Strategies to Improve Post Vaccination Testing Rates Among Infants Born to Hepatitis B-Infected Mothers

Julie E. Lazaroff, MPH
Perinatal Hepatitis B Prevention Unit
Bureau of Immunization
New York City Department of Health & Mental Hygiene

Texas Perinatal Hepatitis B Prevention Summit
May 29, 2018 - May 30, 2018
Contents

- New York City Perinatal Hepatitis B Prevention Program (NYC PHBPP)
- Challenges to obtaining PVST
- Strategies to improve PVST
- Next Steps
New York City Perinatal Hepatitis B Prevention Program (NYC PHBPP)
New York City Statistics

- Population: 8.6 million residents
  - >3 million are foreign-born (35%)
- 121,673 births in NYC in 2015
  - 39 delivery facilities
  - 51% of new mothers were foreign-born
- Birth dose coverage
  - 2017 – 72.3%
NYC PHBP Organization Structure

- The NYC PHBPP
  - Bureau of Immunization (BOI)
  - NYC Department of Health and Mental Hygiene (NYC DOHMH)
- 18 Employees (CDC Immunization Program Grant)
  - PHBP Coordinator: Unit Chief
  - Epidemiologist
  - Supervisors /Public Health Advisors (PHAs): 12
    - Bilingual in Chinese/English
  - Administrative/Clerical: 4
Surveillance of Hep B-infected Pregnant Women

- In New York State, since 1990, providers have been required to test all pregnant women for hepatitis B (hep B)
  - Reporting requirements
- Cases are reported to the PHBP Unit by laboratories, prenatal care providers, delivery facilities and newborn screening card data
- PHAs confirm cases before contacting the patient
Hep B-infected Pregnant Women
NYC, 2000-2017

> 2,000/yr in ‘07 and ‘08

1,600-1,800/yr

1,343 in ‘17
Region of Birth
Hep B-infected Mothers
2017, NYC (n=1256)

- China: 53%
- Western Africa: 15%
- Asia (excl. China): 12%
- Caribbean and Haiti: 6%
- USA: 5%
- Mexico, Central/S. America: 3%
- Europe: 5%
- Other and Unknown: 5%
- Africa (excl. Western): 5%
- Middle East: 6%
Mothers Born in China

- 15%-20% of the mothers who born in China will move back to China or send their infant to China
- Infants return to NYC when school age
  - Case management continues while child is in China
- May be lost to follow-up and found again when mother is pregnant again
  - May be case managed as contacts
Case Management
Interview and Health Education

- Initial and/or post-partum interview
  - Maternal demographics, risk factors and related medical data
  - Hep B disease and routes of transmission
  - Immunization and testing schedules and recommendations
  - Hep B evaluation during and after pregnancy
  - Identify contacts
  - Plans after delivery
Case Management Vaccination and Testing

- Reminders to provider and mother for infant and child contact vaccination and testing
- Documentation of vaccinations
  - NYC Citywide Immunization Registry (CIR)
    - 90% of vaccinations for PHBP Infants
  - Obtain vaccination records for doses administered outside of NYC which are not found in the CIR
- Documentation of PVST
  - Providers fax lab reports to the PHBP Unit
  - Electronic lab reporting
- Infants vaccinated and/or tested in China
  - Families mail, fax or text message reports
Case Management
Infants Born, 2015, NYC (n=1517±)

<table>
<thead>
<tr>
<th>Vaccination</th>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEP* Received</td>
<td>1508</td>
<td>99%</td>
</tr>
<tr>
<td>Series Completed</td>
<td>1388</td>
<td>91%</td>
</tr>
<tr>
<td>PVST Tested</td>
<td>1349</td>
<td>89%</td>
</tr>
<tr>
<td>Not Tested</td>
<td>168</td>
<td>11%</td>
</tr>
<tr>
<td>Total</td>
<td>1517</td>
<td>100%</td>
</tr>
</tbody>
</table>

*PEP (post-exposure prophylaxis) is defined as the administration of hepatitis B immune globulin (HBIG) and the 1st dose of hep B vaccine series within 12 hrs of birth. ± This includes infants transferred to other U.S jurisdictions.
Challenges to PVST Completion and Documentation
PVST Not Documented Infants Born in 2015 (n=168/1517)

- Moved (not including China): 40%
- Moved to China: 15%
- Could not Locate: 10%
- Provider-related: 8%
- Family-related: 7%
- Other: 20%

