MRF Quality Report

s3://talon-storage-private/mrf-feed-uploads/2025-10/2025-07-21_Providence_Health_Plan_254c87ec24ef2237ead1dcf5730c4730_in-network-rates.json.gz

Size: 11.56 GB • MD5: 6f24a7be3e42891aaf2fa808d6d2bc16

Payer: **Providence_Health_Plan** • File Date: **2025-07-21** • Generated: **2026-04-26 16:25 EDT** • Tool Version: **1.0.0** • Elapsed: **28106.80s**

65.0

Limited Reliability

score capped at 65.0 — CMS official schema validation failed (see meta for details)

Errors: 2 • Warnings: 13 • Info: 3

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/2025-10/2025-07-21_Providence_Health_Plan_254c87ec24ef2237ead1dcf5730c4730_in-network-rates.json.gz

Plan Name	Plan ID	Issuer / Sponsor	Market
STANDARD	56707OR1410003-00 (HIOS)	—	individual
STANDARD	56707OR1350004-00 (HIOS)	—	individual
HSA	56707OR1430003-00 (HIOS)	—	individual

CMS Official Schema Validation

FAILED (exit code -1) — File does not conform to the CMS schema.

Validator output:

```
Timed out after 600 s
```

Dimension Scores

Dimension	Score	Weight	Findings
Schema Integrity	70.0	30%	4
Provider Mapping	100.0	15%	4
Code Coverage	89.5	15%	2
Pricing Sanity	59.0	40%	8

Schema Integrity — Findings

Score: 70.0

ERROR `file_freshness`

File is 279 days old (last_updated_on exceeds the 90-day threshold)

WARNING `item_required_fields`

0.01% of in_network items are missing required fields

WARNING `expired_prices`

72594842 negotiated_prices have past expiration dates (8.8%)

ERROR `cms_schema_validation`

CMS official schema validator FAILED (exit code -1). File does not conform to the TIC in-network-rates schema.

Provider Mapping — Findings

Score: 100.0

WARNING `npi_validity`

0.01% of NPIs failed Luhn checksum validation (6 of 119857)

- 1336588484
- 1659650617

WARNING `ein_validity`

0.30% of EINs failed IRS prefix validation (192 of 64268)

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

WARNING `empty_npi_groups`

54 provider groups contain no NPIs

INFO `duplicate_npis`

36634 NPIs appear in more than one provider group

Code Coverage — Findings

Score: 89.5

WARNING `unknown_billing_code_types`

Unrecognized billing_code_type values: {'PROC': 1}

WARNING `billing_code_format`

3924 CPT codes do not match expected format

Pricing Sanity — Findings

Score: 59.0

INFO `per_diem_rates`

17793 per-diem rates (0.0%) — not dollar amounts; excluded from spread analysis

INFO `percentage_rates`

3589219 percentage rates (0.4%) — values represent % of a reference rate, not dollar amounts; excluded from spread analysis

WARNING `zero_rates`

375875 zero-dollar rates (0.05%) — CMS schema requires negotiated_rate > 0 (exclusiveMinimum); may represent unfiled or excluded services

WARNING `extreme_rates`

1.90% of rates are extreme (15576543 above class-specific high threshold, 0 below $0.01)

WARNING `high_frequency_rate_value`

1 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': 2250000.0, 'count': 10877121, 'pct': 1.33}

WARNING `rate_spread_by_class`

billing_class='institutional' / negotiated_type='negotiated': P95/P50 spread is 1550.2x (threshold: 10x, N=94,753 (1,000 sampled), high confidence)

WARNING `rate_spread_by_class`

billing_class='professional' / negotiated_type='fee schedule': P95/P50 spread is 7.1x (threshold: 5x, N=805,073,069 (1,000 sampled), high confidence)

