



Variation in Mother-Infant Linkage Rates by Jurisdiction in U.S. Medicaid Data

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- All other authors report nothing to disclose
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- The views expressed in this presentation represent those of the presenters and do not necessarily represent the official views of the U.S. FDA or ASPE.

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Introduction

Within the U.S. FDA's Sentinel System, linkage of mother and infant data is **critical for the assessment of medication safety** during pregnancy.

U.S. Medicaid/CHIP data in the new Transformed Medicaid Statistical Information System (T-MSIS) format were recently converted to the Sentinel Common Data Model and an initial mother-infant linkage was performed.

Data used for linkage

- 100% Medicaid/CHIP data in the Transformed Medicaid Statistical Information System (T-MSIS) Analytic Files (TAF) format
- We applied data quality-based inclusion/exclusion criteria to exclude jurisdiction-plan-years with “unusable” data quality
- We made two data transformations to the Sentinel Common Data Model (SCDM) prior to linkage
 - First transformation (ETL 1), 2014–2018 data
 - Second transformation (ETL 2), 2014–2020 data

Identifying live birth deliveries & infants for linkage

Version 1 Specifications

Deliveries

- Timing: Deliveries from one year later than the start date of the Medicaid/CHIP data availability to the end of the Medicaid/CHIP data availability
- Encounters: Records with a delivery code to women 10-54 years old at the start of the encounter.
- Washout period: No evidence of delivery for 180 days prior to any identified delivery, during which mothers must have had medical coverage

Infants

- Timing: Those with a date of birth from one year later than the start date of the Medicaid/CHIP data availability to the end of data availability
- Enrollment: Children must have at least one day of enrollment with medical coverage during their first year of life

Version 2 Specifications

Deliveries

- Timing: From ~~one year later than~~ the start date of the Medicaid/CHIP data availability to the end of the Medicaid/CHIP data availability
- Encounters: Records with a delivery code to women 10-54 years old at the start of the encounter.
- Washout period: No evidence of delivery for ~~180~~ 90 days prior to any identified delivery, during which mothers must have had medical coverage

“Infants”

- Timing: Those with a date of birth from ~~one year later than~~ the start date of the Medicaid/CHIP data availability to the end of data availability
- Enrollment: Children must have at least one day of enrollment with medical coverage during their first ~~1~~ 3 years of life

