



Better Outcomes Registry & Network
Registre et Réseau des Bons Résultats dès la naissance

A Data Validation Exercise between the CIHI-DAD and the BORN Information System

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BORN Information System (BIS)– ‘Data In’ Process

BIS System

Cycles from all IVF clinics (2013)

Births from all 97 birthing hospitals in Ontario

Births from all 87 midwifery practice groups in Ontario

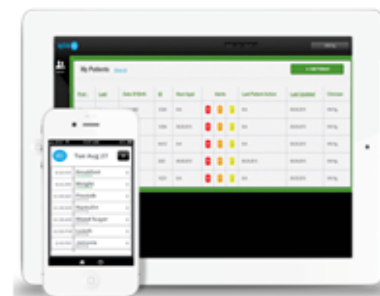
All prenatal screening results from 4 labs (NIPT in dev't)

All newborn screening results from NSO

All Level 2 NICU stays - 50% of Level 3

Prenatal and Newborn Screening follow-up results from clinics

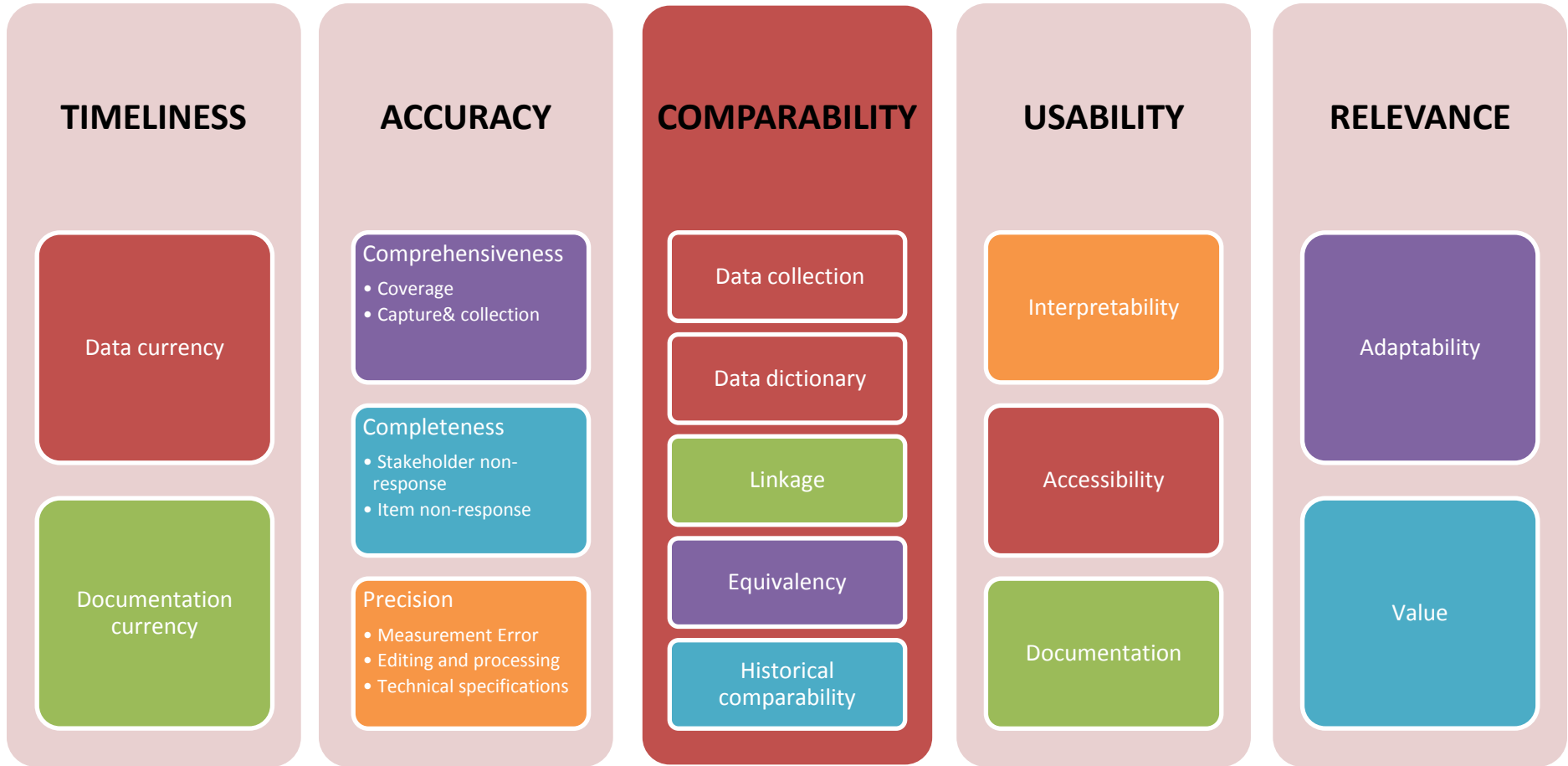
Primary Care: 10 sites provide OAR, RBR, ndds, clinic visits, height/weight



