxter.com
Dominant confounder	Sepsis/shock/contrast/bypass ±48h	−4 NaturePMC
Recovery on drug	SCr normalizes while continued	−3 renalcareus.baxter.com

Query Set – Clean Structured Signal Chain

Stage	Output	Meaning for AI
M0	Cohort of encounters w/ nephrotoxic med exposure	Defines *candidate population* for review & AI
M1	Relevant labs (SCr, BUN, Cystatin C, drug levels)	Core clinical markers for AKI detection
K1	Timelined SCr values (± window around drug exposure)	Allows temporal modeling and trend detection
K2	Baseline SCr	Patient-specific comparator for AKI definition
K3	First abnormal SCr	Ground truth *event onset anchor*
K4	Peak SCr	Event severity peak marker
K5	KDIGO Stage (0–3)	Target label for classification / severity prediction

2. Turning It into AI-Ready Data

a. Labeled Supervised Learning Dataset

Label (y) = KDIGO_Stage

Features (X) =

- Demographics (age, sex, weight, comorbidities)
- Medications (type, dose, duration, # of nephrotoxic agents)
- Lab trends (baseline → first abnormal → peak)
- Encounter context (unit type, length of stay, surgeries)

Can be used to **predict**:

- Likelihood of progressing from Stage 0/1 to Stage 2/3
- Expected time to AKI onset after first dose

Temporal Reasoning Inputs for LLMs

- From K1: chronological **SCr time series** relative to drug start
- From M0/M1: **medication–lab event pairs**
  → Enables reasoning over "drug X given at t0 → SCr spike at t+2 days"
- Can package as JSON or Knowledge Graph:

Automated Chart Abstraction Support

- Use **K3** as the "flag event"
- Auto-retrieve notes & relevant labs in the event window
- Feed to LLM with a **prompt structure**:
    - **Event confirmation** (meets KDIGO criteria?)
    - **Rule-out** (contrast nephrotoxic AKI vs sepsis-related AKI)
    - **Context** (recent surgery, dehydration, etc.)
    - **Operational insight** (timing of med adjustments)

The AI Value

- **LLM-assisted review**: Saves abstractors 50–70% time by pre-highlighting event windows & labs.
- **Predictive alerts**: Build models to flag *likely-to-progress* patients early.
- **Retrospective analytics**: Identify med–lab–outcome patterns for stewardship.

Silver Objects

SILVER Object	What's Inside	Why Keep Here
M0 – NTX_COHORT_YTD	Encounter list + med start/stop dates + patient IDs	Cohort definition from source data
M1 – Labs_Inputs_YTD	All raw labs (SCr, BUN, Cystatin C, drug levels) in window	Retain all values, not just abnormal ones
K1 – KDIGO_SCr_Series_YTD	Sequential lab points ± window	Preserves the original lab history for re-eval
K2 – KDIGO_Baseline_YTD	Baseline SCr (raw numeric)	Core calc input; still "direct" derivation
K3 – KDIGO_FirstAbnormal_YTD	First abnormal lab meeting criteria	Needed for reproducibility
K4 – KDIGO_Peak_YTD	Peak SCr (raw numeric)	Base signal for severity calc

Rule: If it's **summarized, labeled, or engineered for decision-making**, it belongs in GOLD.

GOLD Object	What's Inside	Why Keep Here
KDIGO_Stage_YTD (K5)	Final Stage (0–3) + baseline + dates	Ready-made classification label
Event Window JSON	JSON block: med/lab timeline, baseline, peak, stage	Plug-and-play for LLM or ML
Confounder Flags	E.g., Sepsis, dehydration, cardiac surgery within ±72h	Precomputed context for faster rule-out
Operational Metrics	Time-to-stage, time-to-med-change, service-line	Supports quality dashboards
Knowledge Graph Nodes	Nodes & relationships for patient-event KG	Enables reasoning queries
Abstraction Packs	Bundled labs, meds, notes for review	Gives abstractor 20% to solve 80% of case