

# **How an Immunization Information System Can Improve Acute Disease Investigations and Surveillance**

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Florida Department of Health

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# Introduction

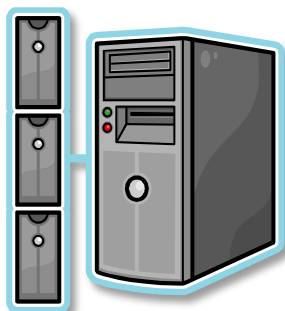
- State Health Online Tracking System (SHOTS)
  - Florida's immunization information system (IIS)
  - Established in 2002
  - Receives immunization data from health care providers across the state
  - Applies algorithms for immunization forecasting
  - Participation is voluntary, except for all 67 Florida county health departments (CHDs)
    - As of February 2015, supporting 5,600 organizations with 14,500 active public and private sites

# Introduction

- Merlin
  - Florida's reportable disease surveillance system
  - Established in 2001
  - Collects reportable disease case data statewide for epidemiological investigations and disease control (111 different disease codes)
    - Includes data for vaccine-preventable diseases (VPDs)
  - Used by all 67 Florida CHDs

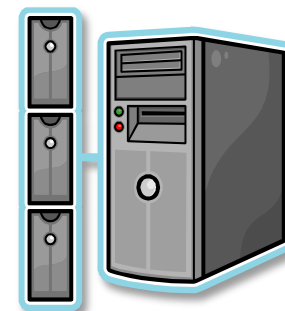
# Introduction

## Merlin – reportable disease surveillance



Reportable disease case data, including VPDs, some vaccination history

## SHOTS – IIS



Vaccination history, forecasting algorithms, Vaccines for Children (VFC) program inventory management

Epidemiologists



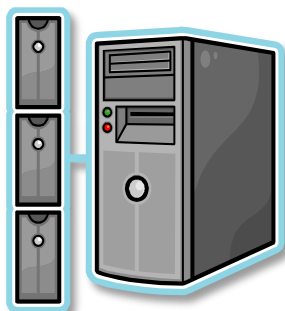
Previous infrastructure: Systems are not interoperable, so time-consuming duplicate work and inefficiencies in locating patients occur.

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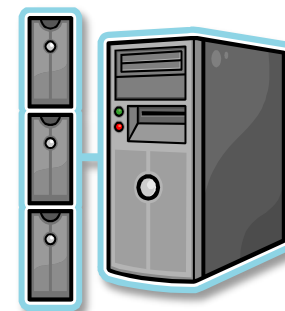
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# Introduction

**Merlin – reportable  
disease surveillance**



**SHOTS – IIS**



**Epidemiologists**



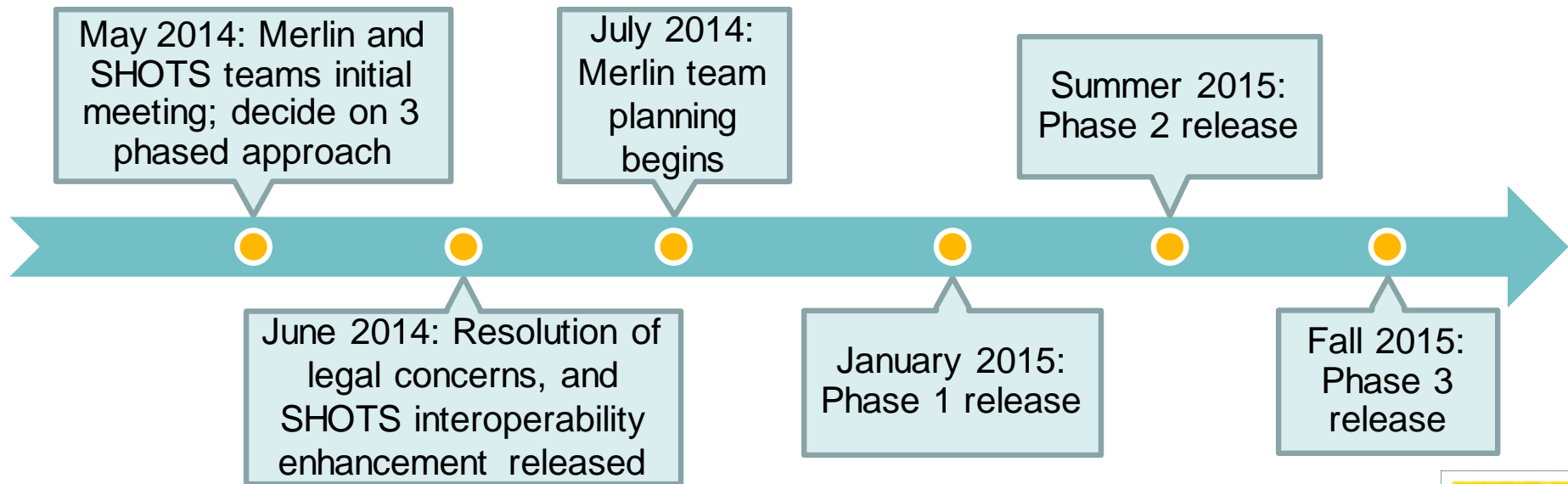
Redesigned infrastructure: Build interoperability to provide more efficient workflows and reduce duplicate work.

