MRF Quality Report

s3://talon-storage-private/mrf-feed-uploads/2025-10/2025-07-15_Providence_Health_Plan_419e8fe322b8cbd687f4834b0b36f30d_in-network-rates.json.gz

Size: 59.96 MB • MD5: 5db70e9f0542a8ed7f5e94ecba1587d2

Payer: **Providence_Health_Plan** • File Date: **2025-07-15** • Generated: **2026-04-26 05:43 EDT** • Tool Version: **1.0.0** • Elapsed: **2636.00s**

74.0

Limited Reliability

score capped at 74.0 — 1 native JSON parse error(s) require payer re-export (see meta for details)

Errors: 3 • Warnings: 11 • Info: 3 • **1 Raw JSON Error(s)**

TOC Plan References

TOC: s3://talon-storage-private/mrf-feed-uploads/2025-10/2025-10-15_Providence-Health-Plan-Master_combine_index.json • Providence Health Plan (Health Plan)

Canonical: s3://talon-storage-private/mrf-feed-uploads/2025-10/2025-07-15_Providence_Health_Plan_419e8fe322b8cbd687f4834b0b36f30d_in-network-rates.json.gz

Plan Name	Plan ID	Issuer / Sponsor	Market
CONNECT	954136880 (EIN)	—	group

Raw JSON Parse Errors

ResponseStreamingError

An error occurred while reading from response stream: ('Connection broken: IncompleteRead(62870422 bytes read, 12281033512 more expected)', IncompleteRead(62870422 bytes read, 12281033512 more expected))

Full message:

```
An error occurred while reading from response stream: ('Connection broken: IncompleteRead(62870422 bytes read, 12281033512 more expected)', IncompleteRead(62870422 bytes read, 12281033512 more expected))
```

Dimension Scores

Dimension	Score	Weight	Findings
Schema Integrity	86.3	30%	4
Provider Mapping	100.0	15%	4
Code Coverage	93.0	15%	1
Pricing Sanity	77.4	40%	8

Schema Integrity — Findings

Score: 86.3

ERROR `file_freshness`

File is 285 days old (last_updated_on exceeds the 90-day threshold)

WARNING `expired_prices`

104012 negotiated_prices have past expiration dates (7.4%)

ERROR `raw_json_error`

Native JSON parse error detected in unpatched source file: An error occurred while reading from response stream: ('Connection broken: IncompleteRead(62870422 bytes read, 12281033512 more expected)', IncompleteRead(62870422 bytes read, 12281033512 more expected)). Scoring below reflects auto-patched data only. File must be re-exported by the payer to fully resolve.

ERROR `parse_crash`

single pass crash after 43 items: An error occurred while reading from response stream: ('Connection broken: IncompleteRead(20451418 bytes read, 12323452516 more expected)', IncompleteRead(20451418 bytes read, 12323452516 more expected))

Provider Mapping — Findings

Score: 100.0

WARNING `npi_validity`

0.00% of NPIs failed Luhn checksum validation (4 of 108476)

- 1336588484
- 1659650617

WARNING `ein_validity`

0.31% of EINs failed IRS prefix validation (191 of 61613)

- 000000001
- 001625898
- 003360711
- 003680161
- 004829723
- *… and 5 more*

WARNING `empty_npi_groups`

51 provider groups contain no NPIs

INFO `duplicate_npis`

35731 NPIs appear in more than one provider group

Code Coverage — Findings

Score: 93.0

WARNING `billing_code_format`

6 CPT codes do not match expected format

Pricing Sanity — Findings

Score: 77.4

INFO `per_diem_rates`

30 per-diem rates (0.0%) — not dollar amounts; excluded from spread analysis

INFO `percentage_rates`

1604 percentage rates (0.1%) — values represent % of a reference rate, not dollar amounts; excluded from spread analysis

WARNING `zero_rates`

49 zero-dollar rates (0.00%) — CMS schema requires negotiated_rate > 0 (exclusiveMinimum); may represent unfiled or excluded services

WARNING `extreme_rates`

0.51% of rates are extreme (7174 above class-specific high threshold, 0 below $0.01)

WARNING `high_frequency_rate_value`

39 rate value(s) appear with suspiciously high frequency (≥0.5% of dollar rates and ≥50 occurrences) — likely placeholder/sentinel values rather than real negotiated rates.

