

Flu Near You Data Implementation Project for 2016 – 2017

May 2017

The Maricopa County Department of Public Health receives funding for this project through a joint organizational partnership between the CSTE and the Skoll Global Threats Fund (SGTF), provided by Council of State and Territorial Epidemiologists (CSTE) through sub-awards from the SGTF award #15-03126.

This study was supported in part by an appointment to the Applied Epidemiology Fellowship Program administered by CSTE the and funded by the Centers for Disease Control and Prevention (CDC) Cooperative Agreement Number 1U38OT000143-04.

The contents of this poster are solely the responsibility of the authors and do not necessarily represent the official views of SGTF or CSTE.

Specific Aim #1: Increase MCDPH public health professionals' knowledge and awareness of the potential uses of participatory surveillance and Flu Near You (FNY) data for public health decision-making and action.

1. Brief report of Maricopa County Flu Near You data: 2015 – 2016

Reports descriptive statistics of recent participation, user demographics, and trends of ILI during the most recent influenza season

2. Report of results from employee pre-survey

3. Slides from Epi Presents on 10-19-2016

Presentation of 2015-2016 report to the MCDPH Office of Epidemiology

4. Report of results from employee one month post-survey: November 2016

5. Report of results from employee seven month post-survey: May 2017

6. Full report of Maricopa County Flu Near You data: 2012 - 2017

7. Slides from All Hands Meeting on 5-2-2017

Presentation of 2015-2016 report to the MCDPH Office of Epidemiology

Influenza-like Illness Surveillance Report for Maricopa County, AZ

2015 - 2016 Influenza Season | Data Source: Flu Near You

The following report summarizes data captured from volunteer reports to the Flu Near You participatory surveillance platform between CDC Weeks 40 and 39 (October 2015 to October 2016). This report is intended to update Maricopa County public health professionals and other partners on system performance and results during the 2015-16 influenza season. Results are NOT final and may be subject to change pending further analyses.

Figure 1. Count of participants and rate of ILI cases per MMWR week in Maricopa County
Flu Season: 2015-2016

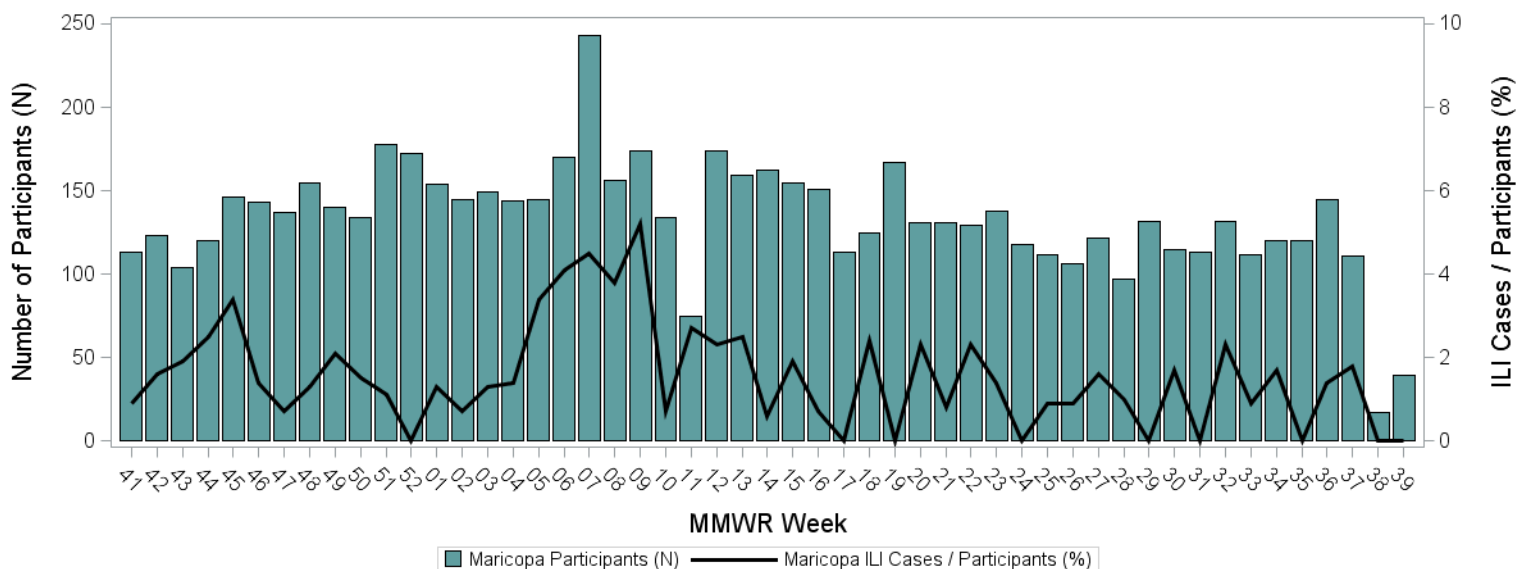


Figure 2. Number of ILI cases reported by zip code in Maricopa County
Flu Season: 2015-2016

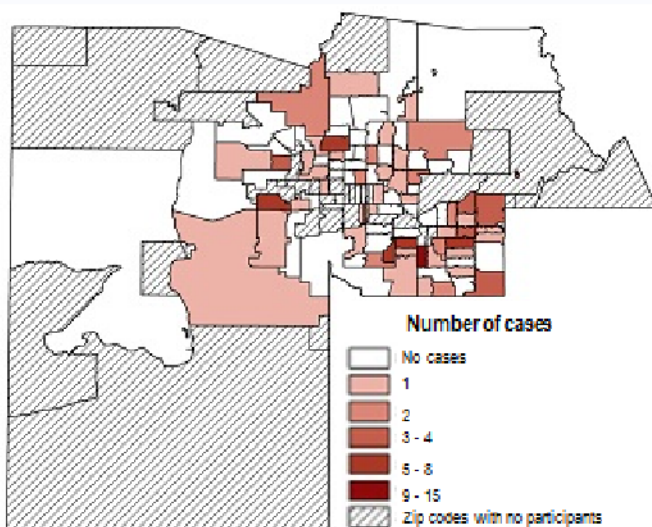
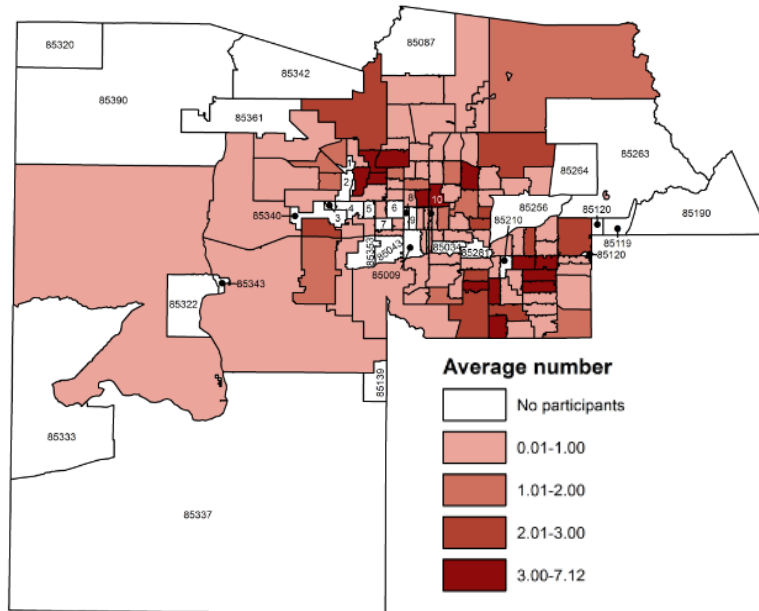


Table 1. ILI reported each week in Maricopa County
the two months preceding October 3, 2016

Weeks starting Monday	MMWR Week	ILI syndrome (N)	Total participants	% participants with ILI
08/01/2016	31	0	113	0.0
08/08/2016	32	3	132	2.3
08/15/2016	33	1	112	0.9
08/22/2016	34	2	120	1.7
08/29/2016	35	0	120	0.0
09/05/2016	36	2	145	1.4
09/12/2016	37	2	111	1.8
09/19/2016	38	0	17	0.0
09/26/2016	39	0	39	0.0
10/03/2016	40	0	77	0.0

Influenza-like Illness Surveillance Report

**Figure 3. Number of registered participants by zip code in Maricopa County
Flu Season: 2015-2016**



**Table 2. Representativeness of FNY users in Maricopa County
Flu Season: 2015-2016**

Variable		Flu Near You	Census*
Gender	Female	402 (72.3%)	2,108,009 (50.6%)
	Male	154 (27.7%)	2,059,938 (49.4%)
Age Group	16-24 years	14 (2.6%)	286,266 (18.4%)
	25-34 years	64 (11.8%)	288,756 (18.6%)
	35-44 years	98 (18.0%)	268,926 (17.3%)
	45-54 years	98 (18.0%)	258,624 (16.6%)
	55-64 years	152 (27.9%)	209,784 (13.5%)
	65+ years	118 (21.7%)	241,483 (15.5%)

*Census data comes from the “2015 American Community Survey 1-Year Estimates”

Influenza-like Illness Surveillance Report

How are the data collected?

Community members 13 years or older can register themselves and household members to participate in Flu Near You, where they are asked to record their gender, birth month and year, and the zip code they reside in. Once registered, every Monday morning, participants receive an email asking 'how are you feeling?' Participants may then either respond that they were feeling healthy, or had no symptoms, or can select from a list of symptoms that they experienced in the last week.

REPORT SYMPTOMS

Health Report

10/03/2016 - 10/09/2016

Did You experience any of these symptoms since last Monday

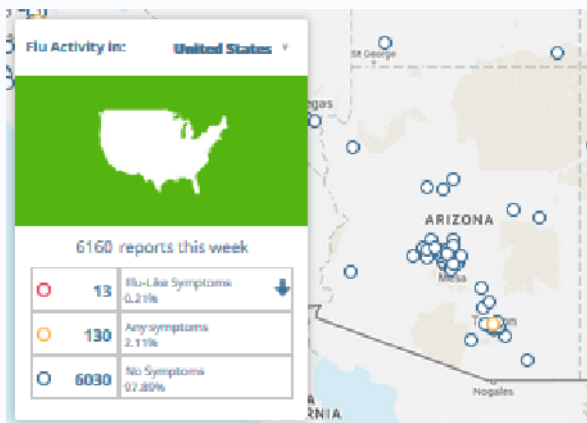
☐ You did not have any of the symptoms listed below

or

☐ Fever	☐ Cough
☐ Headache	☐ Sore throat
☐ Diarrhea	☐ Body aches
☐ Fatigue	☐ Chills/night sweats
☐ Nausea or vomiting	☐ Shortness of breath
☐ Rash	☐ Eye pain
☐ Yellow skin/eyes	☐ Joint/bone pain
☐ Red Eyes	☐ Dark, tea-colored urine

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MAP SYMPTOMS



Why participate?

Registered users have access to many features, such as:

- The ability to report their symptoms
- A map that displays where users can find vaccines in their area
- A map of flu activity in their area and across the nation
- Updated news on the current flu season, flu shots, treatment, recovery time, and more

Everyone is invited to participate in Flu Near You by enrolling at <https://flunearyou.org/>

flu near you 
do you have it in you?



American
Public Health
Association



HealthMap
Global Health, Local Knowledge



skoll global
threats fund

Department ‘Flu Near You’ Survey Results

As part of a CSTE grant awarded to Maricopa County Department of Public Health, a survey was distributed to assess the sixth floor’s understanding and use of participatory surveillance and Flu Near You. A total of sixty surveys were distributed, with 56 being returned.