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# Methods

- Meetings between the Merlin and SHOTS project teams were held to develop the project timeline and a phased implementation schedule.
- Timeline:



# Methods

- Phased approach
  - Phase 1: (display) Merlin enrolled in SHOTS like a provider, using the same HL7 specifications document. Merlin receives and displays information from SHOTS.
  - Phase 2: (update) Merlin receives and reads demographic, contact, and vaccination information from SHOTS and updates records in Merlin.
  - Phase 3: (return) Merlin sends demographic, contact, and vaccination information to SHOTS, and SHOTS updates records.

# Methods

- Merlin users surveyed before Phase 1 planning and after Phase 1 implementation
- Additional user feedback gathered after Phase 1 training sessions
- Analysis of web service transaction records since Phase 1 implementation
  - Compared the transaction records and the number of VPD cases



# Results

- Before Phase 1 planning survey:
  - 88% of responding Merlin users reported also having a SHOTS account.
    - 59% of those with a SHOTS account reported accessing it at least once per week.
- Merlin user feedback:
  - “Would love to have vaccine info available via Merlin.”
  - “I think it will be great.”
  - “It would be amazing to have both systems talking to each other! All vaccine preventable diseases we follow up on require we at least confirm if the patient/suspect is in the FL SHOTS system.”
  - “Not having to get out of Merlin and log into FL SHOTS would be a time saver.”

# Results

## Phase 1: SHOTS Data Viewing Window in Merlin

The screenshot displays the Merlin Communicable Disease Reporting interface. The top navigation bar includes the Merlin logo and a search bar. Below the navigation bar, there are tabs for Home, Search, Outbreak, Analysis, Resources, Task, Admin, EpiGateway, Essence, and EpiCom. A secondary row of tabs includes Food Recalls, SHOTS, Help, and Log Off. The main content area is divided into a left sidebar and a main panel. The sidebar contains links for Profile, Details, Summary (highlighted), History, Cases, Vaccine History, New Case, Create, New Lab, Create, and Quick Reports, Print Summary. The main panel shows the Profile Summary for 'TESTS, TESTS A' with address '1350 NW 14TH ST, MIAMI, FL, 33125, USA' and date of birth '01/01/2001'. Below this is the Cases section, which includes a table of active cases and a section for Deleted Cases.

**Communicable Disease Reporting**

Home **Search** Outbreak Analysis Resources Task Admin EpiGateway Essence EpiCom

Food Recalls SHOTS Help Log Off

Search:

**Profile**

Details

**Summary**

History

Cases

Vaccine History

**New Case**

Create

**New Lab**

Create

**Quick Reports**

Print Summary

**Profile Summary**

Name: **TESTS, TESTS A**

Address: **1350 NW 14TH ST, MIAMI, FL, 33125, USA**

SSN: Date of Birth: **01/01/2001**

**Cases**

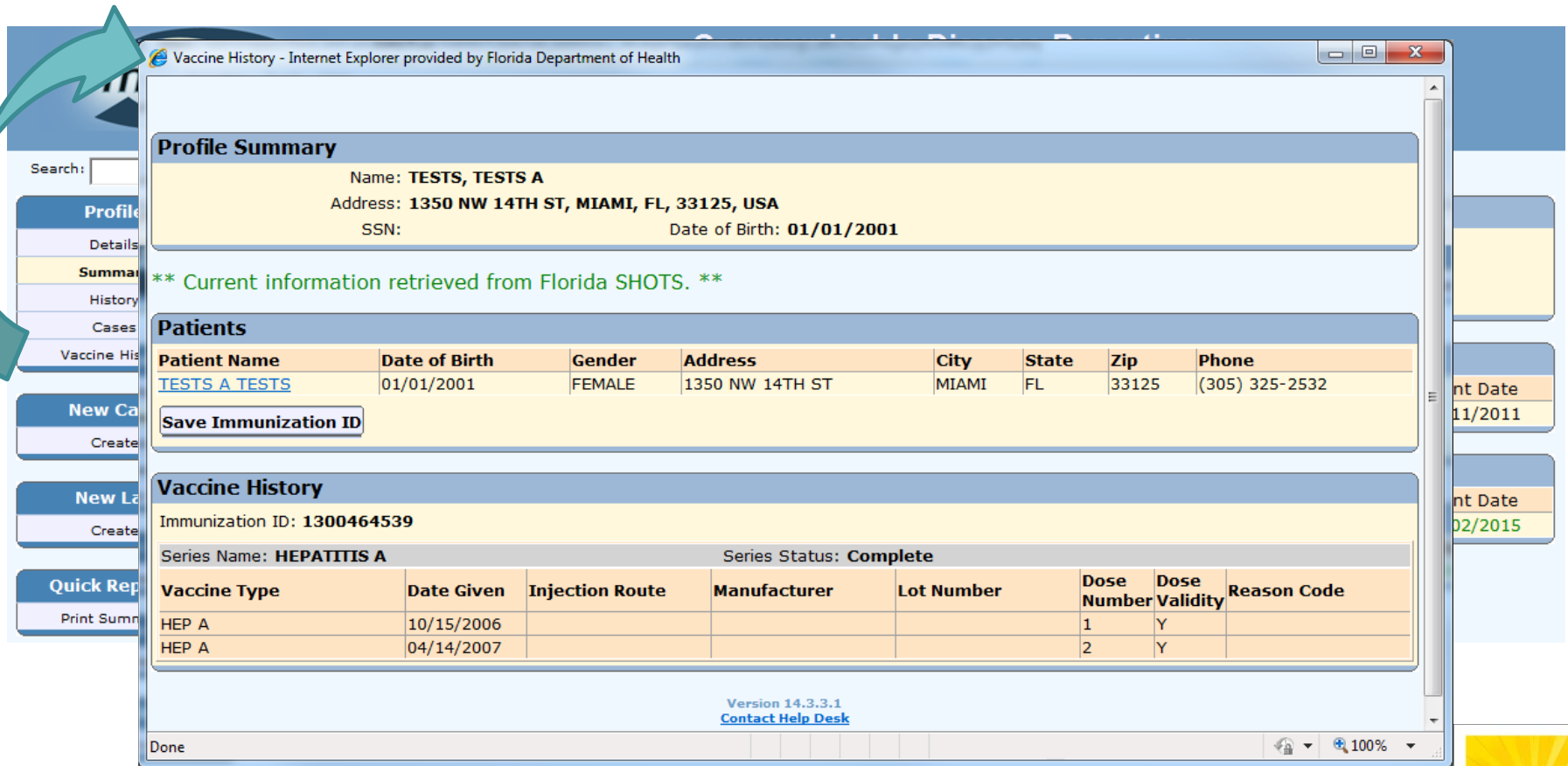
Case #	FL Disease Code	Dx Status	Case Status	Extended Data Status	Event Date
<a href="#">742205</a>	Pertussis - 03390		<a href="#">Incomplete</a>	Needs Extended Data	01/11/2011

**Deleted Cases**

Case #	FL Disease Code	Dx Status	Case Status	Extended Data Status	Event Date
<a href="#">742182</a>	Measles (Rubeola) - 05590		<a href="#">Marked for Deletion</a>	Deleted	02/02/2015

# Results

## Phase 1: SHOTS Data Viewing Window in Merlin Exact Match



Vaccine History - Internet Explorer provided by Florida Department of Health

**Profile Summary**

Name: **TESTS, TESTS A**  
Address: **1350 NW 14TH ST, MIAMI, FL, 33125, USA**  
SSN:   
Date of Birth: **01/01/2001**

**\*\* Current information retrieved from Florida SHOTS. \*\***

**Patients**

Patient Name	Date of Birth	Gender	Address	City	State	Zip	Phone
<a href="#">TESTS A TESTS</a>	01/01/2001	FEMALE	1350 NW 14TH ST	MIAMI	FL	33125	(305) 325-2532

[Save Immunization ID](#)

**Vaccine History**

Immunization ID: **1300464539**

Series Name: **HEPATITIS A** Series Status: **Complete**

Vaccine Type	Date Given	Injection Route	Manufacturer	Lot Number	Dose Number	Dose Validity	Reason Code
HEP A	10/15/2006				1	Y	
HEP A	04/14/2007				2	Y	