Identified deliveries & infants

Version 1 / ETL 1

2.9 million deliveries eligible for linkage

7.8 million infants eligible for linkage

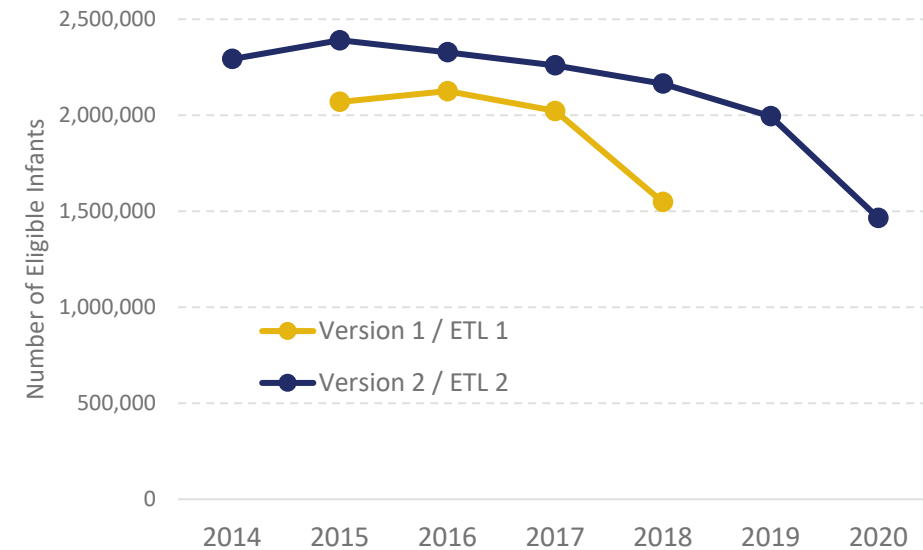
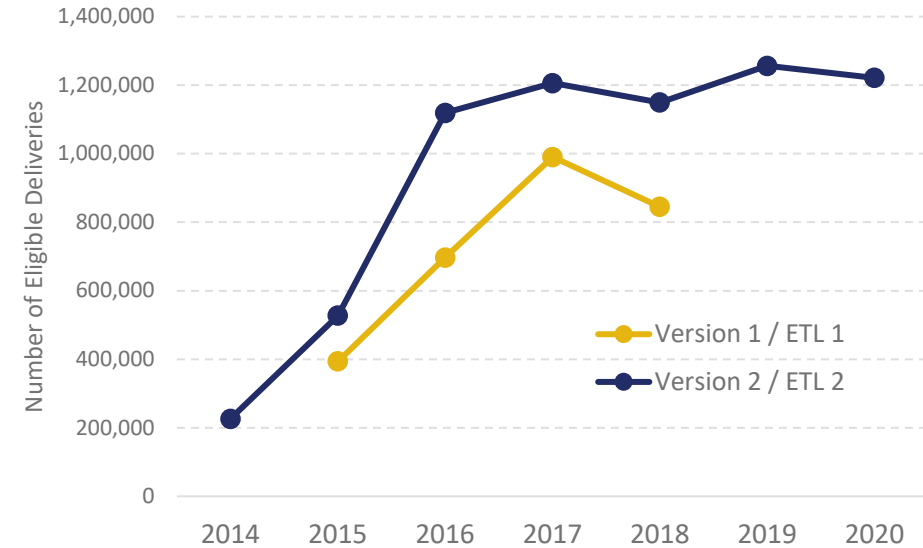
Version 2 / ETL 2

6.7 million deliveries eligible for linkage

14.9 million infants eligible for linkage

Example: Illinois eligible deliveries

Year	Version 1 / ETL 1	Version 2 / ETL 2
2014	--	56,907
2015	68,135	74,150
2016	--	--
2017	32,849	51,042
2018	56,899	61,968
2019	--	58,248
2020	--	55,760



Rules for linking delivery records to infant records

Objective: Most accurate linkage

- Both delivery record and infant record must be associated with the *same jurisdiction*
- Both delivery record and infant record must have the *same case number identifier*
 - Case number is a state-assigned number that is often a proxy for a family identifier
- Infant's *date of birth must be close to the admission/discharge dates* on the delivery record. Specifically:
 - Infant's DOB must be within 3 days (\pm) of a delivery record's admission date, if discharge date is unknown, or
 - Infant's DOB must be between 3 days prior to the delivery record's admission date and the delivery record's discharge date