Figure 1. Distribution of confidence in defining participatory surveillance

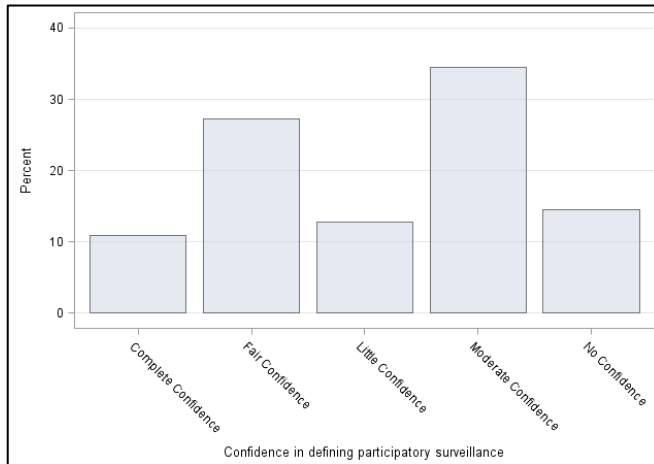


Figure 2. Distribution of awareness of the participatory surveillance application, “Flu Near You”

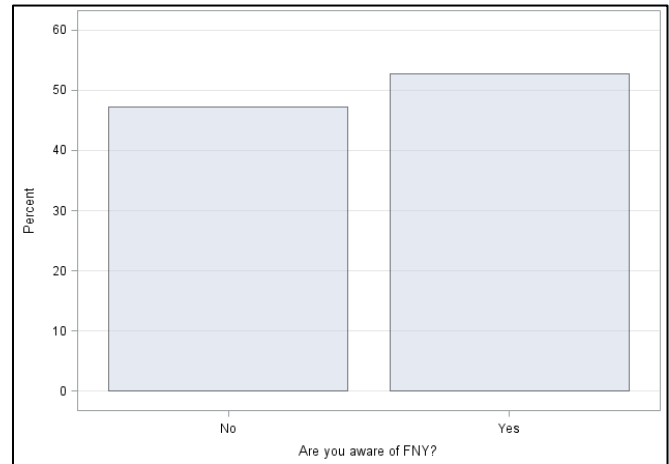


Figure 3. Distribution of registered “Flu Near You” users

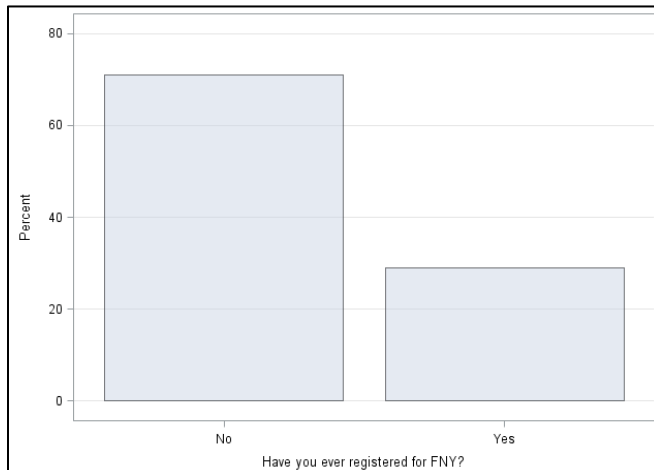
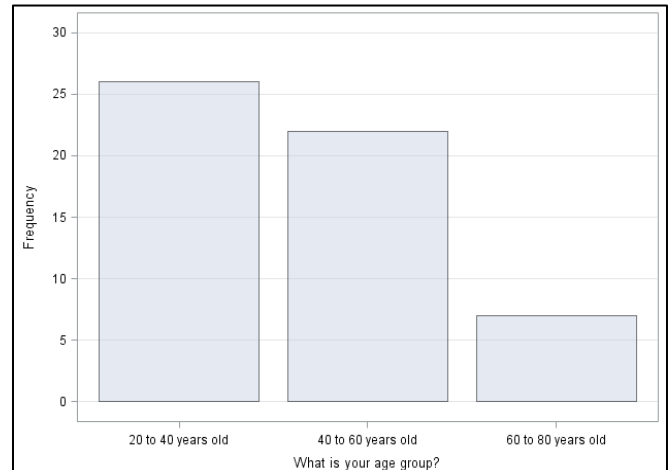


Figure 4. Distribution of age among the sixth floor employees



Overall, we found that the department has moderate confidence in defining participatory surveillance, and that although a majority of the department has heard of Flu Near You, less than 30 percent are registered users.

As a part of the CSTE grant, Maricopa County Department of Public Health is recruiting community members to become active users. In the survey, we found that the majority of employees learned about Flu Near You through a presentation by public health (39.39%), and that the least common place was on social media (3.03%). This is informative for learning where we are successful in reaching people, and where we need to improve our message.

In addition to recruiting users, we are aiming to recruit a representative group of users, with a majority of current Flu Near You users being 60 to 80 year old, and very few users being 20 to 40 years old. Based on the demographics of the sixth floor, employees registering would greatly help with the age group representation of Flu Near You users.

Flu Near You

Kaitlyn Sykes, MPH

Maricopa County
Department of Public Health

WwvPublicHealth.org twitter.com/MaricopaHealth facebook.com/MCDPH



Objectives

1. Background of participatory surveillance
2. Flu Near You
 1. Background
 2. Data collection
 3. Maricopa County participants
 4. Data uses
3. CSTE grant awarded to Maricopa County
4. Benefits of registration for Flu Near You
5. How to register for Flu Near You

Participatory Surveillance

- Collects voluntarily submitted symptom data from the general public in real-time
- Complement to existing systems
- Internet-based participatory surveillance emerging

Flu Near You

- Participatory surveillance system
- Registered users report symptoms using a quick, weekly survey
- Reach community members who do not seek healthcare

Influenza-like illness (ILI) Syndrome

Fever AND at least one of the following: cough or sore throat



Data Collection

flu near you

Did you feel this flu-like illness? (Select one)

☐ No ☐ Yes

Everyone was healthy! (Select one)

☐ No ☐ Yes

Did you experience any of these symptoms since last Monday?

☐ You did not have any of these symptoms since last Monday

Health Report

☐ Fever ☐ Cough

☐ Headache ☐ Sore throat

☐ Stomach issues ☐ Body aches

☐ Fatigue ☐ Chills/rigors

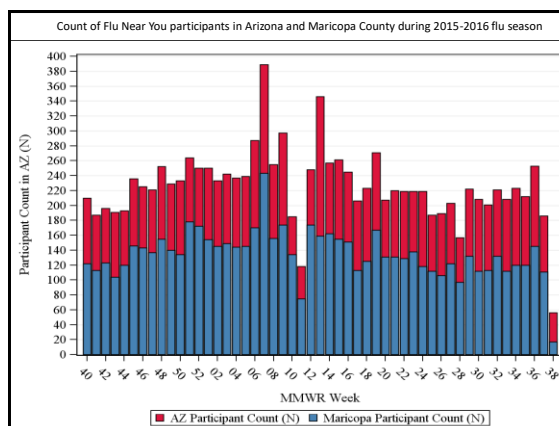
☐ Nausea or vomiting ☐ Shortness of breath

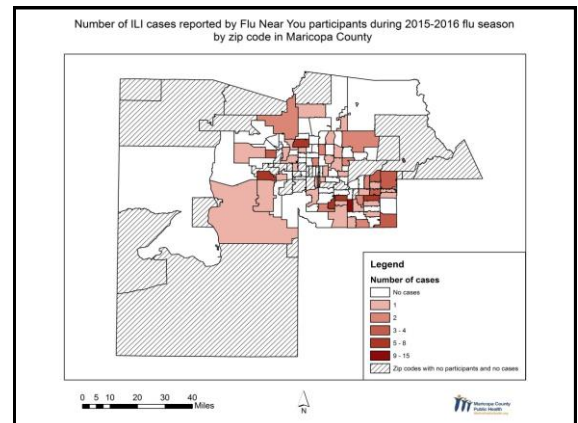
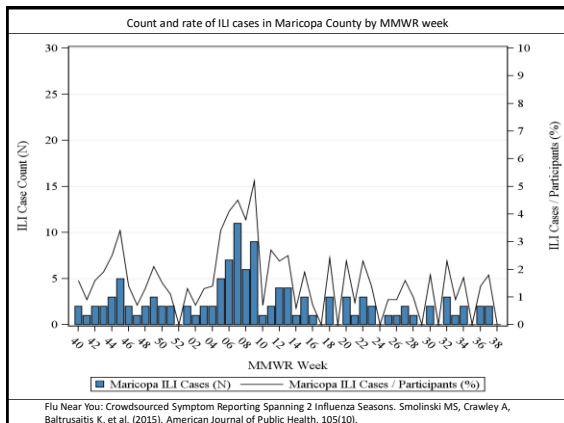
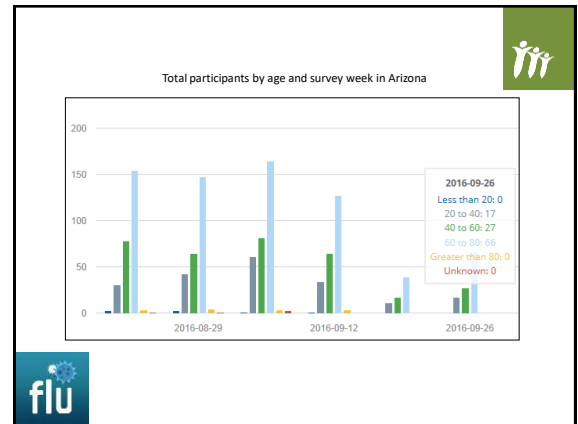
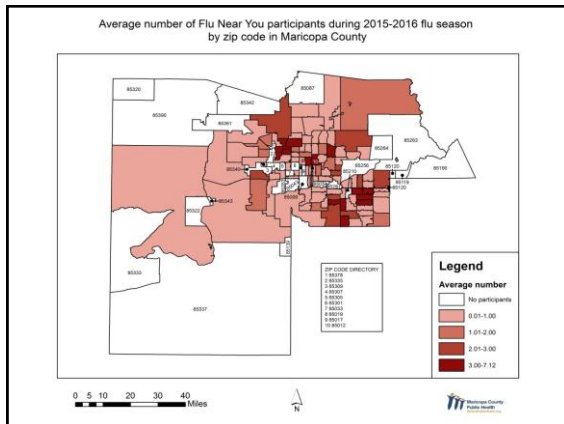
☐ Rash ☐ Fatigue

☐ Yellow discharge ☐ Swollen lymph nodes

☐ Red eyes ☐ Dark, discolored urine

<https://flunearyou.org/#/report>





CSTE Grant

- Increase participation in Flu Near You throughout Maricopa County
- Evaluation of Flu Near You data
- Possible complement to existing traditional surveillance systems

Aim 1

- “Increase MCDPH public health professionals’ knowledge and awareness of the potential uses of participatory surveillance and Flu Near You data for public health decision-making and action”

Aim 2



- “Compare Flu Near You ILI data to existing MCDPH influenza surveillance sources and determine how to utilize data in weekly and annual reports”
- Datasets to compare to Flu Near You
 - CDC ILINet
 - Hospital discharge data
 - Confirmed positive laboratory reports

Aim 3



- “Increase reporting to Flu Near You by Maricopa County residents”
- Three campaigns
 - Social media
 - Youth recruitment
 - Community engagement

Aim 4



- “Develop new analyses for non-ILI Flu Near You data”
- Possible syndromes:
 - Acute respiratory illness (ARI)
 - Respiratory syncytial virus (RSV)

Why participate in FNY?



- Contribute your data to surveillance
- Access to different benefits
 - Map of ILI symptoms in the US and your region
 - Map of places to receive vaccines
 - Updated news on ILI, vaccines, and more



How to register



<https://flunearyou.org>

Maricopa County Employee Challenge



- Challenge you to become sustaining contributors to the application
- Request at least 10 employees commit to:
 - Participate > 85% of the weeks during the 2016-2017 season
 - Respond to both the 1 month and 8 month follow-up surveys

This report was supported in part by an appointment to the Applied Epidemiology Fellowship Program administered by the Council of State and Territorial Epidemiologists (CSTE) and funded by the Centers for Disease Control and Prevention (CDC) Cooperative Agreement Number 1U38OT000143-04



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19 Enroll at: flunearyou.org Oct. 2016

'Flu Near You' User One-Month Post-Survey

As part of a CSTE grant awarded to Maricopa County Department of Public Health, a survey was distributed to Flu Near You users in the department one month after volunteering to sign up for, regularly use, and assist in evaluating FNY. A total of twenty-two surveys were distributed, with fifteen (68.18%) being returned.

