Immunization De-duplication: A Program Developed in New York City to Reduce Duplicate Immunizations

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Objectives

- Background - Citywide Immunization Registry (CIR)
- Describe the design of CIR's immunization de-duplication program
- Discuss implementation details
- Discuss impact on CIR data quality
- Share plans for improving the program

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Citywide Immunization Registry

- NYC's CIR was implemented in 1997
  - NYC population: 8.2 million
    - Approximately 2 million (24%) are under age 19
    - Annual birth cohort is 125,000
  - Reporting of immunization for individuals 0-18 years of age is required by a mandate
  - > 500,000 immunizations received each month
  - ~1,850 NYC providers - 93% participate in CIR
  - Database has 4.7 million records and 58 million immunizations

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Immunization Duplication in an IIS

- Duplicate immunizations:
  - Two or more immunizations within the same vaccine group that represent a single vaccination event
    - DTaP on 2/4/2010 and 2/5/2010
    - Hib/HepB and HepB both on 4/6/2005
  - May be from the same source or different sources
- Level of immunization duplication in an IIS is difficult to assess

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Why are Duplicate Immunizations a Problem?

- Duplicate immunizations:
  - Complicate forecasting programs and data exchange
    - System must choose between 2 or more shots in a series
  - Render vaccination histories confusing
  - Undermine the credibility of IIS data

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Before the De-duplication Project

- In 2010, CIR
  - Contained about 5-7% duplicate immunizations
  - Received an average of 3,700 requests per month from providers for manual immunization corrections (a provider cannot modify shots submitted by another provider)

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The De-duplication Model

Three General rules:

1. Combination shots are deleted only when in comparison with the same formulation (different dates)
2. Only a single pair can be evaluated from a cluster
3. There is always a surviving shot

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The De-duplication Model (2)

- Designed in 3 stages:
  - Stage 1: Identify clusters of duplicate immunizations
  - Stage 2: Perform pair-wise comparison based on a decision matrix that scores each immunization
  - Stage 3: Delete the lowest scoring immunization

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Stage 1: Identification of Duplicate Clusters

- Duplicate cluster are:
  - Two or more immunizations
    - from the same vaccine group
    - administered within 0, 1, or 2 days
    - One valid plus 1 or more invalid shots

Hib Cluster

DTaP/IPV/Hib	3/3/2010
Hib-PRP-T	3/3/2010
Hib NOS	3/5/2010

Polio Cluster

IPV	11/1/2005
Polio NOS	11/1/2005

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Stage 2: Pair-wise Comparison

Assign a score to each vaccine based on the weight of each data element associated with the vaccine

Data elements	Weight
Combo	100
Manufacturer or lot number	3
More specific	2
Entered/modified by CIR	2
VFC eligibility - not UNK	1
By vaccinator	1
Before license date or after end date	-5

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Vaccine Specificity

- Vaccine specificity - hierarchy from most to least specific

1. RotaTeq	code 116	3. Rotashield	code 74
2. Rotarix	code 119	4. Rota NOS	code 122

- Patient age is also used to determine the appropriateness of a vaccine in the following groups: DTP, HepA, Meningococcal

If age is < 7 years	If age is => 7 years
1. DTaP5antig	1. Tdap
2. DT	2. TdpreserFree
3. DTaP	3. Td
4. DTaP NOS	4. DtaP5antig
4. DTP	5. DT
6. Tdap	6. DTaP
7. Tdpreserfree	7. DTaP NOS
8. Td	8. DTP

