Exploring Synergy: Using Survey and Administrative Data Systems to Monitor Local, State, and National Immunization Programs

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2014 Federal CASIC Workshops
Washington, D.C.
March 20, 2014
Outline

- **Background**
  - Immunization Program
  - National Immunization Surveys
  - Immunization Information Systems (IIS)

- **Challenges and Needs**

- **Projects**
  - Sample frame projects
  - Match projects
  - Local area projects

- **Next steps**
  - Local data for local action
  - Two systems/synergy issues
  - IIS “readiness”
  - Strategic planning
National Center for Immunization and Respiratory Diseases (NCIRD) Program

Objective

- Committed to the prevention of disease, disability, and death through immunization and by control of respiratory and related diseases.
  - Added benefit
    - Cost saving
      - Vaccination of each U.S. birth cohort with the current childhood immunization schedule
        - Prevents approximately 42,000 deaths and 20 million cases of disease
        - Net savings of nearly $14 billion in direct costs and $69 billion in total societal costs.
Vaccine-specific coverage* among children 19-35 months, National Immunization Survey (NIS), United States, 1994-2012

* The Healthy People 2020 target for coverage is 90% for all vaccines with the exception of rotavirus (80%) and HepA (85%).
† DTP (3+) is not a Healthy People 2020 objective. DTaP (4+) is used to assess Healthy People 2020 objectives.
§ Reflects 3+ doses through 2008, and Full Series (3 or 4 doses depending on type of vaccine received) 2009 and later.
# Comparison of 20th Century Annual Morbidity and Current Morbidity: Vaccine-Preventable Diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>20th Century Annual Morbidity†</th>
<th>2012 Reported Cases † †</th>
<th>Percent Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallpox</td>
<td>29,005</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>21,053</td>
<td>1</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Measles</td>
<td>530,217</td>
<td>55</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Mumps</td>
<td>162,344</td>
<td>199</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Pertussis</td>
<td>200,752</td>
<td>41,880</td>
<td>79%</td>
</tr>
<tr>
<td>Polio (paralytic)</td>
<td>16,316</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Rubella</td>
<td>47,745</td>
<td>8</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Congenital Rubella Syndrome</td>
<td>152</td>
<td>2</td>
<td>99%</td>
</tr>
<tr>
<td>Tetanus</td>
<td>580</td>
<td>36</td>
<td>94%</td>
</tr>
<tr>
<td><em>Haemophilus influenzae</em></td>
<td>20,000</td>
<td>21*</td>
<td>&gt; 99%</td>
</tr>
</tbody>
</table>

†Source: JAMA. 2007;298(18):2155-2163
† †Source: CDC. MMWR January 4, 2013;61(52);ND-719-ND-731. (provisional week 52 data)

* *Haemophilus influenzae* type b (Hib) < 5 years of age. An additional 14 cases of Hib are estimated to have occurred among the 227 reports of Hi (< 5 years of age) with unknown serotype.
National Immunization Surveys

- A probability-based random-digit-dial (RDD) dual-frame landline telephone and cell telephone survey with a follow-up provider record check

**Family of surveys**
- NIS-Teen – adolescents 13-17 years (2006)
- NIS-Flu – children 6-18 months and 36 months-12 years (2009)
- NIS-Kindergarten (pilot) – children entering/recently entered kindergarten (2013-14 school year)
- National Adult Immunization Survey (NAIS) (pilot) – adults 18 years and older (Summer 2007)
- National 2009 H1N1 Flu Survey (emergency response) - respondents 18 years and older and their children (2009-10)

**Strength**
- National, state, and (limited) local area estimates of vaccination coverage using a standard methodology
IIS

- State/local confidential, computerized, population-based, data systems that collect and consolidate vaccination doses administered by participating vaccination providers
  - Functional IIS in 49 states, five large cities, the District of Columbia, and 8 islands/territories

- Started in the 1970s
  - Common functional standards and core data elements were established in 2001 (and are evolving)

- Strengths
  - Clinical care - Provide a consolidated vaccination record and can forecast when recommended vaccinations are due
  - Population level - Provide aggregate information on vaccination coverage within a state/local area
  - Contains functionalities that assist the immunization program and its stakeholders
  - IIS have high levels of completeness for children and kindergarteners
Challenges

- **Pockets of under-vaccination**
  - Impoverished communities (socioeconomic barriers)
  - Vaccination acceptance concerns cluster (religious, cultural)
  - Increased risk of low vaccination coverage and vaccine preventable disease transmission

- **Changing survey environment**
  - Decrease in landline telephones/increase use of cell telephones
  - Decrease in response rates
  - Increase in costs

- **Varied IIS environment**
  - May be variation in legislation, methods of populating the dataset, or administration of system

- **Perception**
  - Two systems funded to measure vaccination coverage
    - Varying objectives, perspectives, and stakeholder interests

- **Data sharing and confidentiality**
  - NIS CIPSEA
  - IIS legislation, regulations, charters
Needs

- Assess local vaccination coverage (State and Local Health Departments)
  - Identify options to ensure accurate vaccination coverage can be affordably monitored at the local level.