Figure 1. Distribution of how many weeks users reported to Flu Near You over the past month

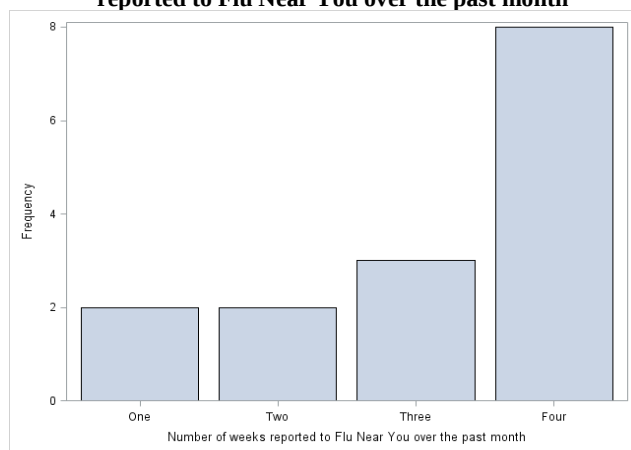


Figure 2. Distribution of how easy it is to complete the weekly health reports

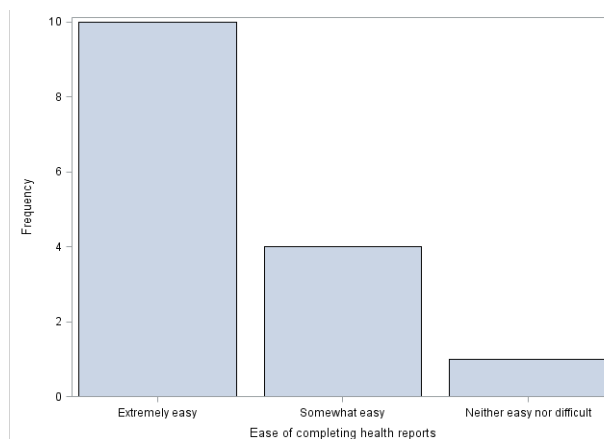


Figure 3. Distribution of how often users have trouble accessing their weekly health report

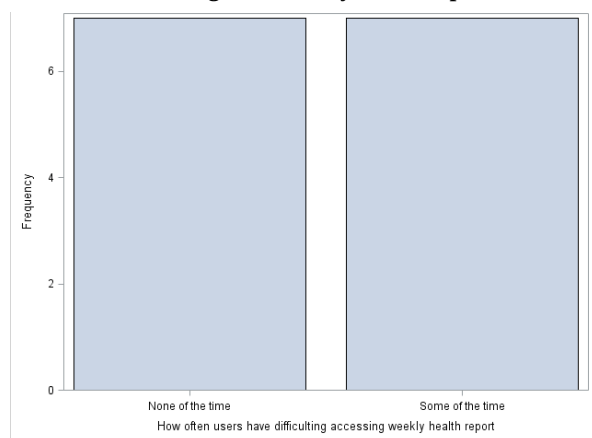
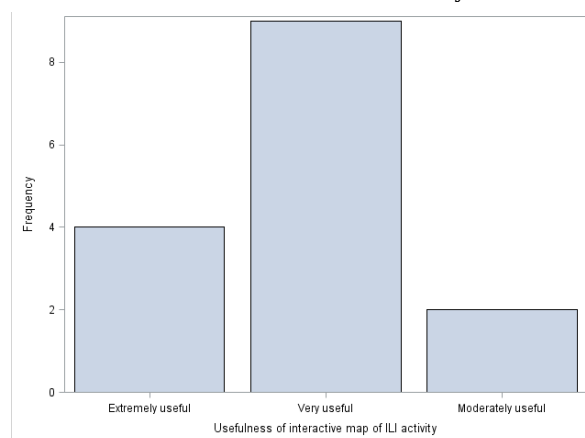


Figure 4. Distribution of usefulness of interactive map of influenza-like illness activity

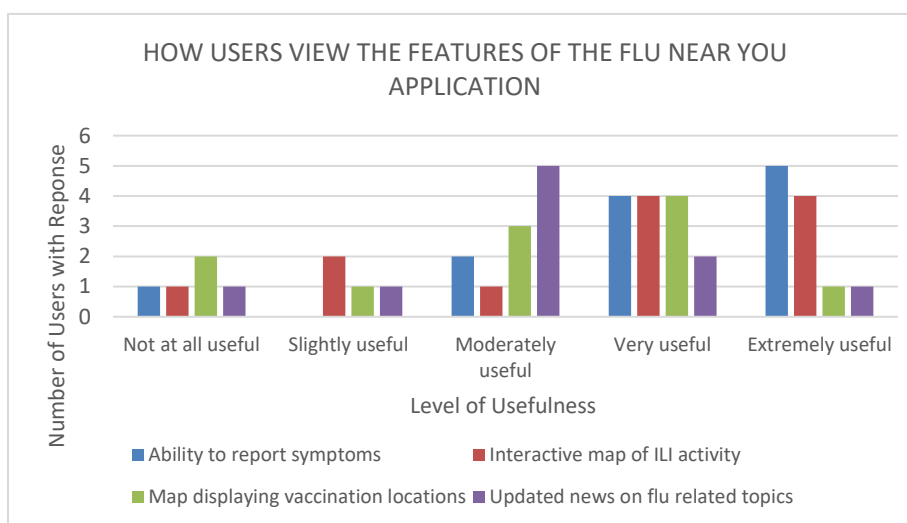
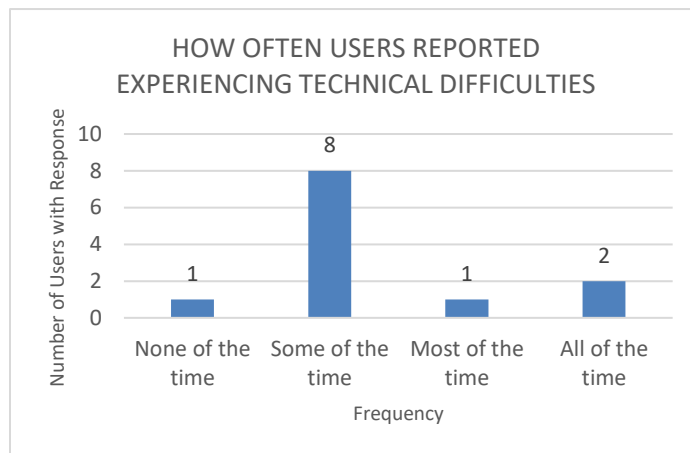
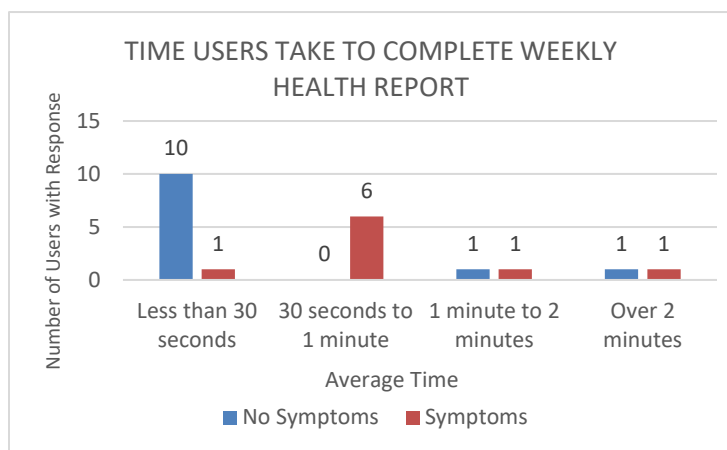


Overall, we found that most FNY users reported all four weeks of the most recent month (53.33%). Sixty-six percent of users reported that the weekly surveys were "extremely easy" to complete. When users had no symptoms to report, almost all users (86.67%) completed their report in less than 60 seconds. When users had symptoms to report, thirty-seven percent completed their report in less than 60 seconds, with all others completing their report in 2 minutes or less. Half of all respondents reported having trouble accessing their weekly health report. The most common reason for not reporting was not receiving an email reminder or push notification (33.33%)

Users reported that both the interactive map and the map displaying vaccination locations were the most useful tools for Flu Near You users, with eighty-six percent reporting it was either extremely useful or very useful. The tool that was least useful for users was the ability to report symptoms, with twenty-six percent of respondents reporting that it was moderately useful.

'Flu Near You' User Seven-Month Post-Survey

As part of a CSTE grant awarded to Maricopa County Department of Public Health, a survey was distributed to Flu Near You users in the department seven months after volunteering to sign up for, regularly use, and assist in evaluating FNY. A total of twenty-one surveys were distributed, with twelve (67.14%) being returned.



Overall, we found that most MCDPH FNY users reported all four weeks of the most recent month (66.67%). Seventy-five percent of users reported that the weekly surveys were “extremely easy” to complete. When users had no symptoms to report, almost all users (83.33%) completed their report in an average of less than 30 seconds. When users had symptoms to report, fifty-eight percent completed their report in an average less than 60 seconds. A majority of respondents (91.67%) reported experiencing technical difficulties at least some of the time. The most common technical difficulties reported were not receiving a reminder email or push notification and either not being able to access or submit the weekly health report.

Users reported that both the ability to report symptoms and the interactive map of ILI activity were the most useful tools for Flu Near You users. The tool that was least useful for users was the access to updated news on flu related topics, with only twenty-five percent of users reporting it as either extremely useful or very useful.

Influenza-like Illness Surveillance Report for Maricopa County, AZ

2011 - 2012 Influenza Season | Data Source: Flu Near You

The following report summarizes data captured from volunteer reports to the Flu Near You participatory surveillance platform between CDC Weeks 40 and 39 (October 2011 to October 2012). This report is intended to update Maricopa County public health professionals and other partners on system performance and results during the 2011-12 influenza season. Results are NOT final and may be subject to change pending further analyses.

Figure 1. Count of participants and rate of ILI cases per MMWR week in Maricopa County
Flu Season: 2011-2012

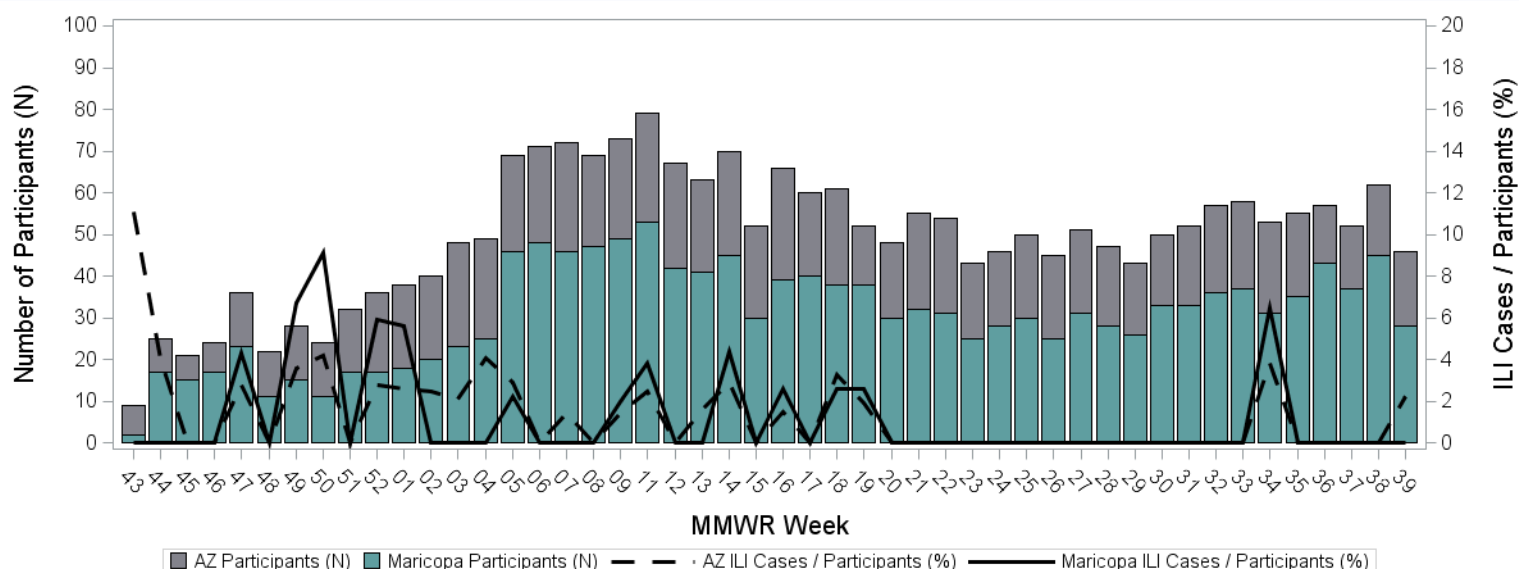


Table 1. ILI reported each week in Maricopa County
during peak for 2011-2012 season

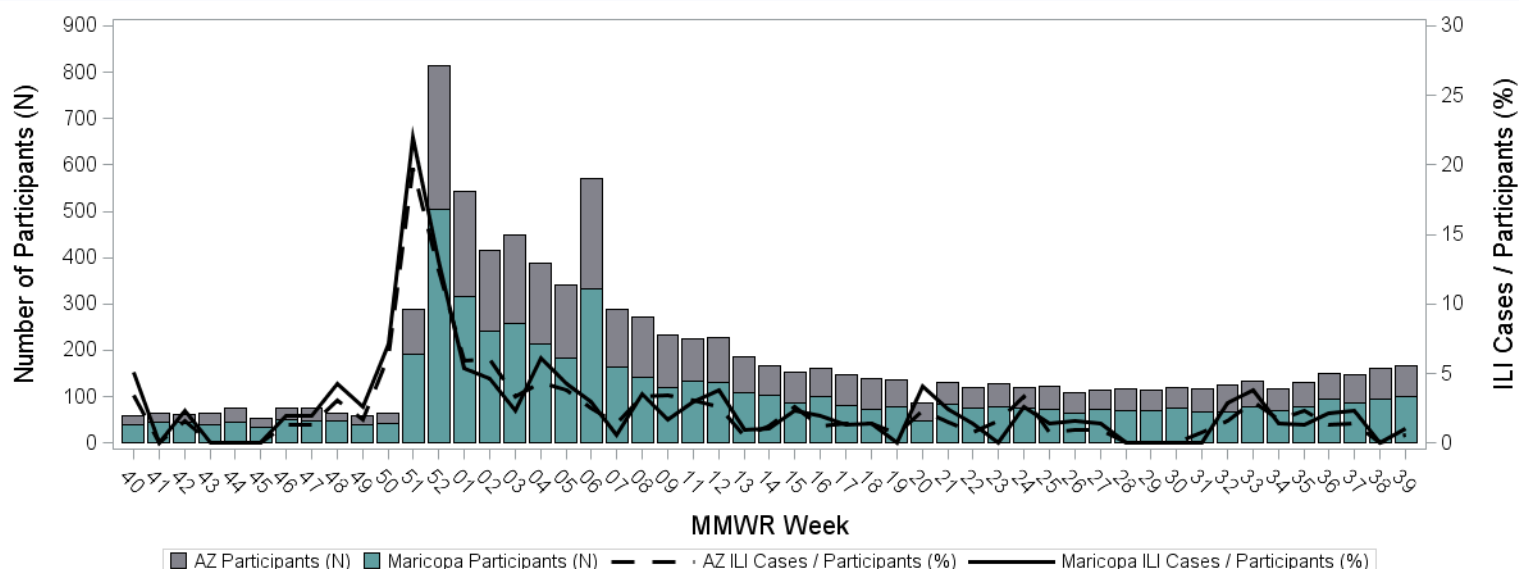
Weeks starting Monday	MMWR Week	No symptoms (N)	Any symptoms - not ILI	ILI syndrome (N)	Total participants	% participants with ILI
10/31/2011	43	1	1	0	2	0.0
11/07/2011	44	14	3	0	17	0.0
11/14/2011	45	13	2	0	15	0.0
11/21/2011	46	15	2	0	17	0.0
11/28/2011	47	19	3	1	23	4.3
12/05/2011	48	8	3	0	11	0.0
12/12/2011	49	11	3	1	15	6.7
12/19/2011	50	8	2	1	11	9.1