Version 14.3.3.1  
[Contact Help Desk](#)

Done

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# Results

## Phase 1: SHOTS Data Viewing Window in Merlin Multiple Matches

### Profile Summary

Name: **TEST, JOHNNY**

Address: **123 MAIN ST, TALLAHASSEE, FL, 32399**

SSN:

Date of Birth: **05/05/2005**

\*\* Current information retrieved from Florida SHOTS. \*\*

### Patients

05/05/2005

Patient Name	Date of Birth	Gender	Address	City	State	Zip	Phone
<input type="checkbox"/> <a href="#">JOHNNY TEST</a>	05/05/2005	MALE	123 MAIN STREET	TALLAHASSEE	FL	32399	850-123-4567
<input type="checkbox"/> <a href="#">JONATHAN TEST</a>	05/05/2005	MALE	123 MAIN ST	TALLAHASSEE	FL	32399	850-123-4567

# Results

## Phase 1: SHOTS Data Viewing Window in Merlin Multiple Matches

### Profile Summary

Name: **TEST, JOHNNY**  
Address: **123 MAIN ST, TALLAHASSEE, FL, 32399**  
SSN:                      Date of Birth: **05/05/2005**

\*\* Current information retrieved from Florida SHOTS. \*\*

### Patients

05/05/2005

Patient Name	Date of Birth	Gender	Address	City	State	Zip	Phone
<input type="checkbox"/> <a href="#">JOHNNY TEST</a>	05/05/2005	MALE	123 MAIN STREET	TALLAHASSEE	FL	32399	850-123-4567
<input checked="" type="checkbox"/> <a href="#">JONATHAN TEST</a>	05/05/2005	MALE	123 MAIN ST	TALLAHASSEE	FL	32399	850-123-4567
<input type="button" value="Save Immunization ID"/>							

### Vaccine History

Immunization ID: **9801000595**

Series Name: **DIPHTHERIA, TETANUS, AND PERTUSSIS**

Series Status: **Up to Date**

Vaccine Type	Date Given	Injection Route	Manufacturer	Lot Number	Dose Number	Dose Validity	Reason Code
PEDIARIX	07/29/2008	INTRAMUSCULAR	GlaxoSmithKline	AC21B150AA	1	Y	
PENTACEL	04/21/2010		sanofi pasteur	C355488	2	Y	
PENTACEL	06/21/2010		sanofi pasteur	C3600AA	3	Y	
DTAP-IPV	05/10/2012		GlaxoSmithKline	AC20B187AA	4	Y	

Series Name: **HEPATITIS B**

Series Status: **Complete**

Vaccine Type	Date Given	Injection Route	Manufacturer	Lot Number	Dose Number	Dose Validity	Reason Code
PEDIARIX	07/29/2008	INTRAMUSCULAR	GlaxoSmithKline	AC21B150AA	1	Y	
HEP B	04/21/2010		GlaxoSmithKline	AHBVB818AA	2	Y	
HEP B			GlaxoSmithKline	AHBVB818BA	3	Y	

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# Phase 1: SHOTS Data Viewing Window in Merlin

## Multiple Matches



# Results

## Phase 1: SHOTS Data Viewing Window in Merlin

**SHOTS Data Viewing Window**

**Merlin Pertussis Case Data**

**Vaccine History - Internet Explorer provided by Florida Department of Health**

**Profile Summary**

Name: AB, RA  
Address:  
SSN:  
Date of Birth: 01/21/2011

**\*\* Current information retrieved from Florida SHOTS. \*\***

**Patients**

Patient Name	Date of Birth	Gender	Address	City	State	Zip	Phone
AA, AB	01/21/2011	MALE			FL	32068	

Save Immunization ID

**Vaccine History**

Immunization ID: 9801668091

Series Name: DIPHTHERIA, TETANUS, AND PERTUSSIS      Series Status: Up to Date

Vaccine Type	Date Given	Injection Route	Manufacturer	Lot Number	Dose Number	Dose Validity	Reason Code
DTAP	08/04/2011				1	Y	
DTAP	09/19/2011				2	Y	
DTAP	11/18/2011				3	Y	
DTAP	09/18/2012		Other manufacturer	C4185AA	4	Y	

Series Name: HEPATITIS B      Series Status: Complete

Done      Local intranet | Protected Mode: On      60%

**Vaccination History**

14. Has the case ever received any doses of diphtheria, tetanus and/or pertussis-containing vaccines? ☐ Yes ☒ No ☐ Unknown

If case was not vaccinated, what was the reason? UNDER AGE FOR VACCINE

Vaccination Date	Vaccination Type	Manufacturer	Lot #
1.			
2.			
3.			
4.			
5.			
6.			