- Assess national and state level coverage (CDC)
  - Valid and comparable estimates over time and across states

- Enhance synergy
  - Leverage the National Immunization Surveys and IIS
    - Minimize survey costs
    - Reduce survey respondent burden
    - Improve IIS completeness
    - Improve survey data validity
    - Manage funds entrusted to NCIRD to assess and evaluate the Immunization Program

- Manage national, state, and local data security issues
NIS-IIS

- **Common element**
  - Provider reported vaccination
    - NIS – Immunization History Questionnaire (IHQ)
    - IIS – both mandatory (via state legislation) and voluntary reporting (in some cases required to administer government funded vaccines)

- **Data sets**
  - NIS and NIS-Teen
  - IIS
NIS-IIS Projects

- **Sample Frame**
  - Assessing the feasibility of using the IIS as a sample frame for the NIS sampling methodology
    - IIS assists NIS

- **Match**
  - Comparing children and their vaccination history as collected by NIS and reported to IIS
    - NIS assists IIS

- **Local Area**
  - Using NIS methodology to assist IIS in determining local area vaccination coverage rates and in identifying pockets of need
    - NIS assists IIS
NIS-IIS SAMPLE FRAME PROJECT
2008 NIS-IIS Sample Frame

- **Objective**
  - Assess potential to use IIS as an NIS sample frame

- **Methods**
  - Two mature IIS
  - Separate, independent samples from each IIS
  - NIS data collection process, including the household telephone interview and the provider survey
    - NIS updated IIS member contact information
  - Immunization data obtained from the IIS
2008 NIS-IIS Sample Frame

- **Results**
  - Large proportion of non-locatable cases, non-working/out-of-scope phone numbers, and ineligible households

<table>
<thead>
<tr>
<th></th>
<th>IIS Non-locatable</th>
<th>Non-working/Out-of-scope</th>
<th>Ineligible households</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>29%</td>
<td>16%</td>
<td>20%</td>
</tr>
<tr>
<td>B</td>
<td>14%</td>
<td>26%</td>
<td>18%</td>
</tr>
</tbody>
</table>

- **Action**
  - IIS could gather and maintain individual member contact information
    - Not the primary function of IIS
Objectives
- Assess potential to use IIS as an NIS sample frame
- Determine the costs of using an IIS sample frame on both the IIS and NIS
- Identify factors that could indicate when an IIS could be used to provide support as a possible sample frame for the NIS (“IIS readiness”)

Methods
- Five IIS with varying maturity
  - External funding provided to IIS to update member contact information through external sources
- Separate, independent samples from each IIS
- NIS data collection process, including the household telephone interview and the provider survey
  - Immunization data obtained from the IIS
2013/2014 NIS-IIS Sample Frame Results from a work in progress

- Two IIS sample frames fielded
  - Data collection has gone smoothly
  - There is still variation in IIS

2013/2014 NIS-IIS Sample Frame Disposition

<table>
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<tr>
<th>IIS</th>
<th>Non-locatable</th>
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<th>Ineligible households</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>29%</td>
<td>23%</td>
<td>11%</td>
</tr>
<tr>
<td>B</td>
<td>56%</td>
<td>18%</td>
<td>7%</td>
</tr>
</tbody>
</table>
Lessons learned from 308(d), CIPSEA, and data sharing

- 308(d) and CIPSEA
  - The NIS sample frame is protected information
    - NIS can use an over sample of children in the IIS or the entire IIS population to prevent the IIS from knowing with certainty which children were in the sample

- Data sharing
  - IIS restrictions on what data may be shared due to legislation, regulation, or charter
    - One IIS could not participate
    - One IIS was able to draw an oversample of potential participants
    - Other IISs closely reviewed ethical and legal options
NIS-IIS MATCH PROJECT
NIS-IIS Match

Objective

- Compare the completeness of IIS and NIS data
  - Participation in the project is at the option of each IIS

Participation

- 2008 9 areas for child sample
- 2009 2 areas for child sample
- 2010 6 areas for child sample and 7 for teen sample
- 2011 2 areas for child sample and 2 for teen sample
- 2013 1 area for child sample and 1 for teen sample
- 2014 1 area for child sample and 1 for teen sample
NIS-IIS Match Methods

Methods

- NIS respondents are asked for consent to contact the child(ren)’s vaccination providers and consent to contact the local/state IIS
- The consented NIS or NIS-Teen children are matched to IIS records to obtain the IIS immunization history
  - Option A - IIS extracting a subset of IIS data that are then shared with NIS (via an SFTP site). The extracted data are used to conduct the match with NIS records.
  - Option B - An NIS staff member travels to the IIS with a secure laptop loaded with linking software to conduct the match on the laptop using an extract of IIS data
NIS-IIS Match Process