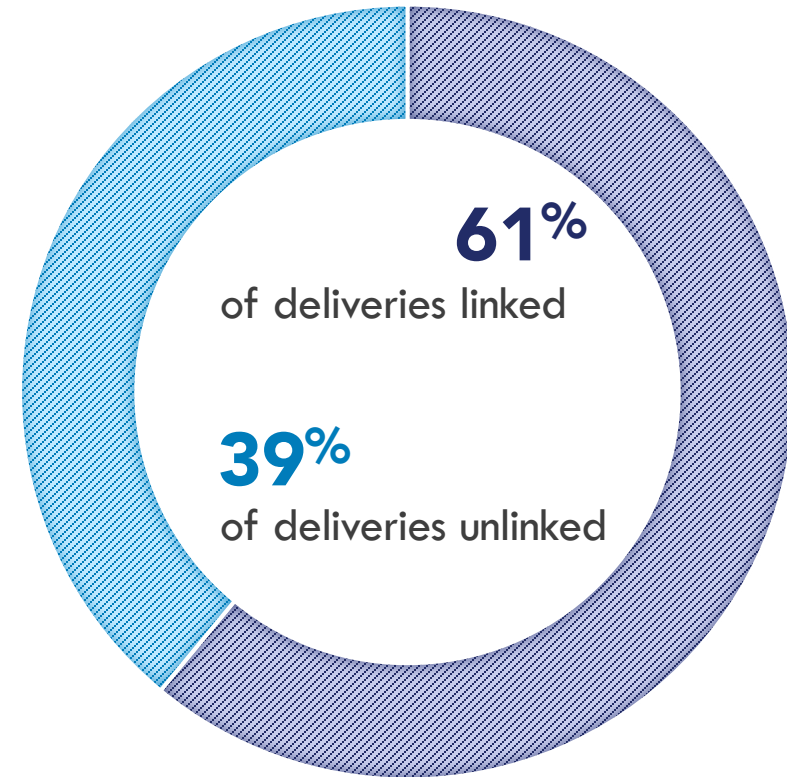
Linkage results

Overall

61% of mother's delivery records—**4.1 million of 6.7 million eligible**—from ETL 2 were linked to child records in the Medicaid/CHIP data

This statistic hides substantial variability

All linkage results should be considered preliminary until approved for use within the Sentinel System.



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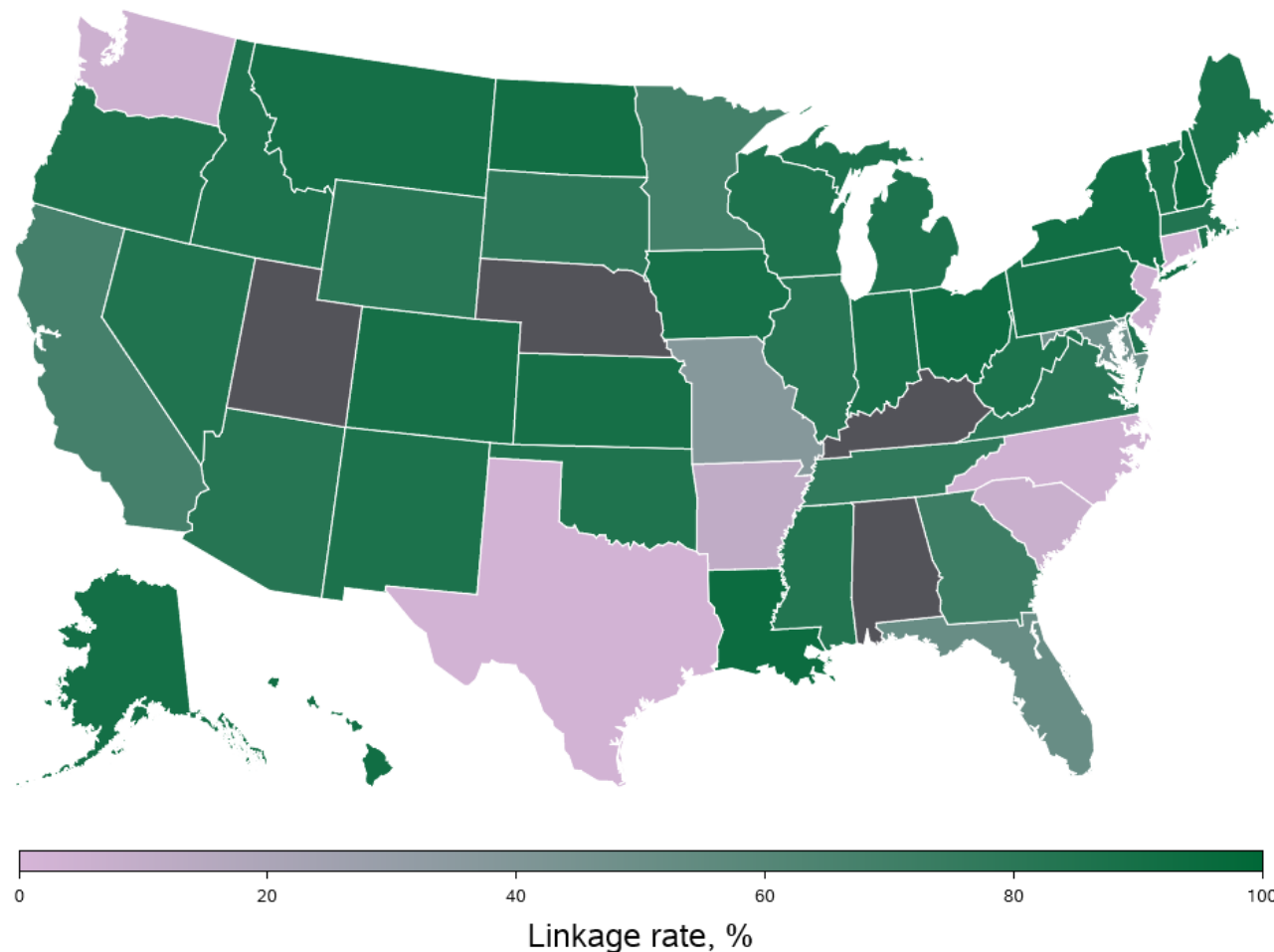
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By jurisdiction