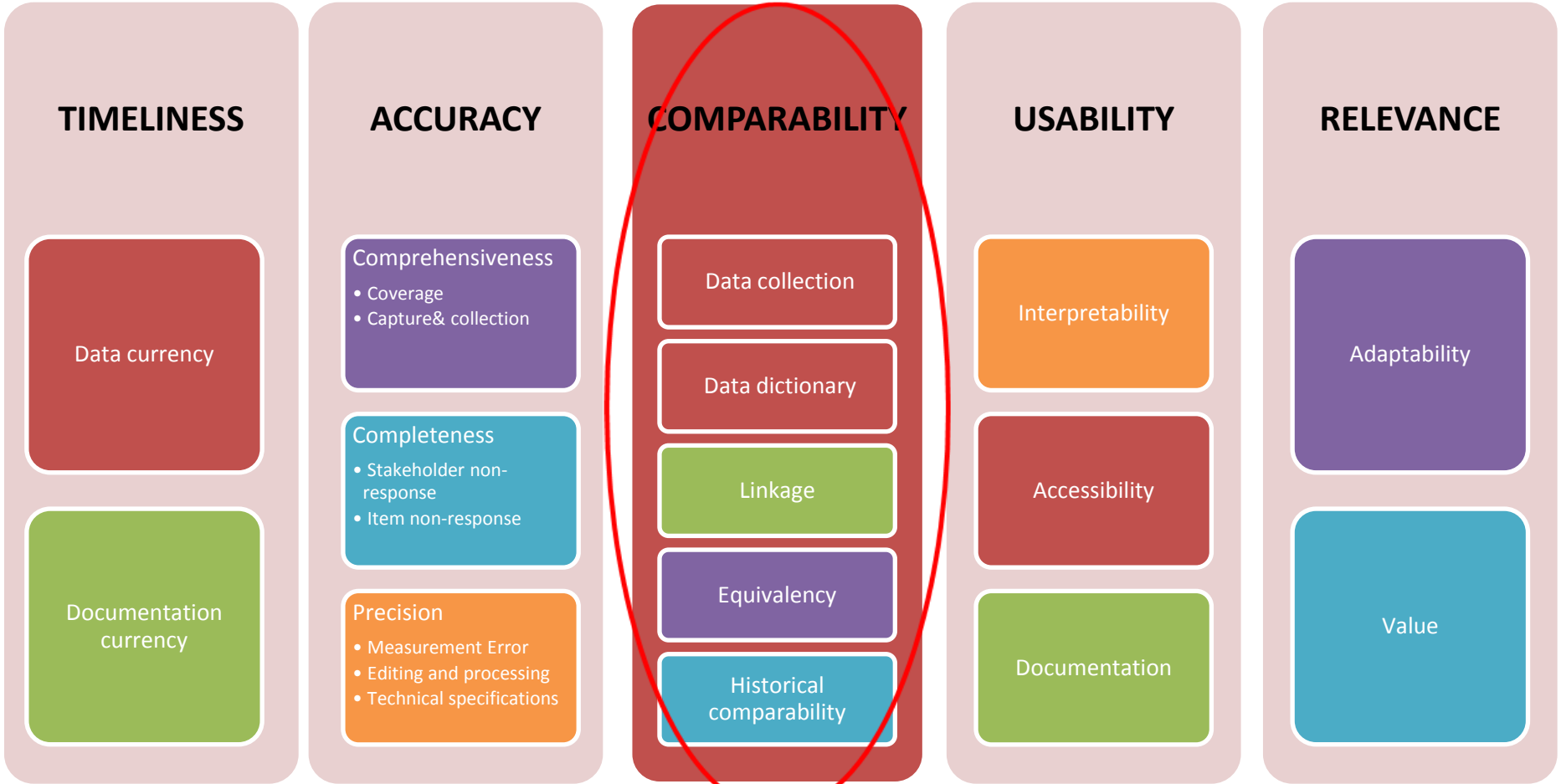
Automatic linking and matching regardless of order of entry