- {'rate': 4.5, 'count': 19960, 'pct': 1.42}
- {'rate': 521.0, 'count': 19708, 'pct': 1.4}
- {'rate': 1283.0, 'count': 19708, 'pct': 1.4}
- {'rate': 3549.5, 'count': 19708, 'pct': 1.4}
- {'rate': 1883.5, 'count': 19708, 'pct': 1.4}
- *… and 5 more*

WARNING `rate_spread_by_class`

billing_class='professional' / negotiated_type='fee schedule': P95/P50 spread is 8.0x (threshold: 5x, N=1,380,888 (1,000 sampled), high confidence)

WARNING `rate_spread_by_class`

billing_class='institutional' / negotiated_type='negotiated': P95/P50 spread is 51.7x (threshold: 10x, N=187, moderate confidence)

WARNING `per_code_rate_spread`

25 rate contexts have a max/min ratio exceeding the type-specific threshold (20x professional / 50x facility, min 3 occurrences required). Each context is a unique combination of all 10 rate-key dimensions. n= shows how many distinct provider rates exist for that exact context.

Code	Code Type	Neg. Type	Billing Class	Arrangement	Setting	Min	Median	Mean	Max	Ratio	n
S0104	HCPCS	fee schedule	professional	ffs	—	$1.36	$1.89	$4699.08	$2250000.00	**1654411.8×**	958
S0104	HCPCS	negotiated	institutional	ffs	—	$1.51	$1200000.00	$752250.75	$1286250.00	**851821.2×**	5
S0104	HCPCS	negotiated	institutional	ffs	—	$1.51	$1200000.00	$752250.75	$1286250.00	**851821.2×**	5
E2205	HCPCS	fee schedule	professional	ffs	—	$3.01	$3.71	$8150.15	$2400000.00	**797342.2×**	27270
E2205	HCPCS	fee schedule	professional	ffs	—	$3.71	$4.35	$8189.47	$2400000.00	**646900.3×**	27141
84376	CPT	fee schedule	professional	ffs	—	$4.24	$6.32	$3184.52	$2250000.00	**530660.4×**	1416
E2205	HCPCS	fee schedule	professional	ffs	—	$22.56	$27.90	$8175.13	$2400000.00	**106383.0×**	27270
87520	CPT	fee schedule	professional	ffs	—	$24.04	$34.34	$3216.92	$2250000.00	**93594.0×**	1415
E2205	HCPCS	fee schedule	professional	ffs	—	$28.07	$32.90	$8216.72	$2400000.00	**85500.5×**	27147
E2205	HCPCS	fee schedule	professional	ffs	—	$30.07	$37.80	$8176.36	$2400000.00	**79813.8×**	27298

Recommended Actions

1. **schema** `file_freshness` **P1**

File is 285 days old (last_updated_on exceeds the 90-day threshold)

2. **schema** `raw_json_error` **P1**

Native JSON parse error detected in unpatched source file: An error occurred while reading from response stream: ('Connection broken: IncompleteRead(62870422 bytes read, 12281033512 more expected)', IncompleteRead(62870422 bytes read, 12281033512 more expected)). Scoring below reflects auto-patched data only. File must be re-exported by the payer to fully resolve.

3. **schema** `parse_crash` **P1**

single pass crash after 43 items: An error occurred while reading from response stream: ('Connection broken: IncompleteRead(20451418 bytes read, 12323452516 more expected)', IncompleteRead(20451418 bytes read, 12323452516 more expected))

4. provider_mapping npi_validity P2

0.00% of NPIs failed Luhn checksum validation (4 of 108476)

5. provider_mapping ein_validity P2

0.31% of EINs failed IRS prefix validation (191 of 61613)

6. provider_mapping empty_npi_groups P2

51 provider groups contain no NPIs

7. pricing zero_rates P2

49 zero-dollar rates (0.00%) — CMS schema requires negotiated_rate > 0 (exclusiveMinimum); may represent unfiled or excluded services

8. pricing extreme_rates P2

0.51% of rates are extreme (7174 above class-specific high threshold, 0 below $0.01)

9. pricing high_frequency_rate_value P2

39 rate value(s) appear with suspiciously high frequency (≥0.5% of dollar rates and ≥50 occurrences) — likely placeholder/sentinel values rather than real negotiated rates.