Influenza-like Illness Surveillance Report for Maricopa County, AZ

2012- 2013 Influenza Season | Data Source: Flu Near You

The following report summarizes data captured from volunteer reports to the Flu Near You participatory surveillance platform between CDC Weeks 40 and 39 (October 2012 to October 2013). This report is intended to update Maricopa County public health professionals and other partners on system performance and results during the 2012-13 influenza season. Results are NOT final and may be subject to change pending further analyses.

**Figure 1. Count of participants and rate of ILI cases per MMWR week in Maricopa County
Flu Season: 2012-2013**



**Table 1. ILI reported each week in Maricopa County
during peak for 2012-2013 season**

Weeks starting Monday	MMWR Week	No symptoms (N)	Any symptoms - not ILI	ILI syndrome (N)	Total participants	% participants with ILI
12/10/2012	49	30	8	1	39	2.6
12/17/2012	50	26	13	3	42	7.1
12/24/2012	51	98	51	42	191	22.0
12/31/2012	52	311	128	66	505	13.1
01/07/2013	01	215	85	17	317	5.4
01/14/2013	02	176	54	11	241	4.6
01/21/2013	03	189	62	6	257	2.3
01/28/2013	04	153	47	13	213	6.1

Influenza-like Illness Surveillance Report for Maricopa County, AZ

2013 - 2014 Influenza Season | Data Source: Flu Near You

The following report summarizes data captured from volunteer reports to the Flu Near You participatory surveillance platform between CDC Weeks 40 and 39 (October 2013 to October 2014). This report is intended to update Maricopa County public health professionals and other partners on system performance and results during the 2013-14 influenza season. Results are NOT final and may be subject to change pending further analyses.

Figure 1. Count of participants and rate of ILI cases per MMWR week in Maricopa County
Flu Season: 2012-2013

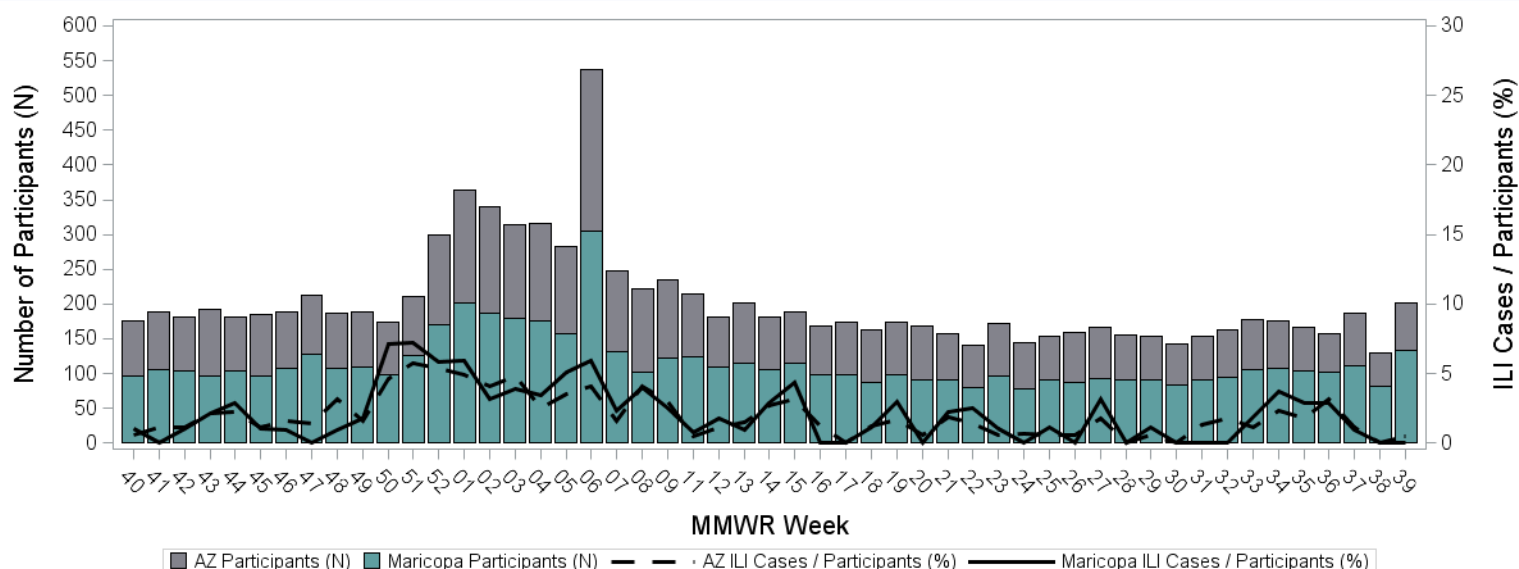


Table 1. ILI reported each week in Maricopa County
during peak for 2013-2014 season

Weeks starting Monday	MMWR Week	No symptoms (N)	Any symptoms - not ILI	ILI syndrome (N)	Total participants	% participants with ILI
12/09/2013	49	82	26	2	110	1.8
12/16/2013	50	74	18	7	99	7.1
12/23/2013	51	94	22	9	125	7.2
12/30/2013	52	133	28	10	171	5.8
01/06/2014	01	154	36	12	202	5.9
01/13/2014	02	152	28	6	186	3.2
01/20/2014	03	141	32	7	180	3.9
01/27/2014	04	150	20	6	176	3.4

Influenza-like Illness Surveillance Report for Maricopa County, AZ

2014 - 2015 Influenza Season | Data Source: Flu Near You

The following report summarizes data captured from volunteer reports to the Flu Near You participatory surveillance platform between CDC Weeks 40 and 39 (October 2014 to October 2015). This report is intended to update Maricopa County public health professionals and other partners on system performance and results during the 2013-14 influenza season. Results are NOT final and may be subject to change pending further analyses.

Figure 1. Count of participants and rate of ILI cases per MMWR week in Maricopa County
Flu Season: 2014-2015

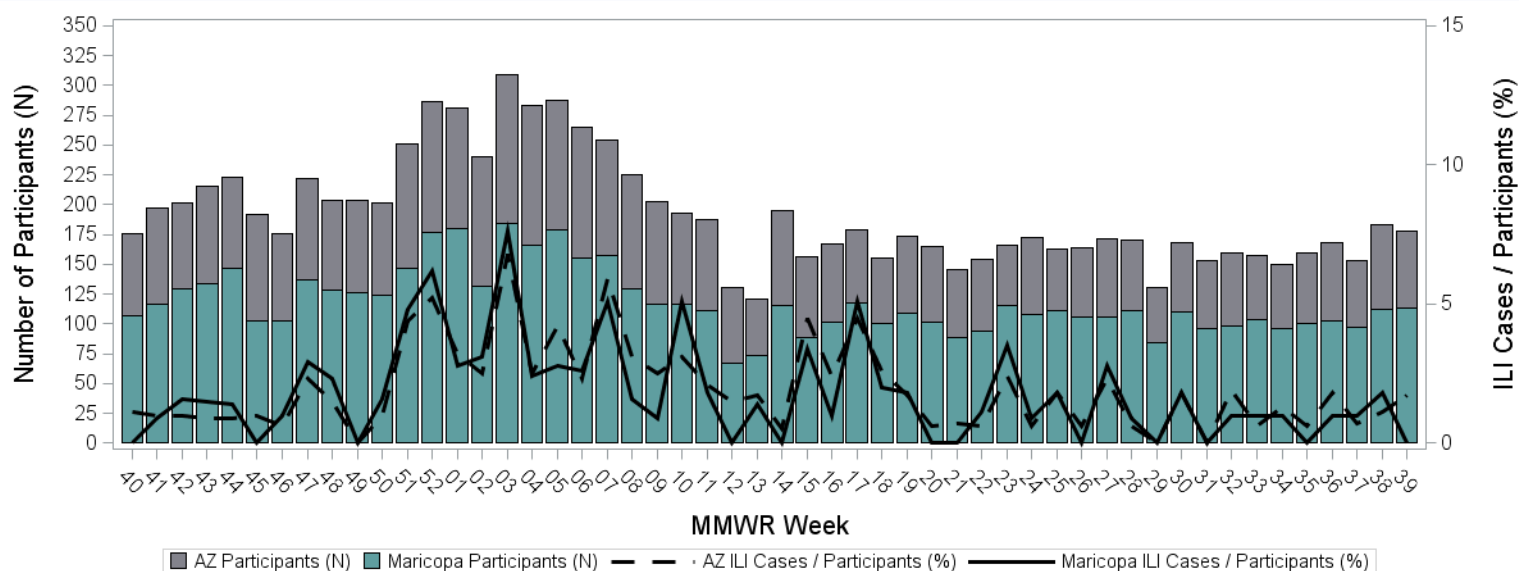


Table 1. ILI reported each week in Maricopa County
during peak for 2014-2015 season

Weeks starting Monday	MMWR Week	No symptoms (N)	Any symptoms - not ILI	ILI syndrome (N)	Total participants	% participants with ILI
12/29/2014	52	150	16	11	177	6.2
01/05/2015	01	149	26	5	180	2.8
01/12/2015	02	112	15	4	131	3.1
01/19/2015	03	154	16	14	184	7.6
01/26/2015	04	144	18	4	166	2.4
02/02/2015	05	154	20	5	179	2.8
02/09/2015	06	137	14	4	155	2.6
02/16/2015	07	133	16	8	157	5.1

Influenza-like Illness Surveillance Report for Maricopa County, AZ

2015 - 2016 Influenza Season | Data Source: Flu Near You

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Figure 1. Count of participants and rate of ILI cases per MMWR week in Maricopa County
Flu Season: 2015-2016

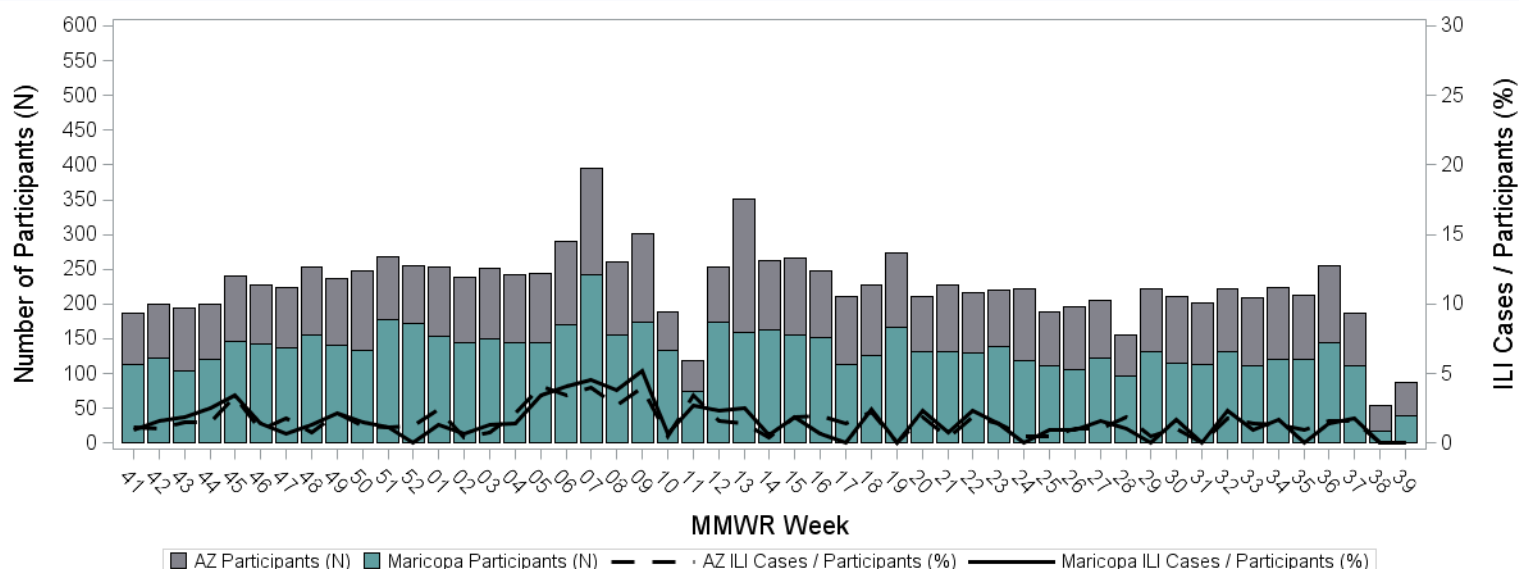


Table 1. ILI reported each week in Maricopa County
during peak for 2015-2016 season