2 million individuals in the BIS

BORN data quality framework



BORN data quality framework



Aim

- To monitor and provide evidence of data quality in BIS data
- To provide rationale that a linkage between CIHI-DAD and BIS datasets could increase data completeness

Objective

- To assess the reliability of key elements collected in the BIS by comparing these with data in the Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD)

CIHI-DAD

- Canadian Institute for Health Information (CIHI)
 - “CIHI is an independent, not-for-profit organization that provides essential information on Canada’s health systems and the health of Canadians”.
- Discharge Abstract Database (DAD)
 - “DAD captures administrative, clinical and demographic information on hospital discharges”.
 - BORN receives an annual dataset which includes all maternal and newborn records from acute care facilities in Ontario.

References:

<https://www.cihi.ca/en/about-cihi>

<https://www.cihi.ca/en/discharge-abstract-database-metadata>

Maternal-newborn linkage in BIS

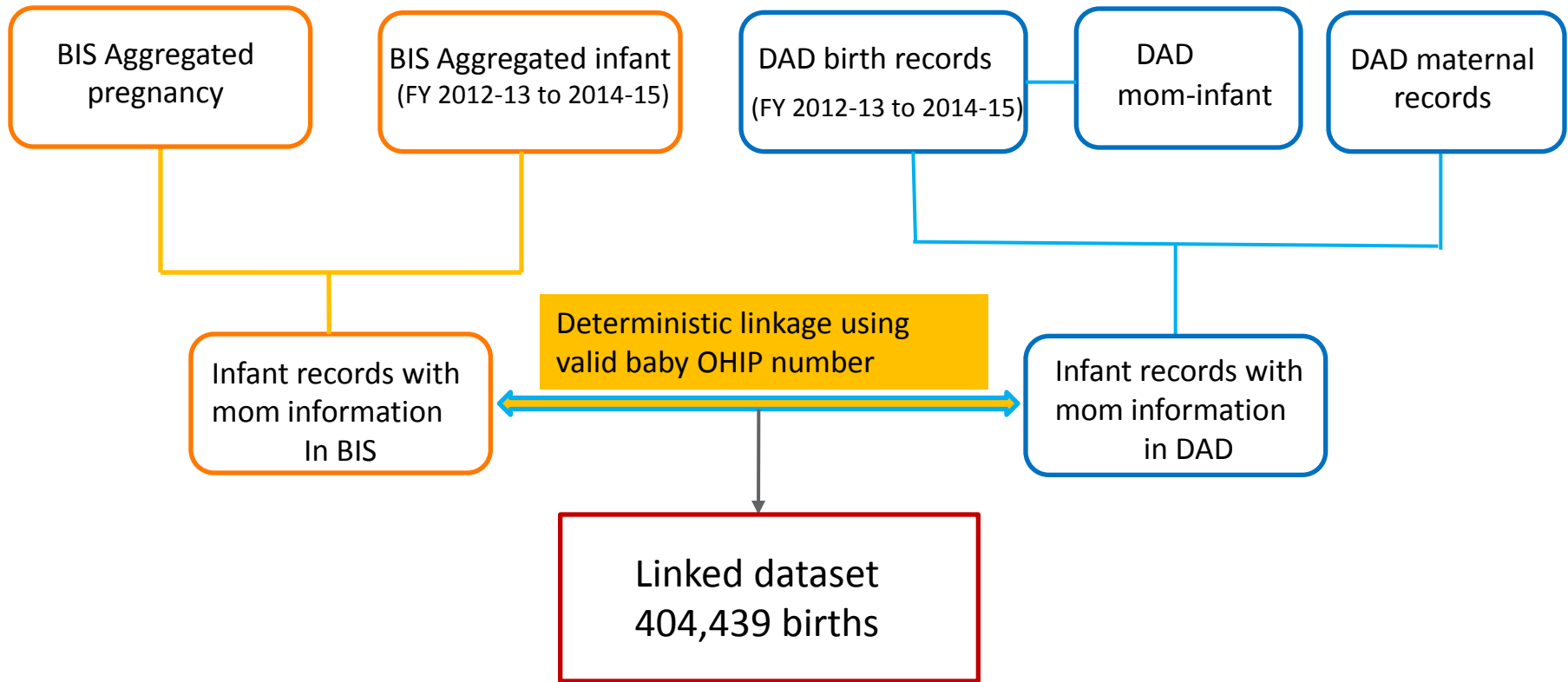
- Based on aggregated infant data with infant birth date in fiscal years 2012-2013, 2013-2014 and 2014-2015
 - 5,615 records from hospital birth and Ontario residence without valid OHIP (3,784 live births and 1,831 stillbirths) were removed.
 - N = 417,558
- Aggregated infant data is linked to aggregated pregnancy data in the BIS to match infant's maternal information

Maternal-newborn linkage CIHI-DAD