NYC Health
Challenges
Errors in PVST Orders and Timing

- PVST errors are not uncommon
  - Incorrect tests are ordered
  - Testing is performed too early
  - Testing is performed too late
- PVST errors require recalling the infant
  - Providers and families will often push-back
    - Anti-HBs (+) alone does not rule out infection
  - Delays and failures to obtain PVST documentation
Challenges
Moved or Cannot be Located

- 75% of the infants without PVST documentation were either no longer residing in New York City or could not be located

- Methods to search for families
  - City agency database (HHS Connect)
  - Regional health information organizations (RHIOs)
  - NYC DOH databases (CIR, ECLRS, Maven)

- Families return to NYC, but do not notify the PHBP Unit
Challenges
Tracking and Sending Reminders

- PHAs have 150-200 cases to track each year
  - Paper tickler systems require manual calculation of dates and regular maintenance

- Sending reminders to families
  - Scheduling and logging reminders require meticulous organization and consistency

- Families are difficult to reach
  - Knowing how families prefer to contacted needs to be documented
Strategies to Improve PVST Completion and Documentation
Patient and Provider Education on PVST Recommendations

- Both patients and providers should be educated on current ACIP PVST recommendations
  - Patients – verbal / educational pamphlet
  - Providers – quick reference sheets

- Two most important health messages
  - Test for both hepatitis B surface antibody (anti-HBs) and hepatitis B surface antigen (HBsAg) to determine if child is immune, infected or susceptible
  - Test at age 9 - 12 months
Electronic Lab Reporting of PVST

- Most laboratory reporting laws are for results that indicate disease (hep B infection)
- In July 2014, the NYC DOHMH requested that the Board of Health amend the health code to require reporting of all HBsAg and anti-HBs results (qualitative or quantitative)
  - Age ≤ 5 years old
  - Regardless of result (positive, negative and indeterminate)
Maven®
NYC Vaccine Preventable Disease Surveillance System

PHBP Unit
Case Management Database
Overview of VPD Maven Features

- Automated PVST electronic lab report import functionality
  - Leverages Maven matching algorithm
- Workflows
  - List of events that meet specified criteria for each step in case management
- Record family preferences on how to contact
- Vaccination and testing reminders log
Electronic Lab Imports

**ALL LAB DATA (ECLRS)**

Disease Classification and Data Processing Steps

hep B reports age ≤ 5 yrs

Reports enter Infant Cases when there is a person match

PHBP UNIT DATABASE (MAVEN®)
New York City Vaccine Preventable Disease Surveillance System

Hepatitis B – Perinatal Infant

Event Summary

Basic Information

Event ID: 100091697
Disease: Hepatitis B
Person:
Address:
Dates:
Investigation Status:
Linked Events/Contacts:
Attachments:
Notifications:

Event Notes

Event is in workflows [View List]
Disease Status: N/A
Event Date: 08/25/2017
Disposition: N/A
Disposition Date: N/A
Age at Event: 0 years 0 months 0 days
Assigned PHA: Willyhawk Huang
Assigned Supervisor: Willyhawk Huang

Lab Results

<table>
<thead>
<tr>
<th>Lab No.</th>
<th>Specimen Collection Date</th>
<th>Specimen Source</th>
<th>Test</th>
<th>Result</th>
<th>Antibiotic</th>
<th>Result</th>
<th>Facility Name</th>
<th>Facility Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>05/17/2018</td>
<td>Blood</td>
<td>HEsAg</td>
<td>Negative</td>
<td></td>
<td></td>
<td>BIOREFERENCE LABORATORY</td>
<td>HONG LI, M.D.</td>
</tr>
<tr>
<td>1</td>
<td>05/17/2018</td>
<td>Blood</td>
<td>Anti-HBs</td>
<td>Positive</td>
<td></td>
<td></td>
<td>BIOREFERENCE LABORATORY</td>
<td>HONG LI, M.D.</td>
</tr>
</tbody>
</table>
Workflow Specifications
Infant ECLRS Report Received

- Case may be open or closed
- A new laboratory report enters an infant case
  - Open and update case
  - Update Interpretation data
    - Immune – Close case
    - Infected – Referral to specialist
    - Susceptible – Advise for single dose revaccination
**Workflow Details - Infant ECLRS Report Received**