- **Process**
  - Determine adequate NIS Provider Data and adequate IIS data
  - Calculate up-to-date (UTD) rates for each vaccine and series based on data source
  - Combine the NIS and IIS Data by treating the IIS as ‘another provider’ and conducting standard NIS data processing procedure.
  - The difference between the combined data and NIS (or IIS) on UTD rates indicates the ‘gain’ in reporting vaccinations if IIS (or NIS) data are incorporated.
Weighted Vaccination Coverage Estimates for 4:3:1:3:3:1 Vaccine Series*
Based on the NIS, the IIS, and the Combined Data: NIS-IIS Match, 2008-2011

4:3:1:3:3:1 series includes ≥4 doses of diphtheria and tetanus toxoids and acellular pertussis vaccine, ≥3 doses of poliovirus vaccine, ≥1 doses of measles vaccine, ≥3 doses of *Haemophilus influenzae* type B vaccine, ≥3 doses of Hepatitis B vaccine, and ≥1 doses of varicella vaccine.
NIS-IIS Match Ongoing Results

- NIS and IIS generally agree in majority of cases
- Discrepancies generally due to only NIS indicating UTD

4:3:1:3:3:1 series includes ≥4 doses of diphtheria and tetanus toxoids and acellular pertussis vaccine, ≥3 doses of poliovirus vaccine, ≥1 doses of measles vaccine, ≥3 doses of *Haemophilus influenzae* type B vaccine, ≥3 doses of Hepatitis B vaccine, and ≥1 doses of varicella vaccine.
NIS-IIS Match Ongoing Results

- NIS vs. IIS UTD Status Disagrees by Child/Household Characteristics
  - Based on 15 delivered reports (13 areas) from 2008 to 2010
  - More discrepancies are found among children who:
    - moved from another area
    - had 2+ providers
  - Fewer discrepancies are found among children who:
    - lived in poverty
    - had only public providers
NIS-IIS Match Ongoing Findings

- **IIS**
  - Results show diversity of vaccination data completeness across IISs
  - Vaccination coverage estimates determined by IISs could be more accurate if NIS data were added
    - However, federal restrictions on sharing data from the NIS prevent data sharing
  - Data sharing
    - One IIS had to withdraw from the match
      - In some jurisdictions, IIS legislation prohibits access to data by researchers or other entities

- **NIS**
  - The NIS would benefit from adding additional vaccination data from the IISs.
    - However, comparability of NIS estimates across states may be affected

- **Next steps**
  - Continue as an option for interested IIS
NIS-IIS LOCAL AREA PROJECT
Objectives

- Develop a sustainable methodology to be used by IIS to produce estimates of vaccination coverage at the local level
- Assist Immunization Programs in differentiating pockets of undervaccination
- Identify characteristics associated with areas with low vaccination coverage in order to target intervention
- Develop metrics that can be used to evaluate when an IIS is viable to produce accurate local area vaccination estimates (“IIS readiness”)
NIS-IIS Local Area Methods

- Four mature IIS
- Selected four local geographic areas within each state for inclusion in the study
  - Areas chosen had low IIS vaccination coverage
- Funding provided to IIS to update member contact information and conduct a medical records abstraction
- Vaccination data were collected from three data sources
  - NIS: NIS Household Data, provider survey data
    - Each IIS selected an oversample of children from the IIS database who reside in the selected local geographic area
    - NIS data collection process, including the household telephone interview and the provider survey
  - IIS: IIS vaccination data
    - Vaccination data obtained from the IIS where allowed and consented
  - Medical records abstraction (from vaccination provider)
    - Each IIS will collect data directly from providers using a medical record abstraction approach for a subset of the IIS sample
NIS-IIS Local Area
Results from a work in progress

- Compile data from the NIS household interview, NIS provider survey, IIS, and medical record abstractions
  - Calculate vaccination coverage estimates
    - Adjust estimates for children who have moved or gone elsewhere (MOGE)
  - Compare vaccination coverage estimates to determine if local areas have true low coverage or artificial coverage due to variation in IIS reporting
  - Provide summary information about providers not participating in the IIS or participating but not submitting data on the sampled child
  - Develop a “total error” simulation

- Similar concerns with 308(d), CIPSEA, and data sharing

- Results soon …
NIS IIS Moving Toward Synergy

- **Local data for local action**
  - Continue to explore methods where CDC can assist state and local health departments estimate local vaccination coverage, allowing Immunization Programs to guide action with data

- **Challenges in having two systems work together**
  - Data privacy, participant confidentiality, and data quality
  - Concern about non-comparability if National Immunization Surveys use IIS data

- **“IIS readiness”**
  - Identify potential IIS performance measures to indicate ability to
    - Serve as an sample frame for National Immunization Surveys
    - Serve as provider for National Immunization Surveys
    - Provide sufficiently accurate estimates of local vaccination coverage fit for this purpose

- **Develop strategic plan for IIS and NIS synergy**
  - Conduct Fit for Purpose Evaluations of IIS and NIS
    - Assess the impact of the use of supplemental IIS data on current NIS methodology
  - Clarify and communicate the complimentary roles of IIS and NIS
Acknowledgements

- CDC
  - Laura Pabst
  - James A. Singleton

- NORC at the University of Chicago
  - Vicki Pineau
  - Margrethe Montgomery