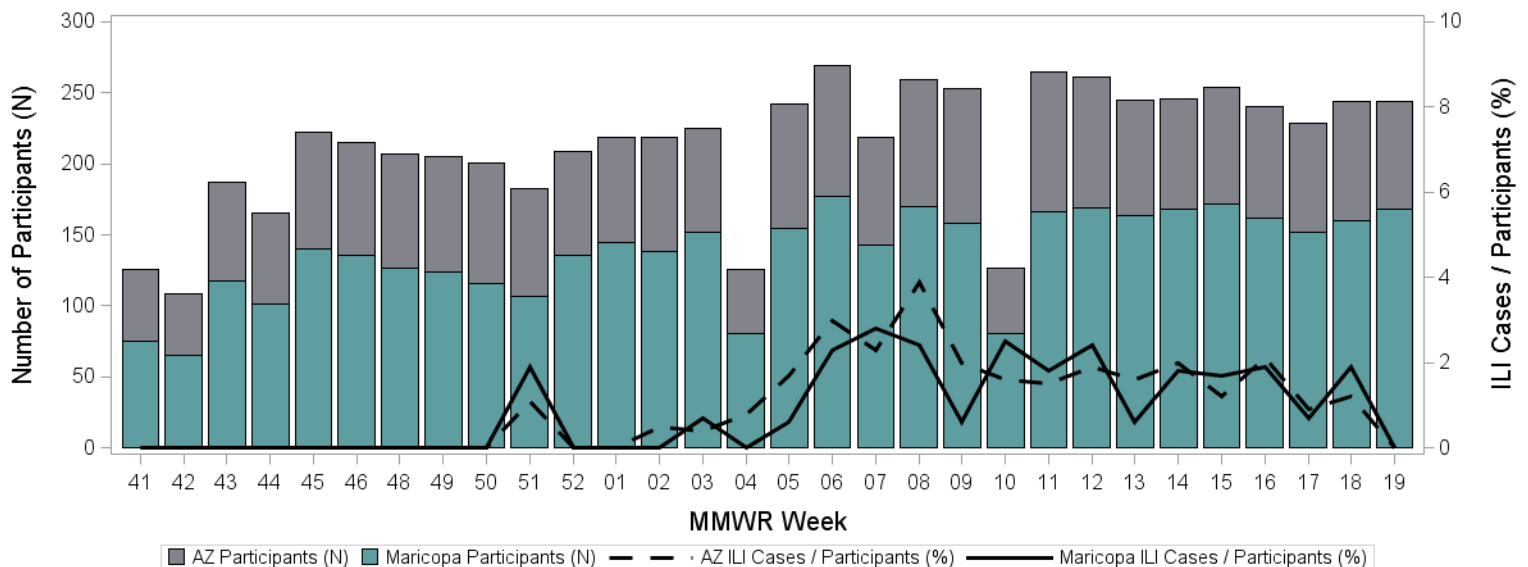
Weeks starting Monday	MMWR Week	No symptoms (N)	Any symptoms - not ILI	ILI syndrome (N)	Total participants	% participants with ILI
01/18/2016	03	139	8	2	149	1.3
01/25/2016	04	127	15	2	144	1.4
02/01/2016	05	128	12	5	145	3.4
02/08/2016	06	156	7	7	170	4.1
02/15/2016	07	211	21	11	243	4.5
02/22/2016	08	134	16	6	156	3.8
02/29/2016	09	147	18	9	174	5.2
03/07/2016	10	131	2	1	134	0.7

Influenza-like Illness Surveillance Report for Maricopa County, AZ

2016 - 2017 Influenza Season | Data Source: Flu Near You

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**Figure 1. Count of participants and rate of ILI cases per MMWR week in Maricopa County
Flu Season: 2016-2017**



**Table 1. ILI reported each week in Maricopa County
the two months preceeding 05-23-2017**

Weeks starting Monday	MMWR Week	No symptoms (N)	Any symptoms - not ILI	ILI syndrome (N)	Total participants	% participants with ILI
03/27/2017	13	152	11	1	164	0.6
04/03/2017	14	154	11	3	168	1.8
04/10/2017	15	155	14	3	172	1.7
04/17/2017	16	149	10	3	162	1.9
04/24/2017	17	144	7	1	152	0.7
05/01/2017	18	145	12	3	160	1.9
05/08/2017	19	157	11	0	168	0.0

Flu Near You

Kaitlyn Sykes, MPH

Maricopa County Department of Public Health

wearepublichealth.org | twitter.com/MaricopaHealth | facebook.com/MCDPH



Objectives

1. Background of public health surveillance
2. Flu Near You
 1. Background
 2. Data collection
 3. Registered users
 4. Data uses
3. How to register for Flu Near You

Public Health Surveillance

- “Continuous, systematic collection, analysis and interpretation of health-related data essential to the planning, implementation, and evaluation of public health practice” (WHO)
- Early warning system
- Detection and notification of health events
- Estimate magnitude and measure trends

Participatory Surveillance

- Collects voluntarily submitted symptom data from the general public in real-time
- Complement to existing systems
- Internet-based participatory surveillance emerging

Flu Near You

- Participatory surveillance system
- Registered users report symptoms using a quick, weekly survey
- Reach community members who do not seek healthcare

Influenza-like illness (ILI) Syndrome

Fever AND at least one of the following: cough or sore throat



Data Collection

flu near you

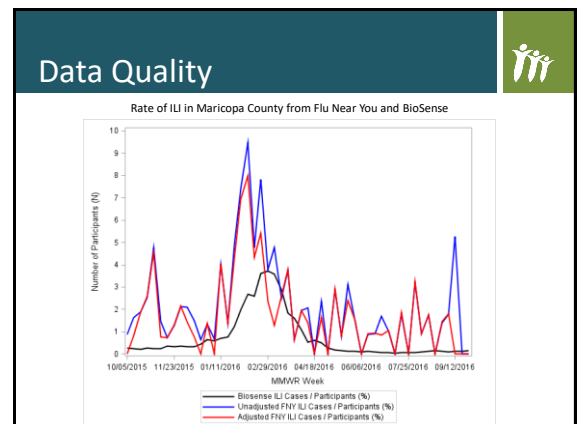
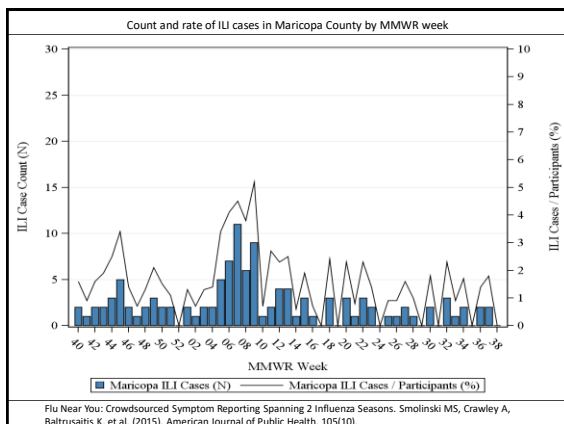
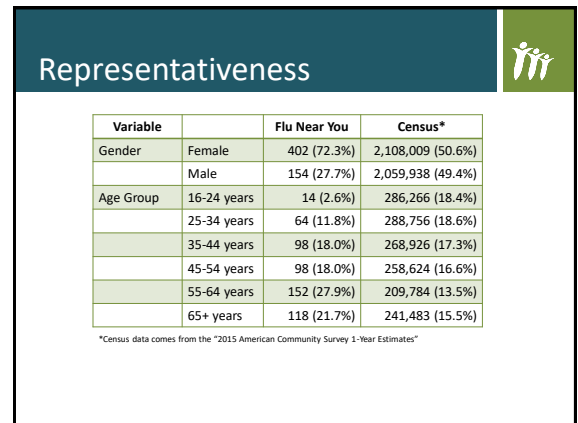
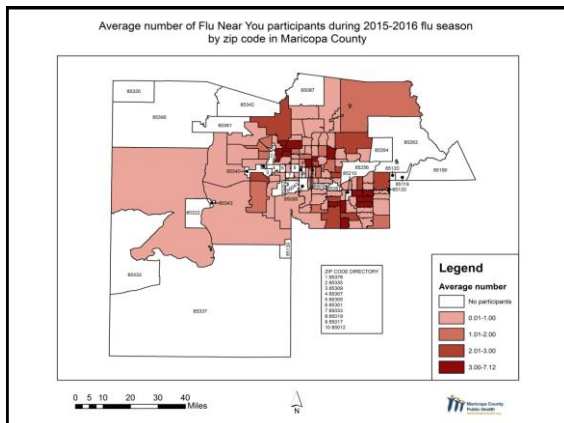
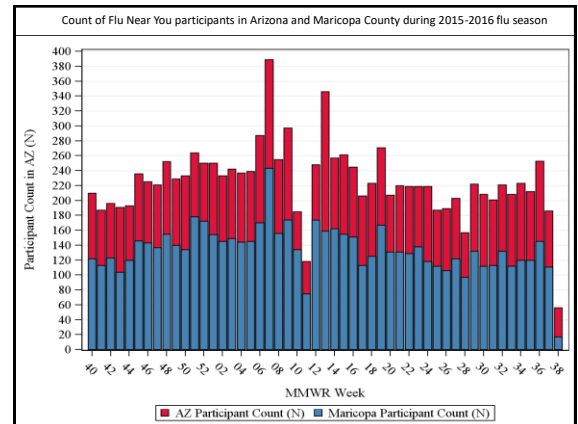
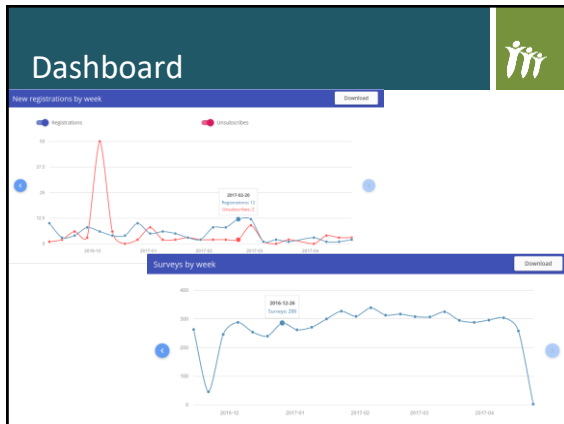


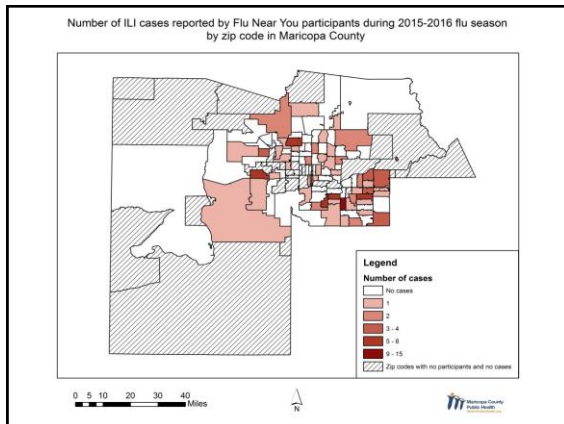
Health Report

Symptoms - 10/1/2016

☐ Did you experience any of these symptoms since last Monday?

☐ Fever	☐ Cough
☐ Headache	☐ Sore throat
☐ Stomach	☐ Body aches
☐ Fatigue	☐ Chills/rigors/fever
☐ Nausea or vomiting	☐ Shortness of breath
☐ Rash	☐ Eye pain
☐ Yellow discharge	☐ Joint/muscle pain
☐ Head lightheaded	☐ Dark, tea-colored urine





Why participate in FNY?