<table>
<thead>
<tr>
<th>Event</th>
<th>Case pending date</th>
<th>Date received</th>
</tr>
</thead>
<tbody>
<tr>
<td>100091697- Clinical</td>
<td></td>
<td>05/19/2018</td>
</tr>
<tr>
<td>100091338- Clinical</td>
<td></td>
<td>05/17/2018</td>
</tr>
<tr>
<td>100091308- Clinical</td>
<td></td>
<td>05/15/2018</td>
</tr>
<tr>
<td>100091220- Clinical</td>
<td></td>
<td>05/20/2018</td>
</tr>
<tr>
<td>100091157- Clinical</td>
<td>04/19/2018</td>
<td>05/19/2018</td>
</tr>
<tr>
<td>100091105- Clinical</td>
<td></td>
<td>05/20/2018</td>
</tr>
<tr>
<td>100090942- Clinical</td>
<td></td>
<td>04/25/2018</td>
</tr>
<tr>
<td>100090889- Clinical</td>
<td></td>
<td>05/18/2018</td>
</tr>
<tr>
<td>100090443- Clinical</td>
<td></td>
<td>04/20/2018</td>
</tr>
<tr>
<td>100088930- Clinical</td>
<td></td>
<td>05/06/2018</td>
</tr>
<tr>
<td>100087955- Clinical</td>
<td></td>
<td>05/16/2018</td>
</tr>
<tr>
<td>100086126- Clinical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100085460- Clinical</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CASE Pending As**

**Transferred w/i US** 3/3/2017 10/29/2017
PVST Interpretation and Documentation

<table>
<thead>
<tr>
<th>Reason for testing</th>
<th>Post Vaccination Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>* What is the interpretation of testing?</td>
<td>Immune</td>
</tr>
<tr>
<td>Date of interpretation</td>
<td>5/25/2018</td>
</tr>
<tr>
<td>Test result documentation obtained by:</td>
<td>Julie Lazaroff</td>
</tr>
<tr>
<td>Was this person tested at the same facility where the final dose was administered?</td>
<td></td>
</tr>
<tr>
<td>Was this person tested early?</td>
<td></td>
</tr>
<tr>
<td>PVS Completed outside of NYC</td>
<td></td>
</tr>
</tbody>
</table>
% PVST Documented: CDC Annual Reports
Infants Born 2013 - 2016

* CDC PHBP PAPA: Includes data from when infants in birth cohort are 1-2 years of age. Excludes infants who transferred to other US jurisdictions.
% PVST Documented and % by ECLRS*
Infant Births^ 2013 - 2016

*ECLRS: NYC Electronic Clinical Laboratory System
^Denominators include infants who transferred in or out within US
Workflow Specifications

PVS Testing Reminder

- Child is \( \geq 244 - 258 \) days old (8 months old)
- Child has received at least three doses of vaccine
  - Final dose \( \geq 168 \) days old (24 seven-day weeks)
- Test results not received
- PHA Activities
  - Send family and provider a reminder one month in advance of when child is due
  - Remind family and provider that child will have two tests – one for immunity and one for infection
<table>
<thead>
<tr>
<th>Event</th>
<th>Name</th>
<th>Birth Date (mm/dd/yyyy)</th>
<th>PHA assigned to event</th>
</tr>
</thead>
<tbody>
<tr>
<td>100098505- Case Management</td>
<td></td>
<td></td>
<td>Wan Leung</td>
</tr>
<tr>
<td>100095754- Case Management</td>
<td></td>
<td></td>
<td>Doreen Simpson</td>
</tr>
<tr>
<td>100093810- Case Management</td>
<td></td>
<td></td>
<td>Helene Su</td>
</tr>
<tr>
<td>100093143- Case Management</td>
<td></td>
<td></td>
<td>Wan Leung</td>
</tr>
<tr>
<td>100092915- Case Management</td>
<td></td>
<td></td>
<td>Doreen Simpson</td>
</tr>
<tr>
<td>100092858- Case Management</td>
<td></td>
<td></td>
<td>Wan Leung</td>
</tr>
<tr>
<td>100092853- Case Management</td>
<td></td>
<td></td>
<td>Dan Ting Chen</td>
</tr>
<tr>
<td>100092837- Case Management</td>
<td></td>
<td></td>
<td>Dan Ting Chen</td>
</tr>
<tr>
<td>100092792- Case Management</td>
<td></td>
<td></td>
<td>Wan Leung</td>
</tr>
<tr>
<td>100092746- Case Management</td>
<td></td>
<td></td>
<td>Dan Ting Chen</td>
</tr>
<tr>
<td>100092720- Case Management</td>
<td></td>
<td></td>
<td>Helene Su</td>
</tr>
<tr>
<td>100092702- Case Management</td>
<td></td>
<td></td>
<td>Doreen Simpson</td>
</tr>
<tr>
<td>100092687- Case Management</td>
<td></td>
<td></td>
<td>Li Li</td>
</tr>
<tr>
<td>100092685- Case Management</td>
<td></td>
<td></td>
<td>Helene Su</td>
</tr>
<tr>
<td>100092681- Case Management</td>
<td></td>
<td></td>
<td>Myrna Lee</td>
</tr>
<tr>
<td>100092679- Case Management</td>
<td></td>
<td></td>
<td>Willyhawk Huang</td>
</tr>
<tr>
<td>100092670- Case Management</td>
<td></td>
<td></td>
<td>Myrna Lee</td>
</tr>
<tr>
<td>100092669- Case Management</td>
<td></td>
<td></td>
<td>Helene Su</td>
</tr>
<tr>
<td>100092666- Case Management</td>
<td></td>
<td></td>
<td>Helene Su</td>
</tr>
<tr>
<td>100092666- Case Management</td>
<td></td>
<td></td>
<td>Helene Su</td>
</tr>
</tbody>
</table>
Workflow Specifications
PVS Testing Past Due