10. pricing rate_spread_by_class P2

billing_class='professional' / negotiated_type='fee schedule': P95/P50 spread is 8.0x (threshold: 5x, N=1,380,888 (1,000 sampled), high confidence)

11. pricing rate_spread_by_class P2

billing_class='institutional' / negotiated_type='negotiated': P95/P50 spread is 51.7x (threshold: 10x, N=187, moderate confidence)

12. **pricing** `per_code_rate_spread` **P2**

25 rate contexts have a max/min ratio exceeding the type-specific threshold (20x professional / 50x facility, min 3 occurrences required). Each context is a unique combination of all 10 rate-key dimensions. n= shows how many distinct provider rates exist for that exact context.

13. **schema** `expired_prices` **P2**

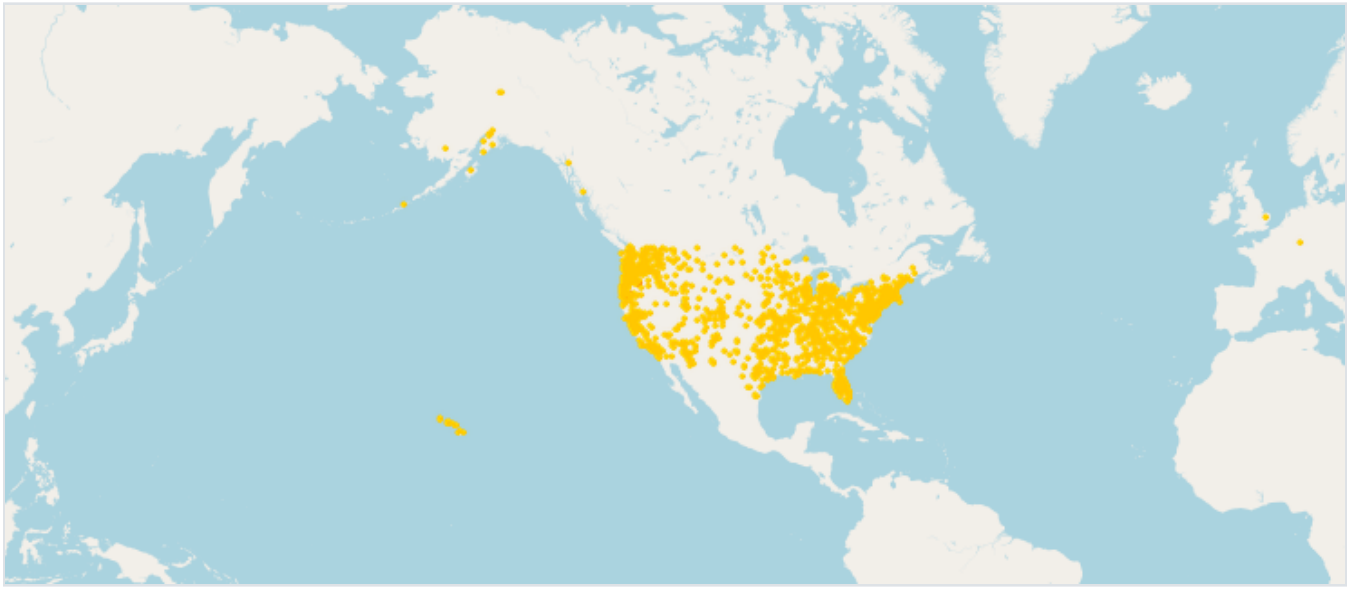
104012 negotiated_prices have past expiration dates (7.4%)

14. **code_coverage** `billing_code_format` **P3**

6 CPT codes do not match expected format

Provider Geographic Coverage

37549 unique NPIs found — 37382 geocoded (100%) — 3787 zip codes represented.