15. Date of last pertussis-containing vaccine prior to illness onset:

16. Number of doses of pertussis-containing vaccine prior to illness onset: (Count doses of any of the following: DTP, DTaP, DTP-Hib, Tdap, P only):

If not vaccinated with 3 or more doses of pertussis vaccine, reason: AGE < 7 MONTHS

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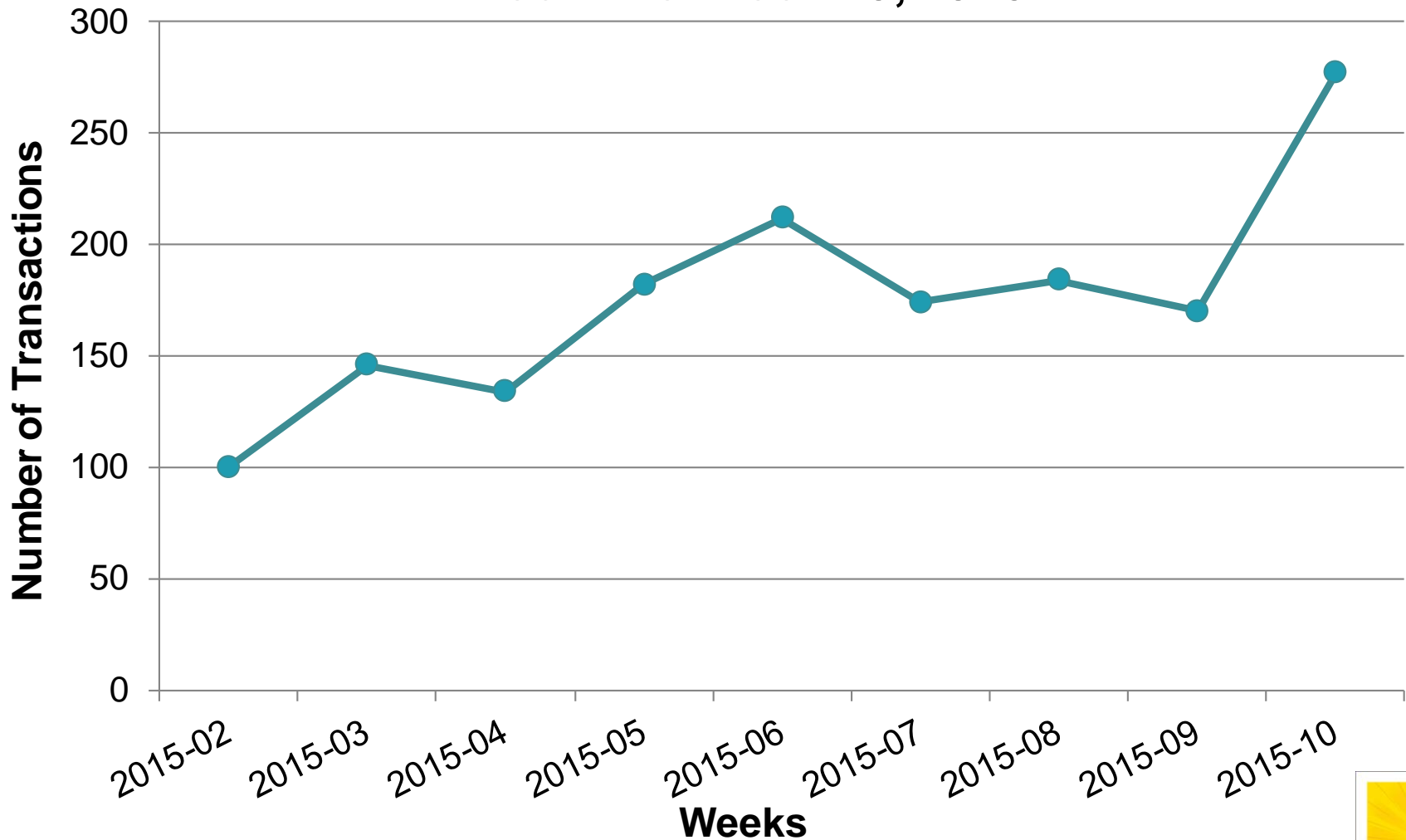
# Results

- After Phase 1 implementation survey:
  - All Merlin users who had used the viewing window said it was useful.
  - Merlin user feedback:
    - “Glad to have this feature!”
    - “I think it is a wonderful addition to Merlin!”
    - “This will be a great resource for all vaccine preventable diseases. I wish all providers (PCP's) would take advantage of using Florida SHOTS.”
- Merlin user feedback after training sessions:
  - Users want information on religious and medical exemptions.
  - Users want to be able to update SHOTS records.