- Contribute your data to surveillance
- Access to different benefits
 - Map of ILI symptoms in the US and your region
 - Map of places to receive vaccines
 - Updated news on ILI, vaccines, and more



How to register

<https://flunearyou.org>

This report was supported in part by an appointment to the Applied Epidemiology Fellowship Program administered by the Council of State and Territorial Epidemiologists (CSTE) and funded by the Centers for Disease Control and Prevention (CDC) Cooperative Agreement Number 1U38OT000143-04

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Public Health Scientist | JessicaWhite@mail.maricopa.gov

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Enroll at: flunearyou.org

Oct. 2016

Specific Aim #2: Compare FNY ILI data to existing MCDPH influenza surveillance sources and determine how to utilize data in weekly and annual reports.

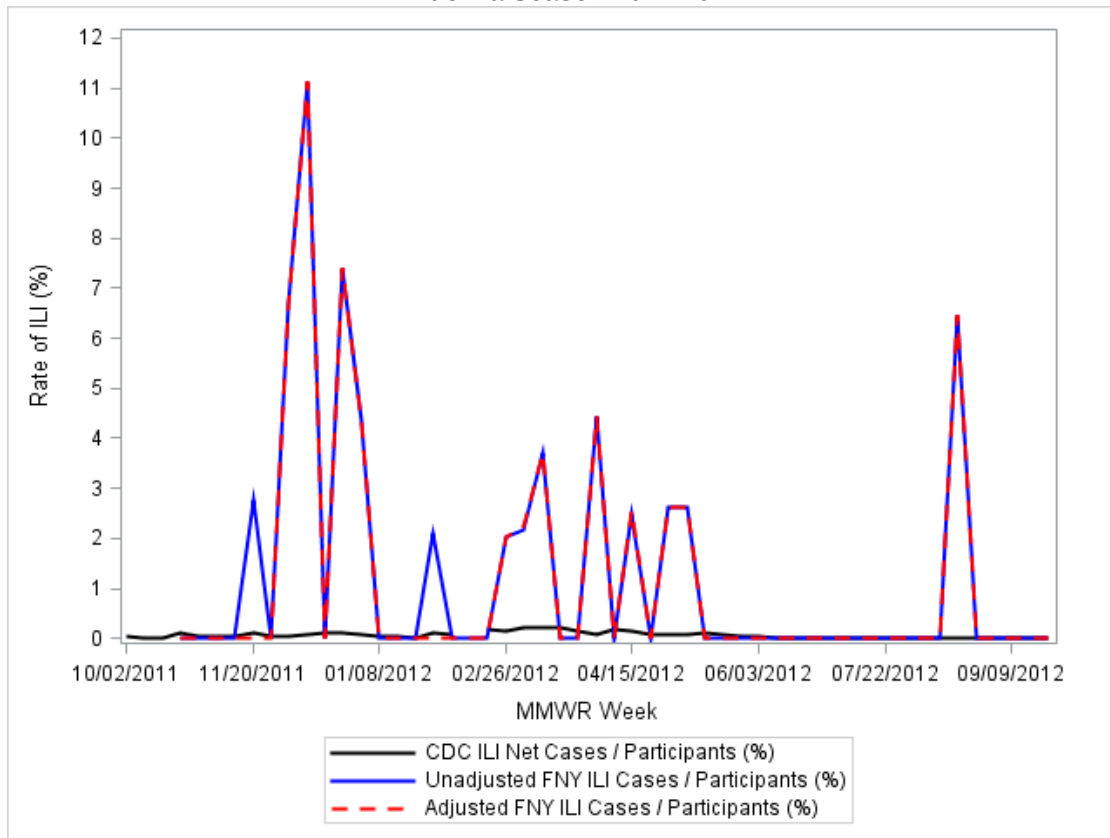
1. Report that shows time series of ILI rates and correlations between FNY data and existing influenza surveillance data from 2012 - 2017
2. Abstract submitted to CSTE
3. Poster presented at CSTE
4. Evaluation document that includes recommendations for integrating FNY into routine influenza surveillance at MCDPH

Correlation between Flu Near You and CDC ILI-Net for influenza-like illness rates for Maricopa County, AZ

2011-2012 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and CDC ILI-Net from October 2011 to October 2012 (MMWR weeks 2011-43 to 2011-39). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. This report aims to assess the correlation of influenza-like illness rates between the two datasets.

**Figure 1. Flu Near You and CDC ILI-Net Rates in Maricopa County, AZ
Influenza Season 2011-2012**



**Table 1. System comparison for Flu Near You and CDC ILI-Net for Maricopa County, AZ
Influenza Season 2011-2012**

System Comparison	Pearson Correlation	RMSE	Peak ILI Week
CDC ILI-Net	1.00000	0.00000% ILI	3/04/2012 (week 10)
CDC ILI-Net vs. Unadjusted FNY	0.18158	2.40855% ILI	12/11/2011 (week 50)
CDC ILI-Net vs. Adjusted FNY	0.15501	2.41896% ILI	12/11/2011 (week 50)

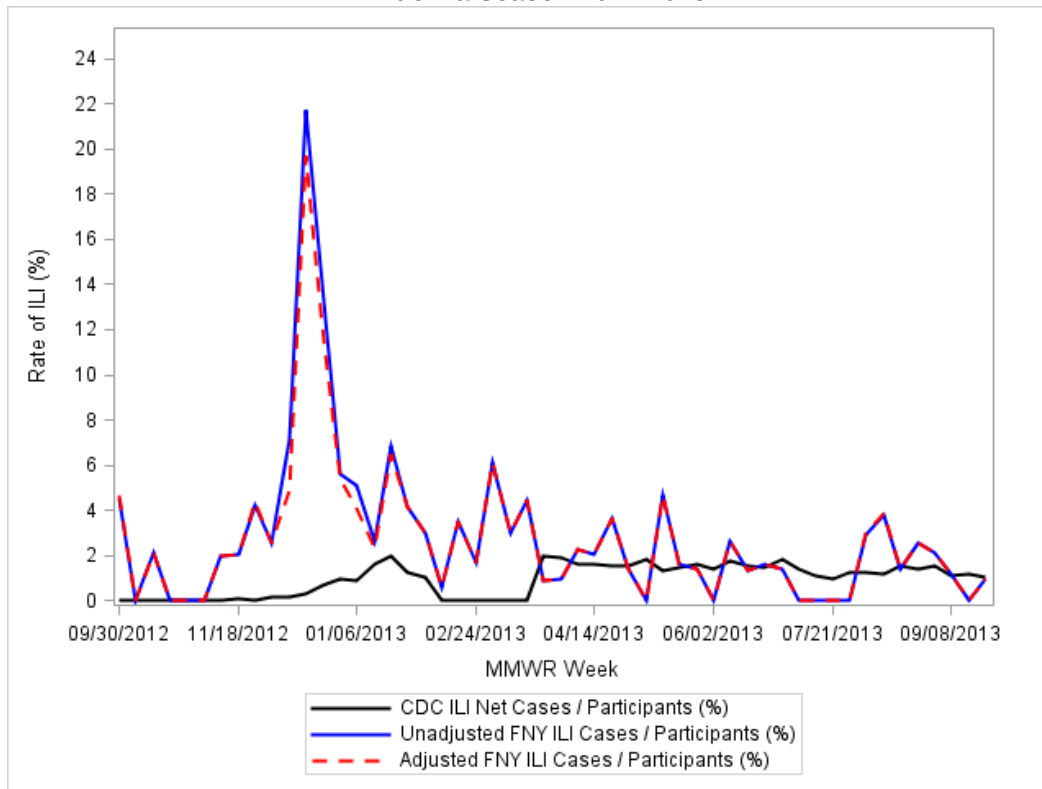
*Indicates p-value <0.01

Correlation between Flu Near You and CDC ILI-Net for influenza-like illness rates for Maricopa County, AZ

2012-2013 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and CDC ILI-Net from October 2012 to October 2013 (MMWR weeks 2012-40 to 2013-39). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. This report aims to assess the correlation of influenza-like illness rates between the two datasets.

**Figure 1. Flu Near You and CDC ILI-Net Rates in Maricopa County, AZ
Influenza Season 2012-2013**



**Table 1. System comparison for Flu Near You and CDC ILI-Net for Maricopa County, AZ
Influenza Season 2012-2013**

System Comparison	Pearson Correlation	RMSE	Peak ILI Week
CDC ILI-Net	1.00000	0.00000% ILI	3/24/2013 (week 13)
CDC ILI-Net vs. Unadjusted FNY	-0.18252	3.62695% ILI	12/16/2012 (week 51)
CDC ILI-Net vs. Adjusted FNY	-0.17980	3.25442% ILI	12/16/2012 (week 51)

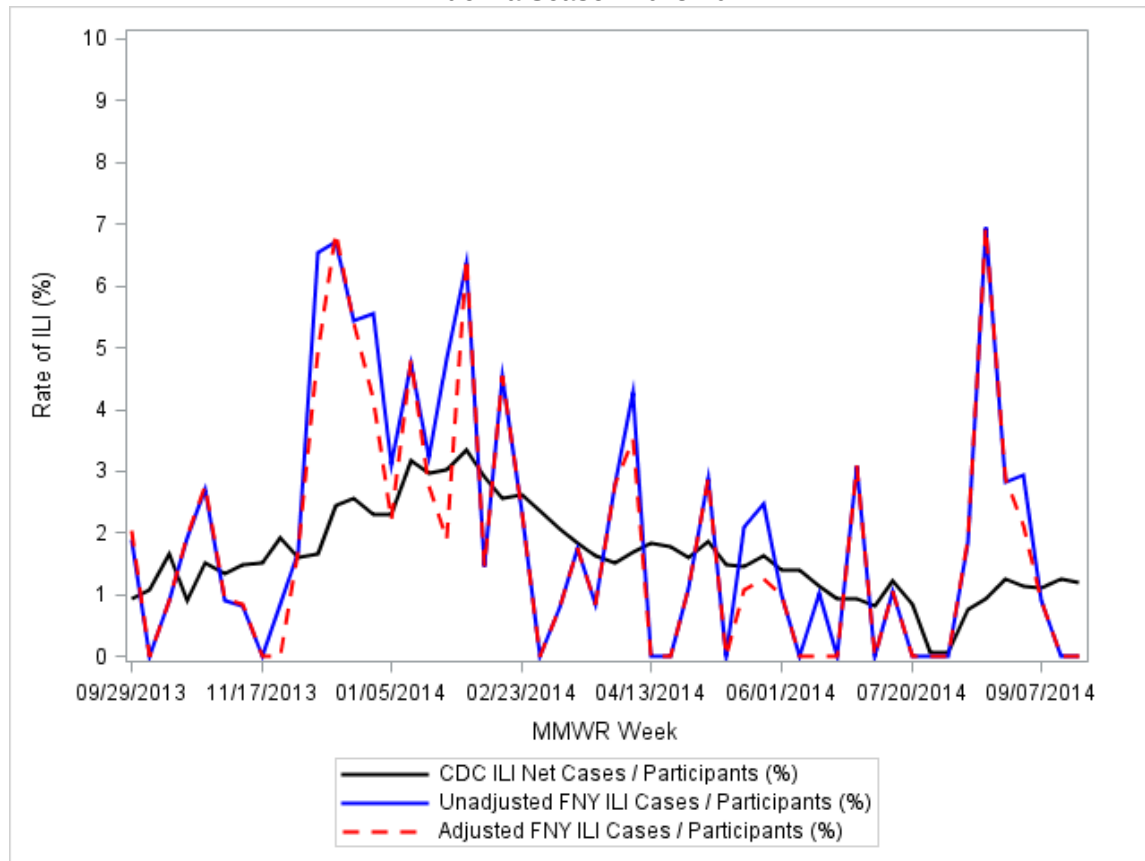
*Indicates p-value <0.01

Correlation between Flu Near You and CDC ILI-Net for influenza-like Illness rates for Maricopa County, AZ

2013-2014 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and CDC ILI-Net from October 2013 to October 2014 (MMWR weeks 2013-40 to 2014-39). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. This report aims to assess the correlation of influenza-like illness rates between the two datasets.