WARNING `per_code_rate_spread`

9132 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
A9699	HCPCS	fee schedule	professional	ffs	—	$0.01	$0.01	$184615.39	$2400000.00	**240000000.0×**	13
90758	CPT	fee schedule	professional	ffs	—	$0.01	$2400000.00	$1940625.00	$2400000.00	**240000000.0×**	16
90668	CPT	fee schedule	professional	ffs	—	$0.01	$2400000.00	$1940625.00	$2400000.00	**240000000.0×**	16
90666	CPT	fee schedule	professional	ffs	—	$0.01	$2400000.00	$1940625.00	$2400000.00	**240000000.0×**	16
90667	CPT	fee schedule	professional	ffs	—	$0.01	$2400000.00	$1940625.00	$2400000.00	**240000000.0×**	16
90296	CPT	fee schedule	professional	ffs	—	$0.01	$2400000.00	$1940625.00	$2400000.00	**240000000.0×**	16
90664	CPT	fee schedule	professional	ffs	—	$0.01	$2400000.00	$1940625.00	$2400000.00	**240000000.0×**	16
90399	CPT	fee schedule	professional	ffs	—	$0.01	$0.01	$930000.01	$2400000.00	**240000000.0×**	5
90393	CPT	fee schedule	professional	ffs	—	$0.01	$2400000.00	$1940625.00	$2400000.00	**240000000.0×**	16
90287	CPT	fee schedule	professional	ffs	—	$0.01	$2400000.00	$1940625.00	$2400000.00	**240000000.0×**	16

Recommended Actions

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

File is 279 days old (last_updated_on exceeds the 90-day threshold)

2. **schema** `cms_schema_validation` **P1**

CMS official schema validator FAILED (exit code -1). File does not conform to the TIC in-network-rates schema.

3. **provider_mapping** `npi_validity` **P2**

0.01% of NPIs failed Luhn checksum validation (6 of 119857)

4. provider_mapping ein_validity P2

0.30% of EINs failed IRS prefix validation (192 of 64268)

5. provider_mapping empty_npi_groups P2

54 provider groups contain no NPIs

6. pricing zero_rates P2

375875 zero-dollar rates (0.05%) — CMS schema requires negotiated_rate > 0 (exclusiveMinimum); may represent unfiled or excluded services

7. pricing extreme_rates P2

1.90% of rates are extreme (15576543 above class-specific high threshold, 0 below $0.01)

8. pricing high_frequency_rate_value P2

1 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.

9. pricing rate_spread_by_class P2

billing_class='institutional' / negotiated_type='negotiated': P95/P50 spread is 1550.2x (threshold: 10x, N=94,753 (1,000 sampled), high confidence)

10. pricing rate_spread_by_class P2

billing_class='professional' / negotiated_type='fee schedule': P95/P50 spread is 7.1x (threshold: 5x, N=805,073,069 (1,000 sampled), high confidence)

11. pricing per_code_rate_spread P2

9132 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.

12. schema item_required_fields P2

0.01% of in_network items are missing required fields

13. schema expired_prices P2

72594842 negotiated_prices have past expiration dates (8.8%)

14. code_coverage unknown_billing_code_types P3

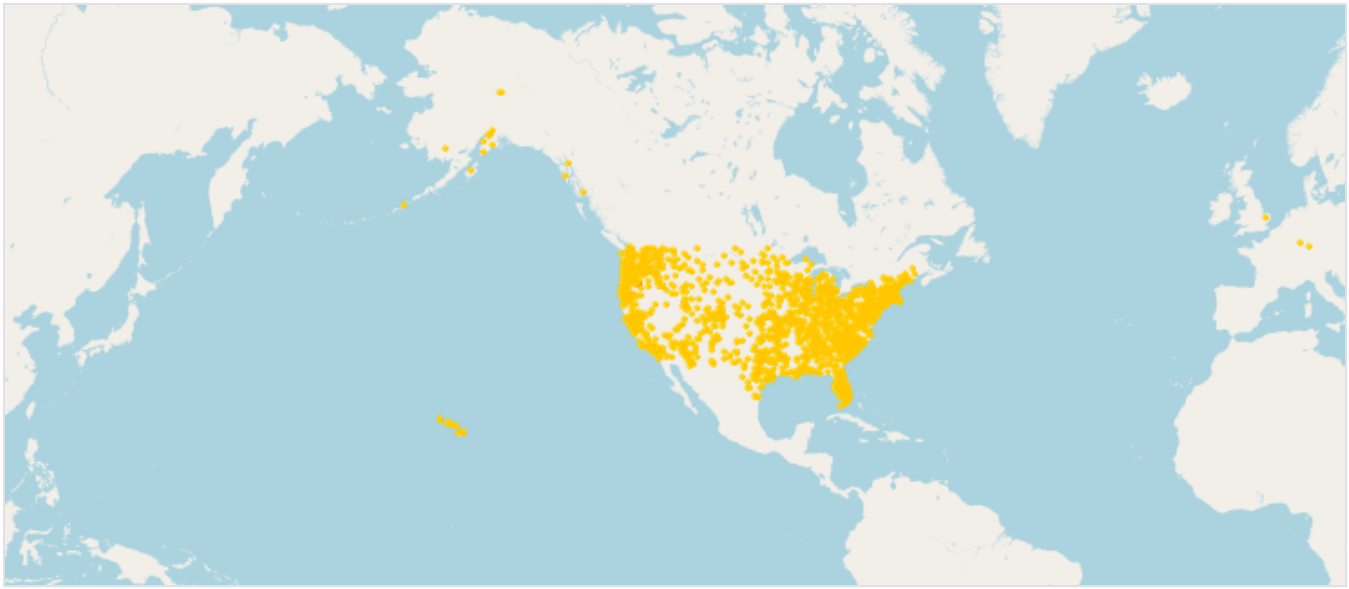
Unrecognized billing_code_type values: {'PROC': 1}