# Results

## Web Service Transactions, Week 2 to Week 10, 2015

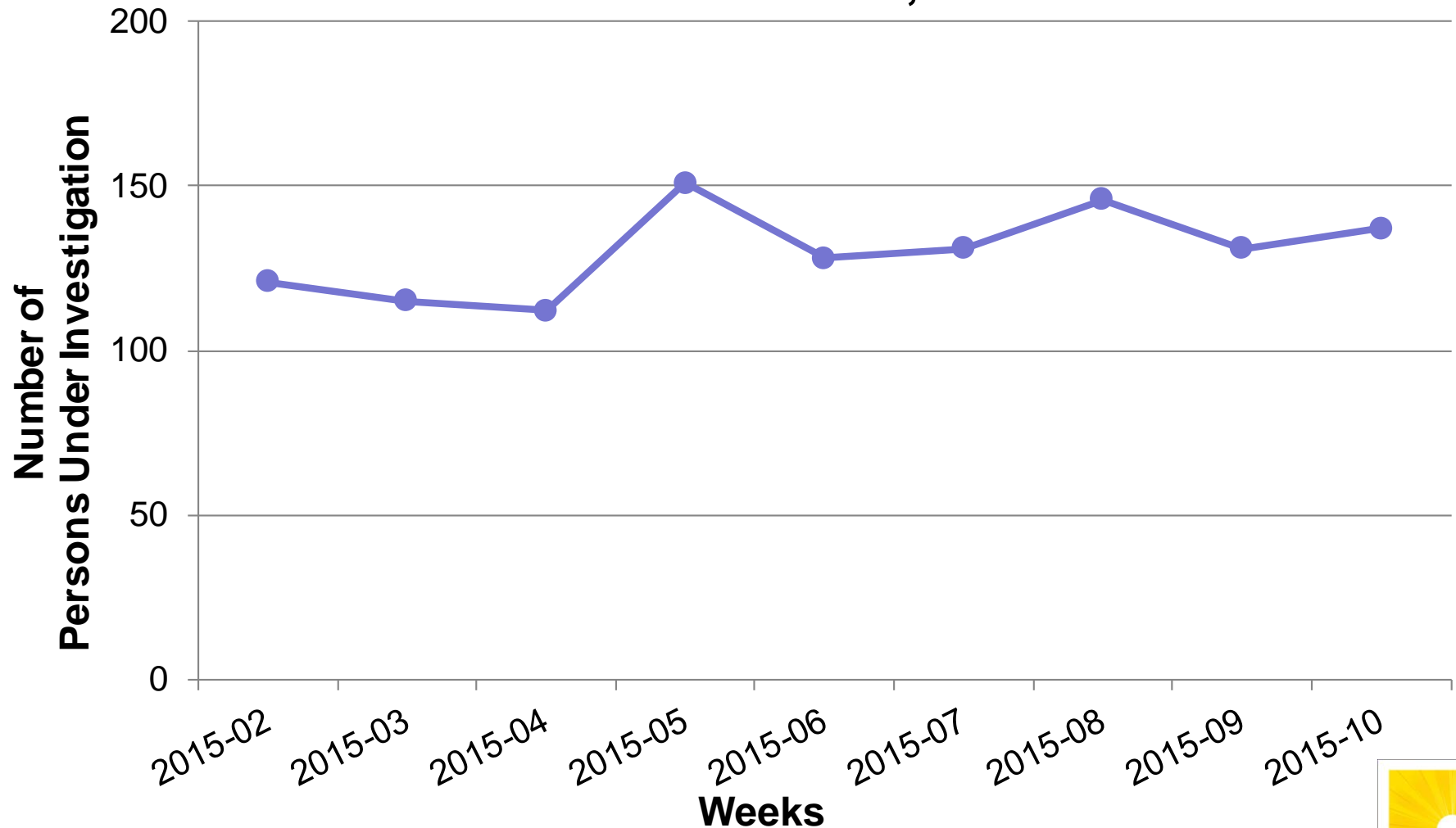


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# Results

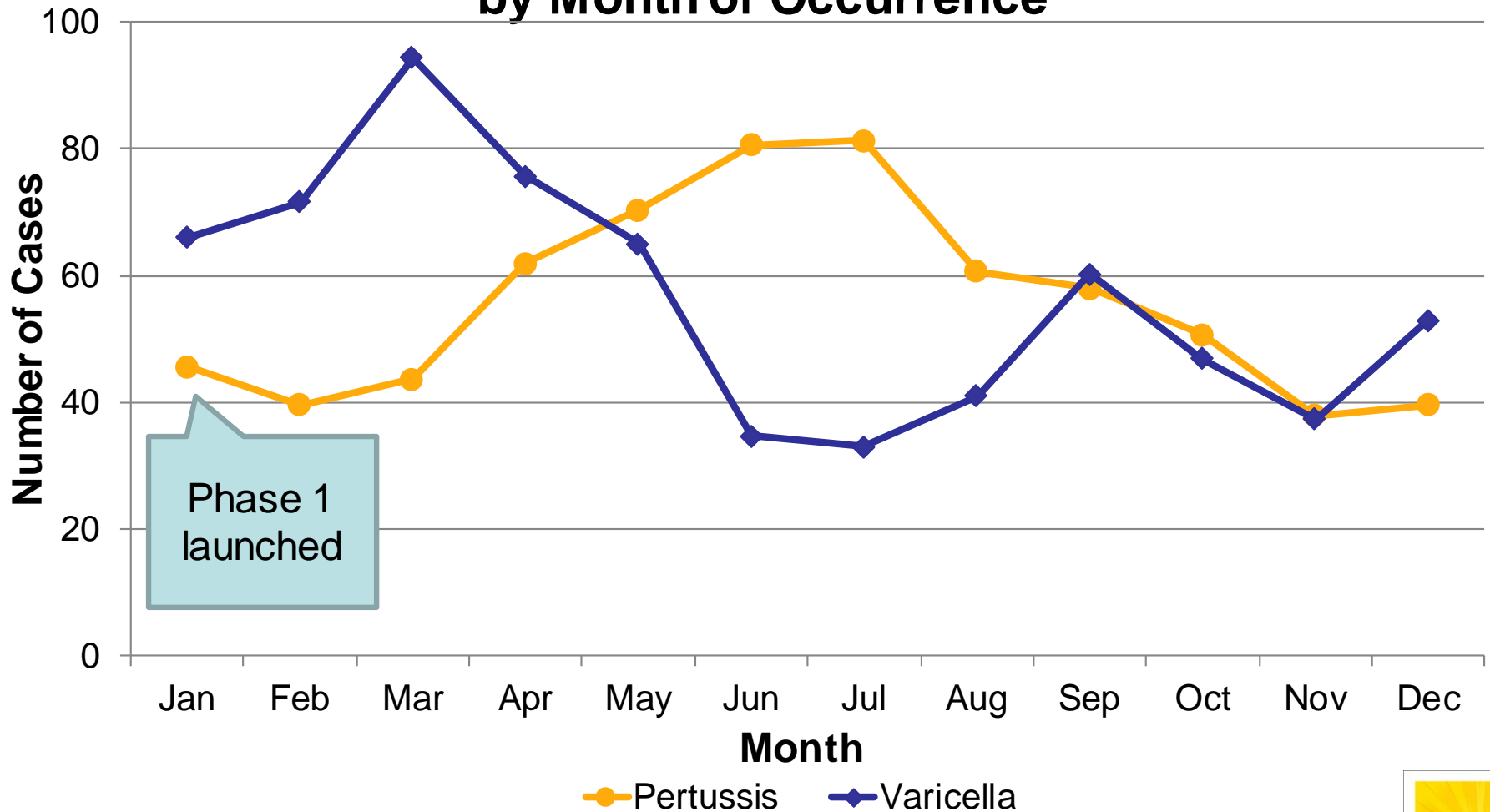
## VPD Persons Under Investigation, Week 2 to Week 10, 2015



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# Results

## Three-Year Average of Cases for Select VPDs by Month of Occurrence



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# Results

- Epidemiologists need to interpret the immunization data in the context of when a case became ill.
- For example, there were 6 measles cases last year.
  - At the time of illness onset:
    - How many cases were fully vaccinated?
    - How many cases received only one dose of vaccine?
    - How many cases were unvaccinated?