Among 49 jurisdictions included in ETL 2 (46 states, DC, PR, VI):

- 34 had linkage rates **over 75%**
- 7 had linkage rates **under 15%**



Not shown: Puerto Rico, 74% linkage; U.S. Virgin Islands, 79% linkage.

Linkage results

By year of delivery

Age Group	% of Deliveries	Linkage rate
2014	3.4%	65.6%
2015	7.9%	60.2%
2016	16.7%	60.7%
2017	18.0%	63.6%
2018	17.1%	62.0%
2019	18.7%	63.0%
2020	18.2%	54.2%

By age of mother at delivery

Age Group	% of Deliveries	Linkage rate
10–19 years	9.4%	58.8%
20–44 years	90.5%	61.1%
45–54 years	0.1%	49.1%

For comparison, overall linkage rate was 60.8%

Linkage results

By encounter type

Healthcare setting	% of Deliveries	Linkage rate
Inpatient	88.7%	62.0%
Other (ED, outpatient, etc.)	11.3%	51.3%

By number of children delivered

Birth type	% of Deliveries	Linkage rate
Singleton	87.3%	62.6%
Multiple	1.1%	62.3%
Unknown	11.6%	47.6%

For comparison, overall linkage rate was 60.8%

Reasons for poor linkage

Unique or nearly unique case numbers

Case numbers will be unique when a jurisdiction does not use them to identify family groups