15. code_coverage billing_code_format P3

3924 CPT codes do not match expected format

Provider Geographic Coverage

41753 unique NPIs found — 41536 geocoded (99%) — 4892 zip codes represented.



Schema Integrity — Metrics

header_missing_fields

header_conditional_issues	
file_age_days	279
items_total	26207
items_missing_required_pct	0.008
items_empty_rates	0
prices_total	822636253
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: 26125 capitation: 82
billing_code_types	HCPCS: 7824 CPT: 15182 CDT: 939 MS-DRG: 818 RC: 566 APC: 877 PROC: 1
expired_prices	72594842
invalid_expiration_format	0

Provider Mapping — Metrics

provider_references_in_file	50970
provider_group_ids_referenced	48971
unresolved_references	0
resolution_rate_pct	100.0
npis_validated	119857
invalid_npi_count	6
npi_validity_rate_pct	99.99

invalid_npi_examples	1336588484, 1336588484, 1336588484, 1659650617, 1659650617, 1659650617
eins_validated	64268
invalid_ein_count	192
ein_validity_rate_pct	99.7
invalid_ein_examples	000000001, 000000001, 000000001, 001625898, 001625898, 001625898, 003360711, 003360711, 003360711, 003680161
empty_npi_groups	54
groups_without_tin	0
npis_in_multiple_groups	36634

Code Coverage — Metrics

unique_codes_total	26125
duplicate_codes	82
duplicate_pct	0.31
by_code_type	**HCPCS** 7812 **CPT** 15112 **CDT** 939 **MS-DRG** 818 **RC** 566 **APC** 877 **PROC** 1
unknown_code_types	**PROC** 1
format_invalid_by_type	**CPT** 3924
codes_not_in_reference	reference_not_loaded

most_frequent_codes	Type	Code	Occurrences
	CPT	99447	2
	CPT	99205	2
	CPT	99342	2
	CPT	99404	2
	CPT	99448	2
	CPT	99203	2
	CPT	99341	2
	CPT	99367	2
	CPT	96375	2
	CPT	99422	2
	HCPCS	G0439	2
	CPT	99401	2
	HCPCS	G0179	2
	HCPCS	G0402	2
	HCPCS	S0250	2
	HCPCS	G0438	2
	HCPCS	G0181	2
	HCPCS	G0513	2
	HCPCS	G0180	2
	HCPCS	G0246	2

Pricing Sanity — Metrics

total_prices_checked	822636253
total_rates	819029241
per_diem_rates	17793
percentage_rates	3589219
negative_rates	0
zero_rates	375875
extreme_high_rates	15576543
extreme_low_rates	0

rate_distribution

sample_n	819029241
sample_k	5000
confidence	high
p5	25.057
p25	194.8075
p50	722.79
p75	1873.905
p95	5308.362500000003
p99	2250000.0

by_billing_class

Class / Type	Count	Median	p25	p75	p95	Confidence
`institutional/ negotiated`	94,753	1060.6	6.0	40338.9	1644138.7	high
`professional/ fee schedule`	805,073,069	693.1	170.0	1726.8	4891.1	high
`institutional/ fee schedule`	13,331,239	530.0	107.4	1852.9	4585.7	high
`professional/ negotiated`	530,180	0.0	0.0	480.0	2250000.0	high

negotiated_types

negotiated	624933
fee schedule	818404308

unique_rate_contexts 101525

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 = `26de40b11164b948` · 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.