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# Results

SHOTS  
Data  
Viewing  
Window

Vaccine History							
Immunization ID: <b>9801668091</b> <b>**Current information retrieved from Florida SHOTS.**</b>							
Series Name: <b>DIPHTHERIA, TETANUS, AND PERTUSSIS</b>				Series Status: <b>Up to Date</b>			
Vaccine Type	Date Given	Injection Route	Manufacturer	Lot Number	Dose Number	Dose Validity	Reason Code
DTAP	08/04/2011				1	Y	
DTAP	09/19/2011				2	Y	
DTAP	11/18/2011				3	Y	
DTAP	09/18/2012		Other manufacturer	C4186AA	4	Y	

Merlin  
Pertussis  
Case Data

Profile / Case Information	
Name: <b>AB, RA</b>	Age at Event: <input type="text" value="0"/>
Address:	Date of Birth: <b>01/21/2011</b>
SSN:	
FL Disease Code: <b>Pertussis - 03390</b>	Case #: <b>478529</b>
Event Date: <b>06/13/2011</b>	Case Status: <b>REPORTED TO CDC</b>
	Ext. Status: <b>Accepted</b>
	DX Status: <b>Confirmed</b>

Vaccination History			
14. Has the case ever received any doses of diphtheria, tetanus and/or pertussis-containing vaccines? <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> Unknown			
If case was not vaccinated, what was the reason? <b>UNDER AGE FOR VACCINE</b>			
Vaccination Date	Vaccination Type	Manufacturer	Lot #
1. <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2. <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Challenge: For a case, need to know vaccination status at the time of illness onset

# Next Steps

## Phase 2: Updating Merlin with SHOTS information

- Provide epidemiologists with ability to update Merlin demographic and contact information with SHOTS data
- Algorithm to compare vaccine types and dates vaccines administered to onset date of VPD case
  - Will look at SHOTS vaccines, as well as vaccines manually entered and temporarily stored in Merlin
- Store calculated information at the time of the case's illness onset

# Next Steps

## Phase 3: Sending Merlin information to SHOTS

- “How can epidemiologists improve the IIS?”
  - By updating and adding records
    - Immediate Merlin user feedback:  
Consistently finding better information during investigations than is available in the registry
- Legal barriers for consideration
  - Sharing data while maintaining confidentiality of patients with a reportable disease

# Next Steps

## Phase 3: Sending Merlin information to SHOTS

- Vaccines sent to SHOTS from Merlin will initially be viewed as unverified (“unattached”).

### VACCINATION LIST

Sort by: ☒ Series ☐ Vaccine ☐ Date Given

Vaccine Series	Vaccine Type	Date Given	Dose/ Interval	Age Yr Mo/ in Days	Total Mos/ Adv Event?	Provider/Person	Source	Del?
DTAP	DTAP	06/03/2008	1 0	4-10 1770	58 N		UNITED HEALTHCARE	<input type="checkbox"/>
MEASLES	MMR	06/03/2008	1 0	4-10 1770	58 N		UNITED HEALTHCARE	<input type="checkbox"/>
MUMPS	MMR	06/03/2008	1 0	4-10 1770	58 N		UNITED HEALTHCARE	<input type="checkbox"/>
POLIO	IPV	06/03/2008	1 0	4-10 1770	58 N		UNITED HEALTHCARE	<input type="checkbox"/>
RUBELLA	MMR	06/03/2008	1 0	4-10 1770	58 N		UNITED HEALTHCARE	<input type="checkbox"/>
VZV	VZV	06/03/2008	1 0	4-10 1770	58 N		UNITED HEALTHCARE	<input type="checkbox"/>

Vaccines in SHOTS from unattached sources have blank Provider/ Person



# Next Steps

## Phase 3: Sending Merlin information to SHOTS

- Once SHOTS can evaluate and accommodate Merlin as a new type of data source, epidemiologists will be able to directly enter and update vaccines in SHOTS from within Merlin.

# Conclusions

- Building interoperability between an IIS and a reportable disease surveillance system will benefit users of both systems.
- New system functionality leads to improved user satisfaction.
- Phase 1:
  - Epidemiologists have better access to quality data.
    - Linkage was already in place for:
      - Enhanced measles response.
      - Higher morbidity months of pertussis and varicella.

# Conclusions

## Next Steps:

- Phase 2:
  - Save time by reducing duplicate data entry
  - More efficient workflow
  - Improved decision support for epidemiologists
- Phase 3:
  - Update IIS through an additional data source, providing more complete contact and demographic information as well as immunization history information
    - Update existing IIS profiles
    - Add people not previously in IIS

# Acknowledgements

- Florida SHOTS development team and the Immunization Section
- Merlin development team
- Merlin users
- Applied Public Health Informatics Fellowship (APHIF) program
- Strengthening Health Systems through Interprofessional Education (SHINE) program



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