- Child is $\geq$ 275 days old (9 months)
- Child has received at least three doses of vaccine
  - Final dose $\geq$ 168 days old (24 seven-day weeks)
- Test results not received
- PHA Activities
  - Call family to advise that child is tested as soon as possible. Assist with making the appointment.
  - Call pediatrician and fax remnder
  - Remind both family and provider that child needs two tests – one for immunity and one for infection
<table>
<thead>
<tr>
<th>Event</th>
<th>Last Update</th>
<th>Name</th>
<th>Birth Date (mm/dd/yyyy)</th>
<th>PHA assigned</th>
</tr>
</thead>
<tbody>
<tr>
<td>100091855- Clinical</td>
<td>05/03/2018</td>
<td>Eman Bassily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091825- Clinical</td>
<td>03/30/2018</td>
<td>Dan Ting Che</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091807- Clinical</td>
<td>05/03/2018</td>
<td>Helene Su</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091767- Clinical</td>
<td>03/28/2018</td>
<td>Tingting Gu-t</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091737- Clinical</td>
<td>03/05/2018</td>
<td>Helene Su</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091699- Clinical</td>
<td>04/10/2018</td>
<td>Doreen Simps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091694- Clinical</td>
<td>05/15/2018</td>
<td>Myrna Lee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091693- Clinical</td>
<td>05/09/2018</td>
<td>Myrna Lee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091691- Clinical</td>
<td>03/05/2018</td>
<td>Dan Ting Che</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091690- Clinical</td>
<td>03/07/2018</td>
<td>Wan Leung</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091689- Clinical</td>
<td>03/06/2018</td>
<td>Tingting Gu-t</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091676- Clinical</td>
<td>05/15/2018</td>
<td>Myrna Lee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091656- Clinical</td>
<td>03/05/2018</td>
<td>Helene Su</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091614- Clinical</td>
<td>03/26/2018</td>
<td>Helene Su</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091569- Clinical</td>
<td>03/13/2018</td>
<td>Helene Su</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091568- Clinical</td>
<td>04/03/2018</td>
<td>Dan Ting Che</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100091563- Clinical</td>
<td>05/15/2018</td>
<td>Myrna Lee</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Contact Preferences

<table>
<thead>
<tr>
<th></th>
<th>Mail</th>
<th>Text</th>
<th>Email</th>
<th>Cell Ph</th>
<th>Home Ph</th>
<th>Work Ph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do Not Use</td>
<td>X</td>
<td>Do Not Use</td>
<td>X For Reminders</td>
<td>X May Use</td>
<td>Not Use</td>
<td>Use for Reminders</td>
</tr>
<tr>
<td>May Use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Reminders Log

<table>
<thead>
<tr>
<th>Reminders Log</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sent reminders to pediatrician and mother about the final dose</strong></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>12/05/2018</td>
</tr>
<tr>
<td><strong>Placed reminder call/text to mother about the final dose</strong></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>12/05/2018</td>
</tr>
<tr>
<td><strong>Placed reminder call/text to mother about the PVS</strong></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>03/05/2018</td>
</tr>
</tbody>
</table>

- Sent reminder to pediatrician and mother about PVST **3/5/2018**
Summary

- Educating patients and provider on why and how PVST should be conducted may help to avoid PVST errors
- Mandating electronic laboratory reporting for PVST has proved to be very beneficial
  - Reports are received without active case management including for cases that have been closed
  - Case Management is more efficient
- Electronic tracking and reminder systems for vaccination and PVST documentation are very helpful and effective
Next Steps

- Disseminate Provider Reference Sheet
  - Laminated and will be available to download
- Advocate for laboratories to offer PVST panel
  - Requires resources and time from labs
  - Will decrease PVST ordering errors
- Enforce laboratory reporting requirement
  - Some labs still reporting only HBsAg or only HBsAg
- Improve workflows and reports in Maven
  - Separate reminder logs for providers and link to workflows
Acknowledgments