**Figure 1. Flu Near You and CDC ILI-Net Rates in Maricopa County, AZ
Influenza Season 2013-2014**



**Table 1. System comparison for Flu Near You and CDC ILI-Net for Maricopa County, AZ
Influenza Season 2013-2014**

System Comparison	Pearson Correlation	RMSE	Peak ILI Week
CDC ILI-Net	1.00000	0.00000% ILI	2/2/2014 (week 6)
CDC ILI-Net vs. Unadjusted FNY	0.50312*	1.79166% ILI	8/17/2014 (week 34)
CDC ILI-Net vs. Adjusted FNY	0.46300*	1.72424% ILI	8/17/2014 (week 34)

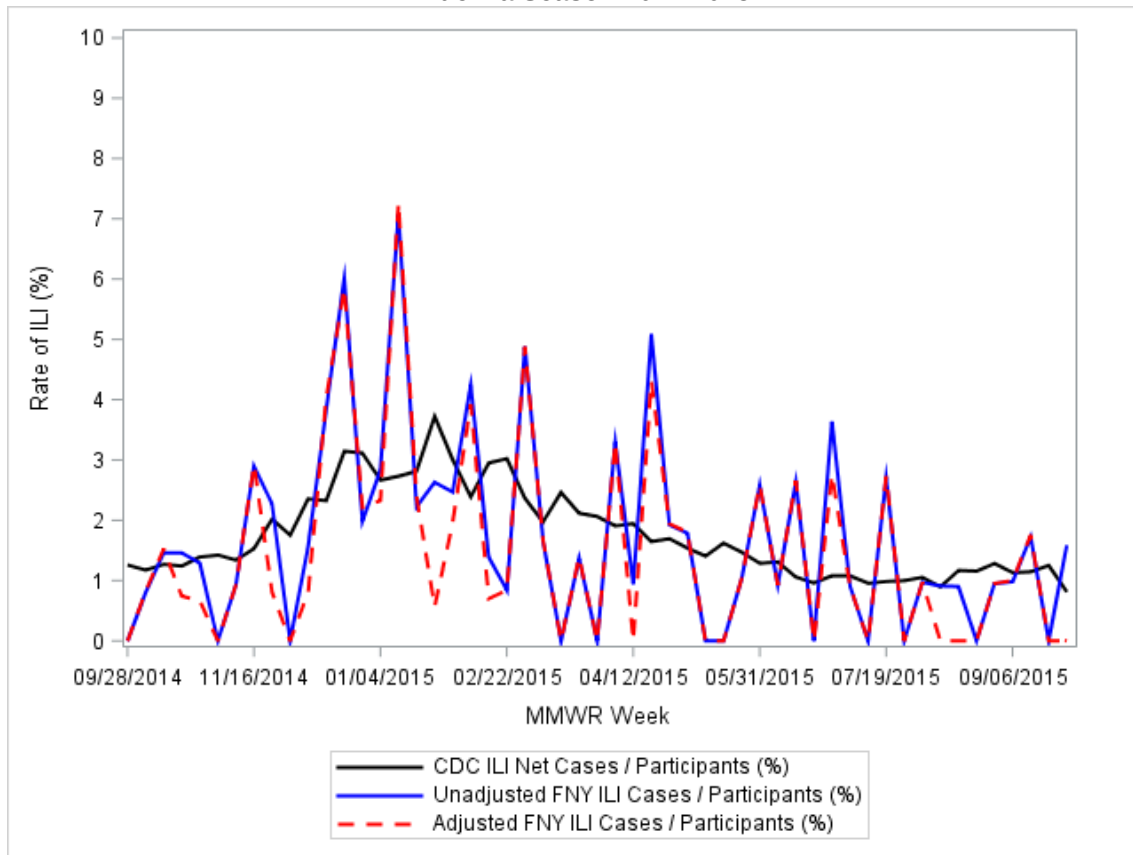
*Indicates p-value <0.01

Correlation between Flu Near You and CDC ILI-Net for influenza-like illness rates for Maricopa County, AZ

2014-2015 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and CDC ILI-Net from October 2014 to October 2015 (MMWR weeks 2014-40 to 2015-39). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. This report aims to assess the correlation of influenza-like illness rates between the two datasets.

**Figure 1. Flu Near You and CDC ILI-Net Rates in Maricopa County, AZ
Influenza Season 2014-2015**



**Table 1. System comparison for Flu Near You and CDC ILI-Net for Maricopa County, AZ
Influenza Season 2014-2015**

System Comparison	Pearson Correlation	RMSE	Peak ILI Week
CDC ILI-Net	1.00000	0.00000% ILI	1/25/2015 (week 4)
CDC ILI-Net vs. Unadjusted FNY	0.43617*	1.47143 % ILI	1/11/2015 (week 2)
CDC ILI-Net vs. Adjusted FNY	0.38543*	1.52769% ILI	1/11/2015 (week 2)

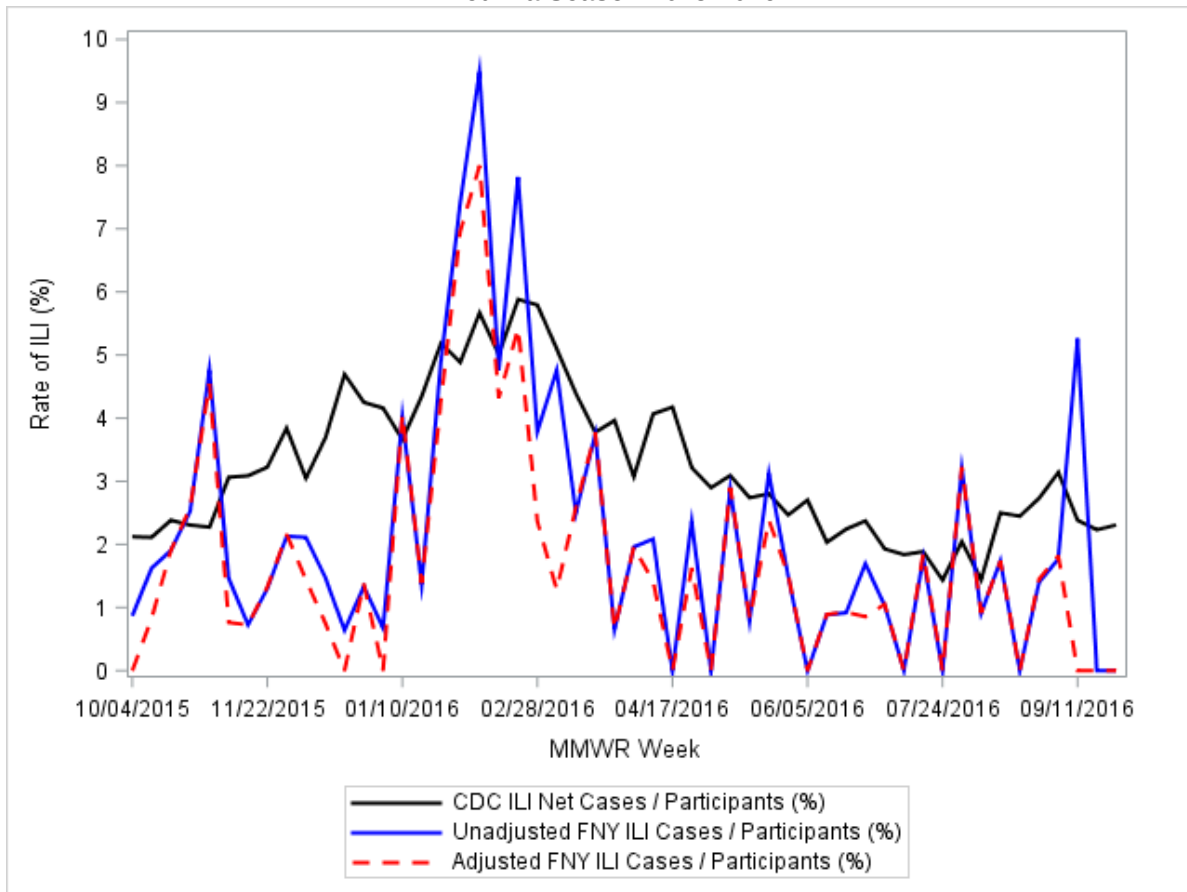
*Indicates p-value <0.01

Correlation between Flu Near You and CDC ILI-Net for influenza-like Illness rates for Maricopa County, AZ

2015-2016 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and CDC ILI-Net from October 2015 to October 2016 (MMWR weeks 2015-40 to 2016-39). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. This report aims to assess the correlation of influenza-like illness rates between the two datasets.

**Figure 1. Flu Near You and CDC ILI-Net Rates in Maricopa County, AZ
Influenza Season 2015-2016**



**Table 1. System comparison for Flu Near You and CDC ILI-Net for Maricopa County, AZ
Influenza Season 2015-2016**

System Comparison	Pearson Correlation	RMSE	Peak ILI Week
CDC ILI-Net	1.00000	0.00000% ILI	2/21/2016 (week 8)
CDC ILI-Net vs. Unadjusted FNY	0.58694*	1.70938% ILI	2/7/2016 (week 6)
CDC ILI-Net vs. Adjusted FNY	0.52180*	1.54025% ILI	2/7/2016 (week 6)

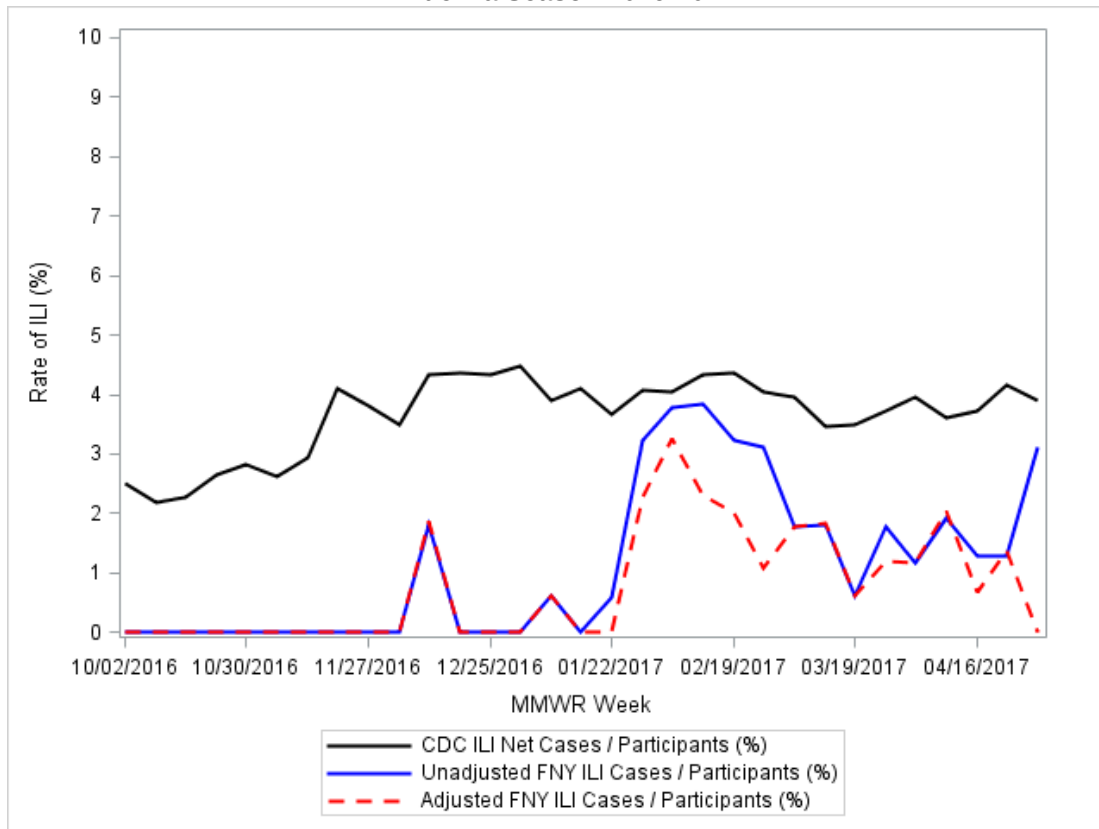
*Indicates p-value <0.01

Correlation between Flu Near You and CDC ILI-Net for influenza-like illness rates for Maricopa County, AZ

2016-2017 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and CDC ILI-Net from October 2016 to May 2017 (MMWR weeks 2016-40 to 2017-18). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. This report aims to assess the correlation of influenza-like illness rates between the two datasets.