Missing case numbers

Missing case numbers also prevent proper linkage between deliveries and infants

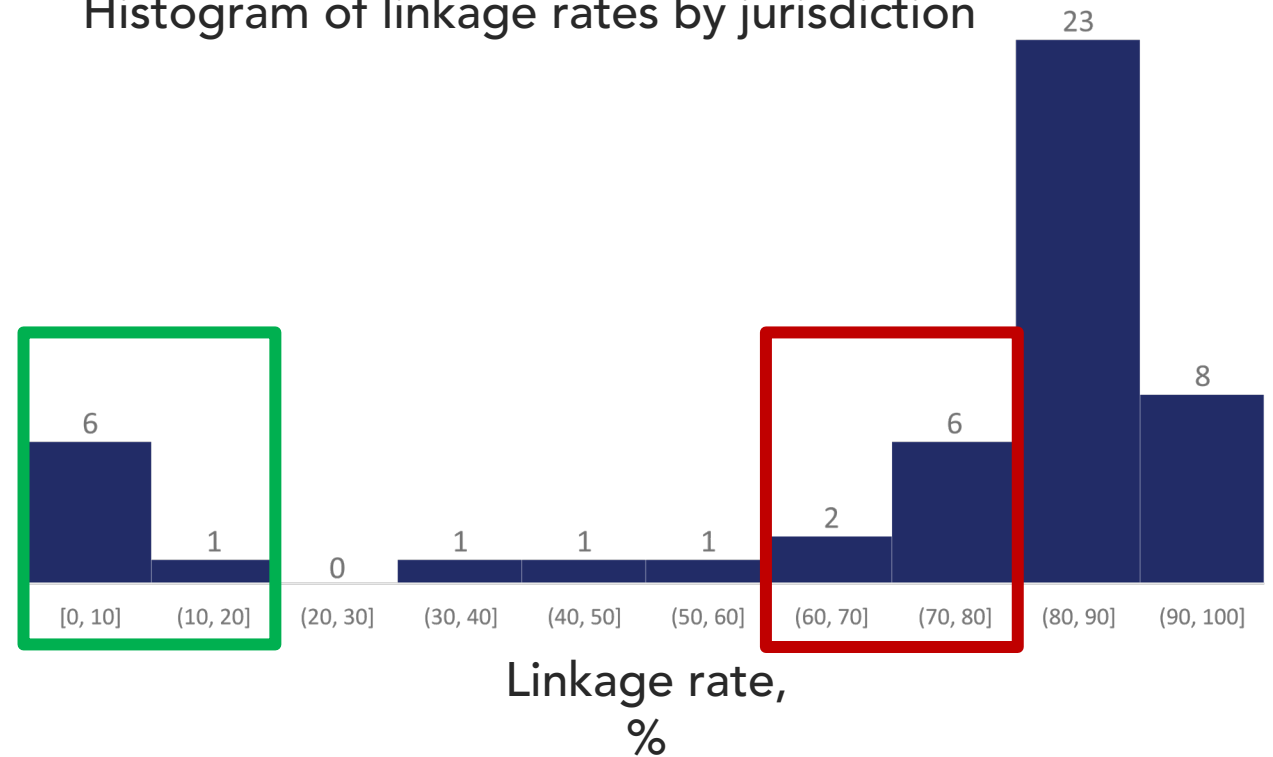
Of these 7 jurisdictions:

- 7 had case numbers that were unique 85% or more of the time
- 2 had case number missing over 10% of the time

Of these 8 jurisdictions:

- 4 had case number missing over 10% of the time

Histogram of linkage rates by jurisdiction



Notable differences from prior linkage in MAX data

Better linkage in TAF data

Jurisdiction	MAX Linkage Rate	TAF Linkage Rate	Δ [TAF – MAX]
Montana	0.0%	90.0%	+90.0%
New York	49.5%	92.0%	+42.5%
Georgia	32.6%	74.2%	+41.6%
Maryland	9.3%	47.7%	+38.4%
Louisiana	62.6%	94.3%	+31.7%
Indiana	58.8%	89.0%	+30.2%

5 more jurisdictions with linkage rates 20–30% higher in TAF than in MAX

MAX results from: Palmsten K, Huybrechts KF, Mogun H, Kowal MK, Williams PL, Michels KB, Setoguchi S, Hernández-Díaz S. Harnessing the Medicaid Analytic eXtract (MAX) to evaluate medications in pregnancy: design considerations. PLoS one. 2013 Jun 26;8(6):e67405.

Notable differences from prior linkage in MAX data

Worse linkage in TAF data

Jurisdiction	MAX Linkage Rate	TAF Linkage Rate	Δ [TAF – MAX]
Washington	78.0%	4.6%	-73.4%
New Jersey	68.9%	4.3%	-64.6%
Missouri	51.6%	37.4%	-14.2%
Minnesota	82.3%	68.6%	-13.7%
North Carolina	16.6%	3.5%	-13.1%
South Dakota	89.6%	79.3%	-10.3%

MAX results from: Palmsten K, Huybrechts KF, Mogun H, Kowal MK, Williams PL, Michels KB, Setoguchi S, Hernández-Díaz S. Harnessing the Medicaid Analytic eXtract (MAX) to evaluate medications in pregnancy: design considerations. PLoS one. 2013 Jun 26;8(6):e67405.



Conclusion

In the U.S. Medicaid/CHIP TAF data, mother-infant linkage was **successful for most jurisdictions**.

In other jurisdictions, alternative methods for linkage would need to be explored.



Thank You

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