Schema Integrity — Metrics

header_missing_fields	
header_conditional_issues	
file_age_days	285

items_total	43
items_missing_required_pct	0.0
items_empty_rates	0
prices_total	1409118
prices_missing_required_pct	0.0
prices_missing_field_breakdown	
prices_missing_service_code	0
prices_invalid_billing_class	0
rates_without_providers	0
negotiation_arrangements	ffs: 43
billing_code_types	CPT: 23 HCPCS: 12 MS-DRG: 4 CDT: 1 RC: 2 APC: 1
expired_prices	104012
invalid_expiration_format	0

Provider Mapping — Metrics

provider_references_in_file	50530
provider_group_ids_referenced	46390
unresolved_references	0
resolution_rate_pct	100.0
npis_validated	108476
invalid_npi_count	4
npi_validity_rate_pct	100.0
invalid_npi_examples	1336588484, 1336588484, 1659650617, 1659650617
eins_validated	61613
invalid_ein_count	191

ein_validity_rate_pct	99.69
invalid_ein_examples	000000001, 000000001, 000000001, 001625898, 001625898, 001625898, 003360711, 003360711, 003360711, 003680161
empty_npi_groups	51
groups_without_tin	0
npis_in_multiple_groups	35731

Code Coverage — Metrics

unique_codes_total	43	
duplicate_codes	0	
duplicate_pct	0.0	
by_code_type	**CPT**	23
	HCPCS	12
	MS-DRG	4
	CDT	1
	RC	2
	APC	1
unknown_code_types		
format_invalid_by_type	**CPT**	6
codes_not_in_reference	reference_not_loaded	

most_frequent_codes	

Type	Code	Occurrences
CPT	87652	1
HCPCS	G8568	1
CPT	57210	1
HCPCS	G2127	1
CPT	24065	1
CPT	27566	1
CPT	3CHL3	1
MS-DRG	801	1
CPT	22206	1
CPT	94760	1
CPT	52315	1
HCPCS	G2000	1
CPT	3AGM3	1
HCPCS	S3828	1
HCPCS	S0104	1
HCPCS	G0330	1
HCPCS	G0480	1
CPT	84376	1
CPT	81165	1
CDT	D5850	1

Pricing Sanity — Metrics

total_prices_checked	1409118
total_rates	1407484
per_diem_rates	30
percentage_rates	1604
negative_rates	0
zero_rates	49
extreme_high_rates	7174
extreme_low_rates	0

rate_distribution

sample_n	1407484
sample_k	5000
confidence	high
p5	4.5
p25	102.0
p50	757.06
p75	2245.98
p95	6146.98
p99	10726.96

by_billing_class

Class / Type	Count	Median	p25	p75	p95	Confidence
`professional/ fee schedule`	1,380,888	772.6	133.1	2254.5	6147.0	high
`institutional/ fee schedule`	26,360	667.6	37.2	2295.4	6289.9	high
`professional/ negotiated`	49	12.0	0.0	944.0	4348.7	low
`institutional/ negotiated`	187	31798.9	42.6	42801.9	1644040.5	moderate

negotiated_types

fee schedule	1407248
negotiated	236

unique_rate_contexts 165

rate_key_dimension_validity

invalid_negotiated_type	0
invalid_negotiated_types_seen	{}
invalid_setting	0
invalid_settings_seen	{}
invalid_severity_of_illness	0
severity_on_non_apr_drg	0
institutional_with_service_codes	0
invalid_service_code_format	0
billing_code_modifier_too_long	0

Scoring Methodology

Embedded in this report at generation time.

Overall Score

Weighted sum of four structural dimensions, normalized to a 0–100 scale. Pricing sanity is excluded when the file contains only non-dollar rate types (capitation, per-diem, or percentage) — dollar-amount spread analysis is not applicable in that case.