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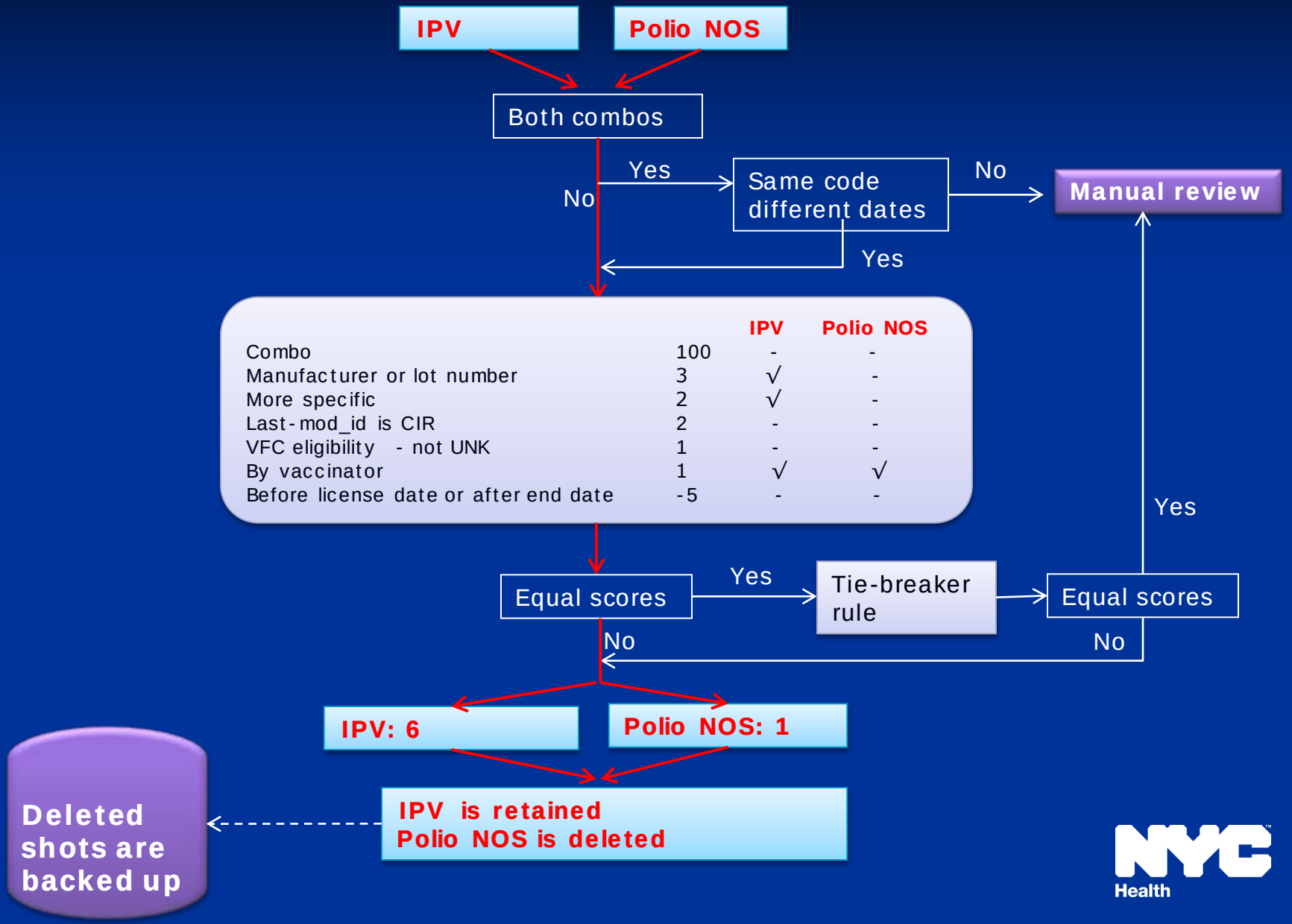
Stage 3: Resolution

- Select the “best” vaccine
- Delete lowest-scoring vaccine
- Apply tie-breaker logic if scores are tied (using entry date time)
- Send to manual review if still tied after the tie-breaker

Decision Matrix



Required Database Changes

- New fields/tables added to support the de-duplication process:
  - To store the most recent deduplication date for each record
  - To store data on each patient processed by the program
  - To store back-up data on each deleted immunization
  - To store statistics for each run of the program

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Results

- First runs on the entire database (in 2010): ~ 1.5 million deletions
- Weekly runs thereafter – only on new records and records that were modified since the last run: 10 to 12,000 deletions
- As of August 2012: a total of 2.9 million immunizations deleted (~70% of all duplicates)
  - 725,000 patient records affected, or 16% of CIR