- Combine CIHI-DAD fiscal years 2012-2013, 2013-2014 and 2014-2015 birth records
 - Only 2,109 baby records (0.5% of 410,950 birth records showing Ontario health records) without valid OHIP (0=321, 9=1,788). '0'= HCN not available, '9'=Stillbirth.
 - Total records: 408,841
- Link the cross-walk data file (baby-mom in CIHI-DAD) developed by BORN and then patch infant's maternal information in DAD

Flowchart of linkage

(FY 2012-2013 to 2014-2015)



Linkage rate: BIS: 404,558 / 417,749 = 96.8%; DAD: 404,439 / 408,841 = 98.9%

Methods

- Comparison variables
 - Infant records
 - Live birth or stillbirth (pregnancy outcome), birth date, sex, postal code, birth weight, gestational week at birth
 - Maternal records
 - Mother's birth date
 - Number of fetuses
 - Induction of labour: intervention code ("5.AC.30") in ICD-10-CA
 - Cesarean delivery: the intervention code ("5.MD.60") in ICD-10-CA
- Analysis methods
 - Percentage of agreement and Kappa coefficients (simple or weighted)

Methods

Kappa agreement assessment criteria

< 0: Less than chance agreement

0.01 – 0.20: Slight agreement

0.21 – 0.40: Fair agreement

0.41 – 0.60: Moderate agreement

0.61 – 0.80: Substantial agreement

0.81 – 0.99: Almost perfect agreement

References:

1. Cohen J. A coefficient of agreement for nominal scales. Educational and Psychological Measurement 1960;20:37-46.

2. Anthony J. Viera, MD; Joanne M. Garrett, Understanding Inter-observer Agreement:, The Kappa Statistic. Fam Med 2005;37(5):360-3.