- PHBP – Public Health Advisors
- Ariba Hashmi, MPH
  PHBP Unit Epidemiologist
- Jen Rosen, MD
  Director of VPD Surveillance
- Rob Arciuolo, MPH*
  Epidemiologist, VPD Surveillance
- Jane R. Zucker, MD, MSc
  BOI Assistant Commissioner
EXTRA SLIDES
**NYC Identified Births vs. CDC Expected Birth Tables**

<table>
<thead>
<tr>
<th>Measure</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identified Births</td>
<td>1684</td>
<td>1842</td>
<td>1600</td>
<td>1657</td>
<td>1517</td>
</tr>
<tr>
<td>Expected Point Estimate</td>
<td>1775</td>
<td>1896</td>
<td>1776</td>
<td>1837</td>
<td>1399</td>
</tr>
<tr>
<td>Identified/Point Estimate</td>
<td>95%</td>
<td>97%</td>
<td>90%</td>
<td>90%</td>
<td>92%</td>
</tr>
<tr>
<td>Expected Lower Limit</td>
<td>1378</td>
<td>1483</td>
<td>1384</td>
<td>1436</td>
<td>1249</td>
</tr>
<tr>
<td>Identified/Lower Limit</td>
<td>122%</td>
<td>124%</td>
<td>116%</td>
<td>115%</td>
<td>121%</td>
</tr>
</tbody>
</table>

*CDC 2015 Birth Tables accounted for Mother’s Region of Birth*
INCIDENCE OF BIRTH TO HBV-INFECTED WOMEN

Incidence per 100,000 Live Births

- **Annual Percentage Change = 3.1**

- **1998-2006 APC = 3.1***
- **2006-2015 APC = -1.4***

* APC is significantly different from zero at $\alpha = 0.05$
Incidence by Country of Birth

- **US Observed Incidence**: 1998-2015 APC = -7.3*
- **Foreign Observed Incidence**: 1998-2007 APC = 3.6*, 2007-2015 APC = -1.1
- **China Observed Incidence**: 1998-2006 APC = 1.8*, 2006-2015 APC = -3.3*
- **Other Foreign Observed Incidence**: 1998-2015 APC = -0.7*

* APC is significantly different from zero at α = 0.05
PVST Completed
Infants Born 2013 – 2016 – By Quarter

<table>
<thead>
<tr>
<th>Quarter</th>
<th># of Infants</th>
<th>PVST Completed</th>
<th>% PVST Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1-2 2013</td>
<td>844</td>
<td></td>
<td>89%</td>
</tr>
<tr>
<td>Q3-4 2013</td>
<td>809</td>
<td></td>
<td>88%</td>
</tr>
<tr>
<td>Q1-2 2014</td>
<td>811</td>
<td></td>
<td>89%</td>
</tr>
<tr>
<td>Q3-4 2014</td>
<td>870</td>
<td></td>
<td>89%</td>
</tr>
<tr>
<td>Q1-2 2015</td>
<td>738</td>
<td></td>
<td>89%</td>
</tr>
<tr>
<td>Q3-4 2015</td>
<td>779</td>
<td></td>
<td>89%</td>
</tr>
<tr>
<td>Q1-2 2016</td>
<td>751</td>
<td></td>
<td>87%</td>
</tr>
<tr>
<td>Q3-4 2016</td>
<td>789</td>
<td></td>
<td>80%</td>
</tr>
</tbody>
</table>
References

Avoid Testing Too Early

- PVST should not be performed earlier than 9 months of age
  - Avoid detection of passive anti-HBs from HBIG
  - Increase ability to detect a late onset of infection
- Testing for HBsAg < one month after vaccination may result in a false HBsAg+
  - Hep B vaccine contains the HBsAg
Avoid Testing Too Late

- Testing for anti-HBs should not be delayed unnecessarily after the final dose.
  - Anti-HBs titers may wane, but there is still protection from persistent cellular immunity
  - Anti-HBs titer decline may occur as early as two to six months following vaccination.
  - Delaying testing may result in unnecessary revaccination in a child who has cellular immunity.
% PVST Documented and % by ECLRS
Without Infants Who Moved to China

*PVST Documented as of 5/18/2018
% PVST Documented and % by ECLRS With only Infants Who Moved to China

- 2013: 62%
- 2014: 71%
- 2015: 72%
- 2016: 57%

- % ECLRS Reported:
  - 2013: 7%
  - 2014: 10%
  - 2015: 11%
  - 2016: 11%