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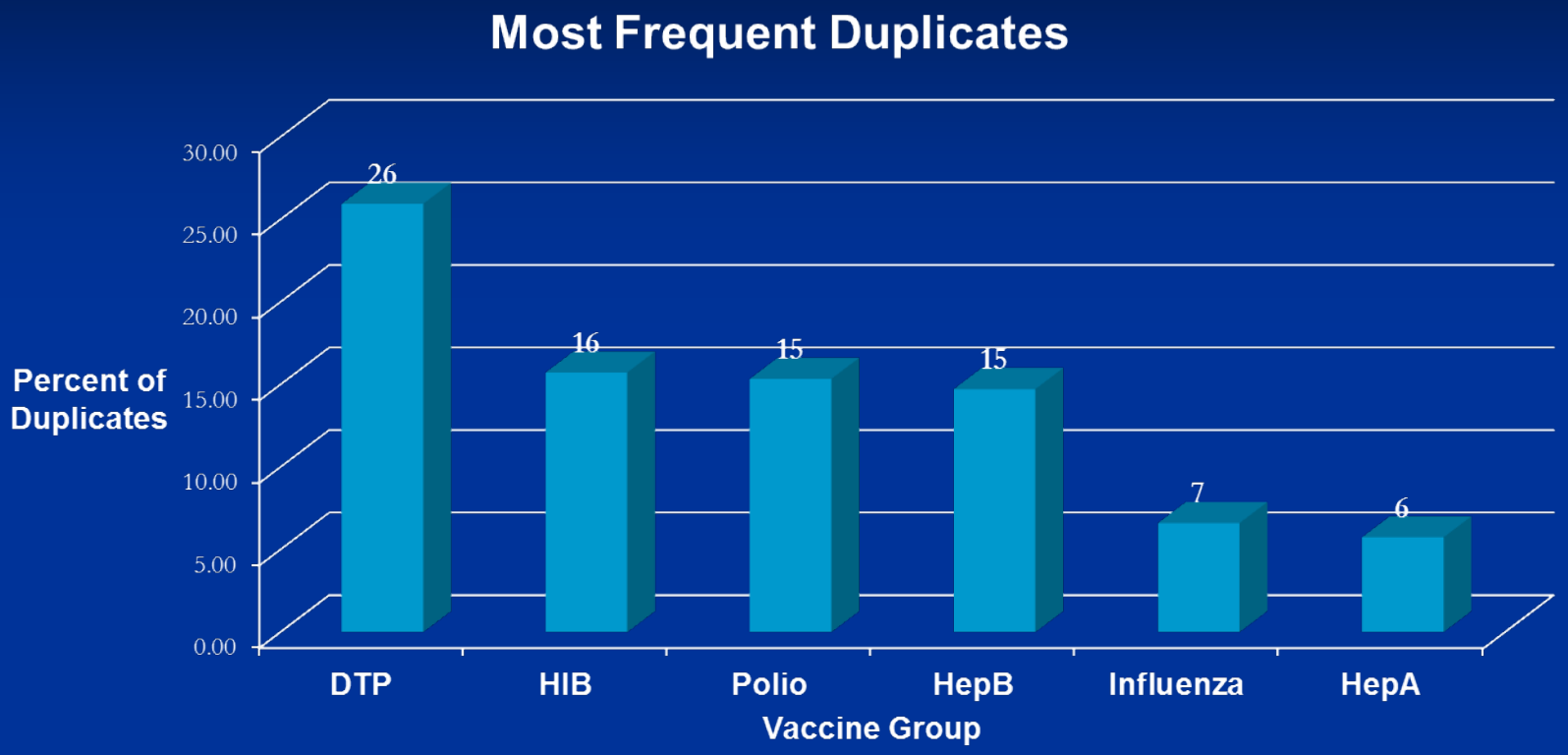
Profile of Duplicates



Most frequent manual review pair are 2 combos or 2 vaccines with same code, different dates

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Results (continued)

Additional measure

- Provider requests for manual corrections and deletions decreased by over 50% - from 3,700 to ~1,700 per month

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Conclusions

- Immunization deduplication is feasible within a large IIS
- Fairly simple methodology – large impact
- Manual review is not feasible for a large IIS like the CIR
- Program has a significant impact on CIR data quality and operations

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Considerations

- De-duplication program must be set up as a routine activity for highest return on investment
- Interval chosen is proportionally related to level of manual review possible (staffing), potential errors

Next Steps

- Further evaluate impact of the program on specific types of immunization, and proportion that is sent to manual review
- Consider expanding the ‘duplicate definition window’ from 3 days to a wider range

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Thank you

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