Results

Table 1. Distribution of live birth or stillbirth in BIS and CIHI-DAD in linked dataset

| | | BIS | | |
|----------|------------|------------|------------|---------|
| | | Live birth | Stillbirth | Total |
| CIHI-DAD | Live birth | 404,291 | 61 | 404,352 |
| | Stillbirth | 0 | 87 | 87 |
| | Total | 404,291 | 148 | 404,439 |

Percent agreement between CIHI-DAD and BIS: 99.98%

Kappa coefficient agreement between CIHI-DAD and BIS : 0.74, 95% CI (0.68-0.80)

Note: Out of all stillbirths, 148 records in the BIS with valid OHIP were linked

Results

Table 2. Agreement between BIS and DAD among linked birth records

| Variables | N | Percent agreement (%) | Kappa test | | | |
|---|---------|-----------------------|-------------------|-------------|-------------|---------|
| | | | Kappa coefficient | 95% CI | | p value |
| | | | | Lower limit | Upper limit | |
| Baby's date of birth | 404,439 | 99.9% | NA | NA | NA | NA |
| Baby's sex | 404,439 | 99.4% | 0.9885 | 0.9880 | 0.9889 | <0.0001 |
| Baby's weight* | 403,396 | 95.5% | NA | NA | NA | NA |
| Gestational age at birth (weeks) ^{*,§,£} | 404,005 | 98.4% | 0.9195 | 0.9186 | 0.9204 | <0.0001 |
| Baby's postal code* | 404,164 | 91.8% | NA | NA | NA | NA |

*: missing values (less than 1%) were excluded

§: percent agreement of gestational age (weeks) at birth calculation, agreement was defined as within 1 week of difference in gestational age

£: weighted Kappa coefficient was reported

Results

Table 3. Agreement between BIS and DAD among linked maternal records

| Variables | N | Percent agreement (%) | Kappa test | | | |
|-----------------------|---------|-----------------------|-------------------|-------------|-------------|---------|
| | | | Kappa coefficient | 95% CI | | p value |
| | | | | Lower limit | Upper limit | |
| Mom's date of birth* | 403,059 | 99.1% | NA | NA | NA | NA |
| Induction of labour* | 402,552 | 92.1% | 0.7823 | 0.7800 | 0.7845 | <0.0001 |
| Cesarean delivery * | 403,059 | 99.8% | 0.9952 | 0.9949 | 0.9956 | <0.0001 |
| Number of fetuses*, § | 403,007 | 99.9% | 0.9787 | 0.9770 | 0.9805 | <0.0001 |

*: missing values (less than 1%) were excluded

§: weighted Kappa coefficient was reported

Results

- Excellent percent agreement ($\geq 90\%$) for all assessed key elements
- Substantial to almost perfect agreement on Kappa test
 - Substantial agreement (0.61–0.80): *stillbirth or live birth, induction of labour*
 - Almost perfect agreement (0.81–0.99): *cesarean delivery, number of fetuses, baby's sex*

References:

1. Cohen J. A coefficient of agreement for nominal scales. Educational and Psychological Measurement 1960;20:37-46.
2. Anthony J. Viera, MD; Joanne M. Garrett, Understanding Inter-observer Agreement:, The Kappa Statistic. Fam Med 2005;37(5):360-3.

Discussion

- Potential reasons for discrepancies could include
 - Slight difference in some elements' definitions
 - Different time points of data entry
 - Different data element sources
 - Errors from manual data entry

Next steps...

- Data abstraction study to explore the potential reasons for discrepancies based on hospital chart review
- Report to BORN's data quality committee and discuss strategies
- Future work on data quality
 - A review of the data quality framework
 - Implement strategies to improve data quality and perform random audits

Conclusion

- Overall, the BIS and CIHI-DAD had a high concordance on main birth/maternal elements
- The criteria and methods for data collection are consistent in two systems
- More work is needed to understand discrepancies

Acknowledgements

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Thank you !
Questions ?

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