Normalized Weights	**Schema Integrity**	30%
	Provider Mapping	15%
	Code Coverage	15%
	Pricing Sanity	40%
Confidence Bands	**High**	≥90
	Usable With Caution	≥75
	Limited Reliability	≥60
	Not Usable	<60
Score Caps	**Raw Json Errors Only → 74.0**	Native JSON syntax errors in the unpatched source file. File must be re-exported by the payer; scoring reflects auto-patched data only.
	Cms Validation Failure Only → 65.0	CMS official schema validator reports the file does not conform to the TIC spec.
	Both Raw Json Errors And Cms Failure → 59.0	Both native JSON syntax errors and CMS schema validation failure present.

Rate Context Key — 14-Tuple Field Coverage

Every rate in a CMS TIC MRF file is described by a 14-field tuple. Fields 1–10 form the rate-context key used to group and compare rates across the system. Fields 11–12 (provider, expiration date) are validated separately and excluded from the grouping key for analytical reasons. Each of the four scoring dimensions validates a distinct slice of this tuple — together they cover all 14 fields.

Field	Validated by
`1 billing_code_type`	Schema (required field) + Code Coverage (enum + format validation)
`2 billing_code_type_version`	Schema (required field)
`3 billing_code`	Schema (required field) + Code Coverage (format, duplicates, reference lookup)
`4 billing_code_modifier`	Pricing (modifier length, key normalization)
`5 service_code`	Pricing (POS format, normalization, institutional-class check)
`6 negotiated_type`	Pricing (CMS TIC enum validation)
`7 billing_class`	Schema (CMS TIC enum validation) + Pricing (spread thresholds)

Field	Validated by
8 negotiation_arrangement	Schema (CMS TIC enum validation) + Pricing (FFS vs bundle/capitation gating)
9 severity_of_illness	Pricing (APR-DRG only, valid values 1–4)
10 setting	Pricing (CMS TIC enum validation)
11 provider (NPI/EIN)	Provider Mapping (Luhn checksum, IRS prefix, group resolution) — excluded from grouping key
12 expiration_date	Schema (date validity, far-future sanity) — excluded from grouping key
13 additional_generic_notes	not validated (free-text)
14 negotiated_rate	Pricing (negative/zero/extreme-value checks, spread analysis)

- Fields 1–10 are the grouping key. Each unique combination is a distinct rate context — rates with different modifiers, POS codes, or arrangements land in separate buckets and are never compared against each other.
- Provider (field 11) is excluded from the key: the spread check is cross-provider by design. Partitioning by provider produces singleton buckets and eliminates the spread signal.
- Expiration date (field 12) is excluded because it is a contract lifecycle attribute, not a clinical context. Rates for the same service should be comparable regardless of when they expire.
- service_code (field 5) arrays are flattened and normalized before keying: '1' → '01', and a rate with ['11','22'] contributes to both the '11' and '22' buckets so rates are compared apples-to-apples by place of service.

Schema Integrity

Validates required fields, enum values, conditional requirements, and date validity per the CMS TIC in-network-rates schema. Also checks file freshness and expiration date sanity.

Method: Penalty-based deductions from 100, capped per category.

per_missing_required_header_field	5
per_header_conditional_issue	2
freshness_warn	5
freshness_error	10
item_missing_fields_pct	×5 (cap 30)
empty_rates_pct	×0.5 (cap 5)
price_missing_fields_pct	×10 (cap 30)
rates_without_providers_rate	×200 (cap 20)
expired_prices_pct	×0.5 (cap 5)
file freshness warn days	45
file freshness error days	90
expiry far future years	3

Provider Mapping

Verifies that all provider_group_id references in in_network items resolve to an entry in the provider_references array. Validates NPI integrity via Luhn checksum and EIN integrity via IRS-issued 2-digit prefix.

Method: Weighted component sum (not purely penalty-based).

provider_resolution (60%)	`resolution_rate% × 0.60`
npi_validity (30%)	`(100 − invalid_npi_pct × 5) × 0.30`
ein_validity (10%)	`10 − (invalid_ein_pct × 0.1) [0% invalid → 10 pts, 100% invalid → 0 pts, linear]`

Code Coverage

Tracks every (billing_code_type, billing_code) pair and flags unrecognized CMS TIC code types, format violations for CPT/HCPCS/NDC, and duplicates (same code appearing in multiple in_network items).

Method: Penalty-based deductions from 100.

per_unknown_code_type	`3 pts each (cap 20)`
format_invalid_pct	`× 0.5 (cap 10)`
duplicate_code_pct	`× 2 (cap 20)`
codes_not_in_reference_pct	`× 0.5 (cap 30) — only when reference set is loaded`

Pricing Sanity

Detects invalid rates (negative, zero, extreme-value) and distribution anomalies (per-class P95/P50 spread, per-code max/min ratio, flat-rate distributions). Exact counts are used for all validity checks (negative, zero, extreme, dimension validity). Percentile-based checks (spread, IQR) use reservoir sampling — k=5 000 global, k=1 000 per (billing_class, negotiated_type) bucket — so memory stays bounded on large files. Per-code max/min spread is exact (all rates seen, no sampling).

Method: Penalty-based deductions from 100.

negative_rate_pct	`× 5 (cap 20)`
zero_rate_pct	`× 3 (cap 15) — warning (not error)`
extreme_rate_pct	`× 5 (cap 25) — ffs only`
class_spread_excess	`(spread − threshold) × 2, max across (billing_class, negotiated_type) buckets (cap 15)`
per_code_high_spread_count	`× 0.1 (cap 15)`
invalid_negotiated_type_pct	`× 3 (cap 10) — rates silently dropped`
invalid_setting_pct	`× 1 (cap 5) — silently defaults to wildcard`
invalid_severity_pct	`× 1 (cap 5) — silently normalised to ''`
institutional_with_service_codes_pct	`× 1 (cap 5) — extra key variation`
invalid_service_code_pct	`× 2 (cap 5) — encode raises ValueError`

extreme high by billing class	professional: 25000.0, institutional: 2000000.0, both: 2000000.0, default: 500000.0
extreme low	0.01
spread warn p95 over p50 by class	professional: 5, institutional: 10, both: 10, default: 5
per rate context max min ratio	professional_codes: 20, facility_drg_codes: 50
flat rate iqr p75 threshold pct	5.0
flat rate min rates to check	100
spread min n to flag	50
per code min n to flag	3

Dashboard: MRF Identity Key

(ingest-time — not stored in report JSON)

The dashboard assigns a persistent `mrf_key` to each MRF so that all validation runs of the same file are grouped together in the score-history view, even if the payer re-exports the file at a new URL.

Tier 1 — entity + plan_id	Used when both `reporting_entity_name` and `plan_id` are present. Key input: `plan|<entity>|<plan_id_type>|<plan_id>`. Stable across monthly re-exports.
Tier 2 — URL hash	Fallback when `plan_id` is absent. Key input: the raw file location URL/path. Entity name alone is not used — a payer publishes multiple distinct plans under the same entity name and without `plan_id` they cannot be safely distinguished. A URL change produces a different key.

The key is a 16-character MD5 hex digest of the input string (case-insensitive, whitespace-stripped). **This run:** mrf_key = `6094690e0198ab32` · entity = Providence_Health_Plan · tier = 2 (URL hash)

Provider Geographic Coverage

(supplemental — does not affect score)

Geographic analysis is a supplemental feature computed on demand after scoring completes. It does not affect any scoring dimension — it is an observational overlay to assess the breadth and distribution of in-network providers.

NPPES	CMS National Plan and Provider Enumeration System — monthly full-replacement CSV. Maps each NPI to its primary registered ZIP code.
ZCTA centroids	GeoNames US postal code file. Maps each 5-digit ZIP to a (latitude, longitude) centroid for map placement.

Process: Extract all NPIs from the MRF file → resolve each NPI to its primary practice ZIP via NPPES → aggregate provider count per ZIP → map each ZIP to a lat/lon centroid via ZCTA → render as a weighted heatmap (intensity ∝ provider count per ZIP).

Limitations: NPIs absent from NPPES (recently issued, test NPIs, EINs) are excluded and reduce the geocoding match rate. Location reflects the provider's NPPES-registered primary address, not necessarily where they accept this specific plan. Map viewport covers the bounding box of ZIP codes representing 90% of total provider count, dropping sparse geographic outliers.