**Figure 1. Flu Near You and CDC ILI-Net Rates in Maricopa County, AZ
Influenza Season 2016-2017**



**Table 1. System comparison for Flu Near You and CDC ILI-Net for Maricopa County, AZ
Influenza Season 2016-2017**

System Comparison	Pearson Correlation	RMSE	Peak ILI Week
CDC ILI-Net	1.00000	0.00000% ILI	1/1/2017 (week 1)
CDC ILI-Net vs. Unadjusted FNY	0.45895*	1.19493% ILI	2/12/2016 (week 7)
CDC ILI-Net vs. Adjusted FNY	0.42332**	0.88251% ILI	2/5/2016 (week 6)

*Indicates p-value <0.01

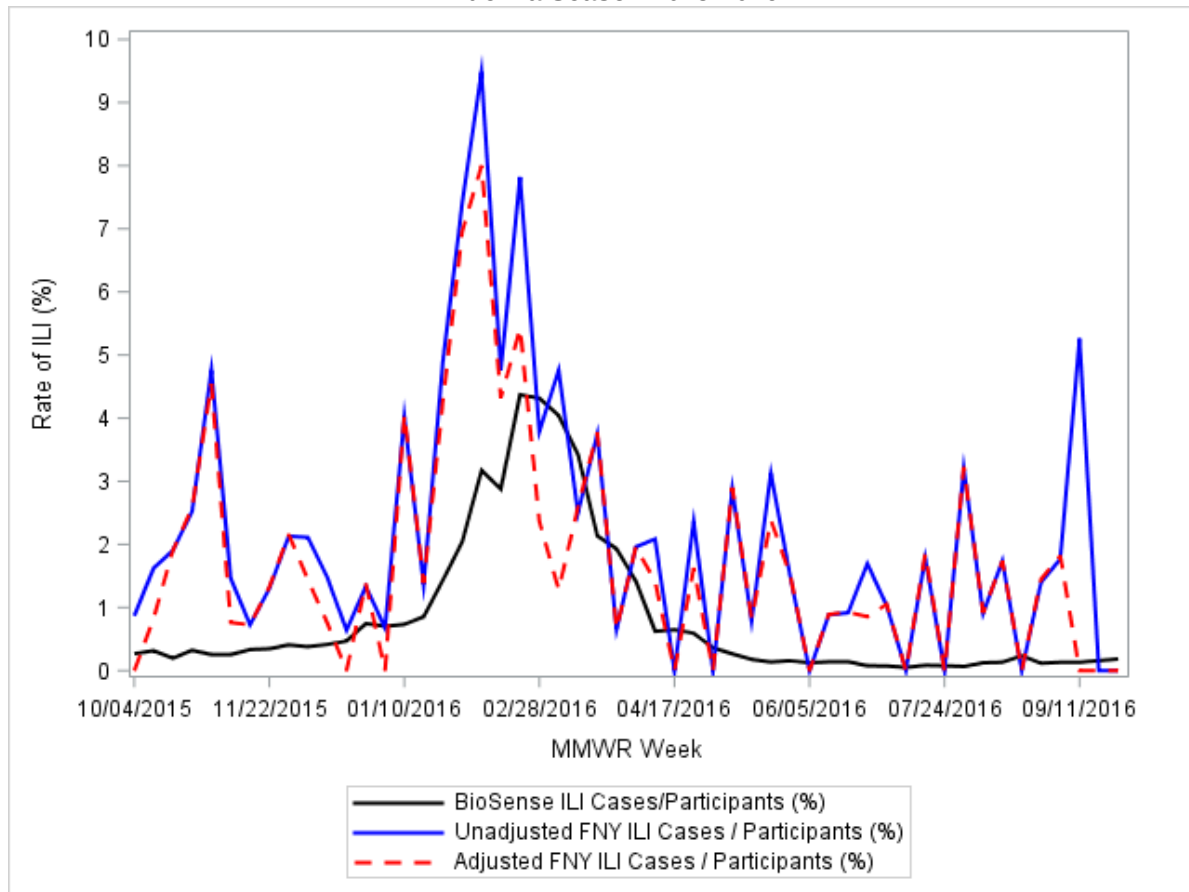
**Indicates p-value <0.05

Correlation between Flu Near You and NSSP BioSense influenza-like illness rates for Maricopa County, AZ

2015-2016 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and the National Syndromic Surveillance Program BioSense Platform from October 2015 to October 2016 (MMWR weeks 2015-40 to 2016-39). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. This report aims to assess the correlation of influenza-like illness rates between the two datasets.

**Figure 1. Flu Near You and BioSense Rates in Maricopa County, AZ
Influenza Season 2015-2016**



**Table 1. System comparison for Flu Near You and BioSense for Maricopa County, AZ
Influenza Season 2015-2016**

System Comparison	Pearson Correlation	RMSE	Peak ILI Week
BioSense	1.00	0.00% ILI	2/28/2016 (Week 9)
BioSense vs. Unadjusted FNY	0.65*	1.60% ILI	2/7/2016 (Week 6)
BioSense vs. Adjusted FNY	0.55*	1.51% ILI	2/7/2016 (Week 6)

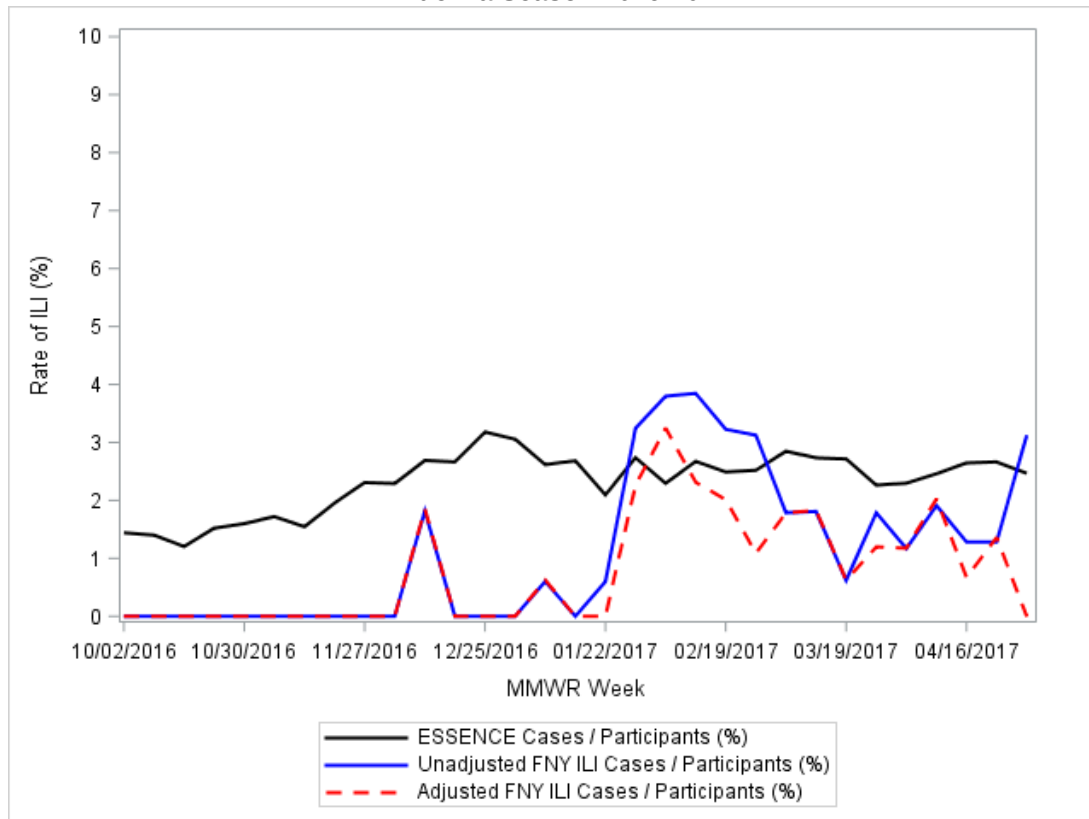
*Indicates p-value <0.01

Correlation between Flu Near You and NSSP BioSense influenza-like illness rates for Maricopa County, AZ

2016-2017 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and the National Syndromic Surveillance Program BioSense Platform from October 2016 to May 2017 (MMWR weeks 2016-40 to 2017-18). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. This report aims to assess the correlation of influenza-like illness rates between the two datasets.

**Figure 1. Flu Near You and ESSENCE Rates in Maricopa County, AZ
Influenza Season 2016-2017**



**Table 1. System comparison for Flu Near You and ESSENCE for Maricopa County, AZ
Influenza Season 2016-2017**

System Comparison	Pearson Correlation	RMSE	Peak ILI Week
CDC ILI-Net	1.00000	0.00000% ILI	12/25/2016 (week 52)
CDC ILI-Net vs. Unadjusted FNY	0.38918**	1.23890% ILI	2/12/2017 (week 7)
CDC ILI-Net vs. Adjusted FNY	0.40279**	0.89158% ILI	2/5/2017 (week 6)

*Indicates p-value <0.01

**Indicates p-value<0.05

Committee & Topic: Surveillance / Informatics: Novel surveillance methods, analytics, and data sources

Title: (185 character max)

Flu Near You Captured Novel Influenza-like Illness Data from Maricopa County Residents Who Did Not Seek Healthcare During the 2015-2016 Influenza Season (152)

Keywords: Syndromic Surveillance; *influenza surveillance*; *evaluation*

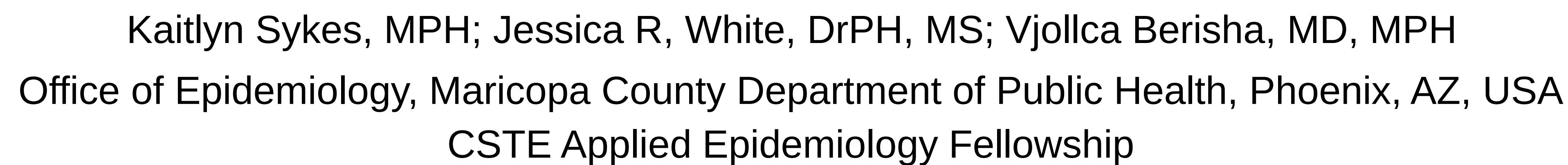
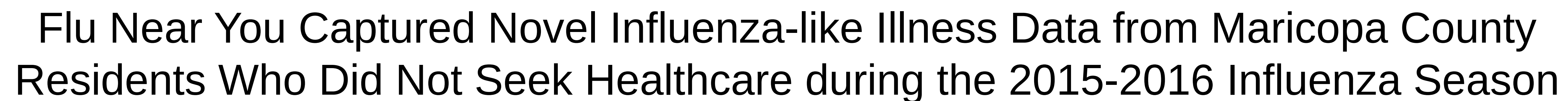
Authors: Kaitlyn Sykes, Vjollca Berisha, Jessica White

BACKGROUND: Flu Near You (FNY), a near real-time participatory surveillance system for tracking symptoms in the U.S. and Canada, provides a novel source for influenza-like illness (ILI) data. This study aimed to evaluate whether FNY provided Maricopa County Department of Public Health (MCDPH) with more timely or additional information during the 2015-2016 influenza season compared to the National Syndromic Surveillance Program BioSense Platform.

METHODS: We filtered national FNY data to include only Maricopa County zip codes. Using CDC's "Updated Guidelines for Evaluating Public Health Surveillance Systems", we evaluated three major attributes of the system. Timeliness was assessed by describing the time intervals between symptom onset, symptom reporting, and data analysis. We measured representativeness by comparing the demographics of FNY users to Census population data from Maricopa County. To assess data quality, we analyzed the correlation of ILI trends (defined as fever AND [cough OR sore throat]) from FNY and BioSense by calculating the Pearson correlation statistic and root mean square error (RMSE). To account for potential bias from those who used FNY only once, we removed one-time users from the dataset and reexamined the correlation to BioSense.

RESULTS: Maricopa County had 557 unique FNY users (175 [31%] one-time users) from 10/05/15 – 10/02/16, with 19 to 232 users per week (mean=130). Each Monday, users received surveys to report symptoms experienced during the previous 7 days. The survey for that timeframe was open to symptom reporting for one week before the dataset was finalized and posted to a dashboard for use by public health agencies. Therefore, symptom data were received by MCDPH 8 – 14 days after onset. Compared to the general population, Maricopa County FNY users included significantly more females (72.3% vs. 50.57%, $p<0.01$) and adults over 45 ($p<0.01$). Of the 162 users who reported ILI symptoms, 74 (45.7%) did not seek healthcare. FNY rates of ILI over time were significantly correlated with BioSense rates (Pearson=0.65, $p<0.01$, RMSE=1.60%). The correlation remained significant but did not improve when one-time users were removed from the dataset (Pearson=0.55, $p\text{-value}<0.01$, RMSE=1.51%). During the 2015-16 season, FNY detected a peak in ILI three weeks prior to BioSense.

CONCLUSIONS: FNY captured data from persons who did not seek healthcare and identified a peak in ILI three weeks earlier than BioSense. These timely, unique data may complement existing influenza surveillance. In an effort to increase representativeness and regular use of FNY, MCDPH continues to encourage enrollment in Maricopa County.



To evaluate whether Flu Near You provided Maricopa County Department of Public Health (MCDPH) with more timely or additional information about community level influenza-like illness (ILI) compared to the National Syndromic Surveillance Program BioSense Platform



- Near real-time participatory surveillance system
- Registered users report select symptoms using a quick, weekly survey
- Includes community members who do not seek healthcare

METHODS

- 2015-2016 influenza season
- Data sources: Flu Near You (FNY); National Syndromic Surveillance Program BioSense Platform (BioSense 2.0); U.S. Census Bureau, 2015 American Community Survey
- Attributes: timeliness, representativeness and data quality

Timeliness

S	M	T	W	T	F	S	System	Peak ILI Week
	SYMPTOMS						Unadjusted FNY	2/8/16 (Week 6)
							Adjusted FNY	2/8/16 (Week 6)
							BioSense 2.0	2/29/16 (Week 9)
	Email Survey	SURVEY OPEN FOR REPORTING					Peak ILI occurred 3 weeks earlier in FNY compared to BioSense 2.0	
		DATA AVAILABLE FOR ANALYSIS					With the 8-14 day delay in data availability, MCDPH would be notified 1-2 weeks prior to BioSense 2.0	

- Peak ILI occurred 3 weeks earlier in FNY compared to BioSense 2.0
- With the 8-14 day delay in data availability, MCDPH would be notified 1-2 weeks prior to BioSense 2.0

Representativeness

FNY users were not representative of the population of Maricopa County due to the overrepresentation of females and those 45 years and older.

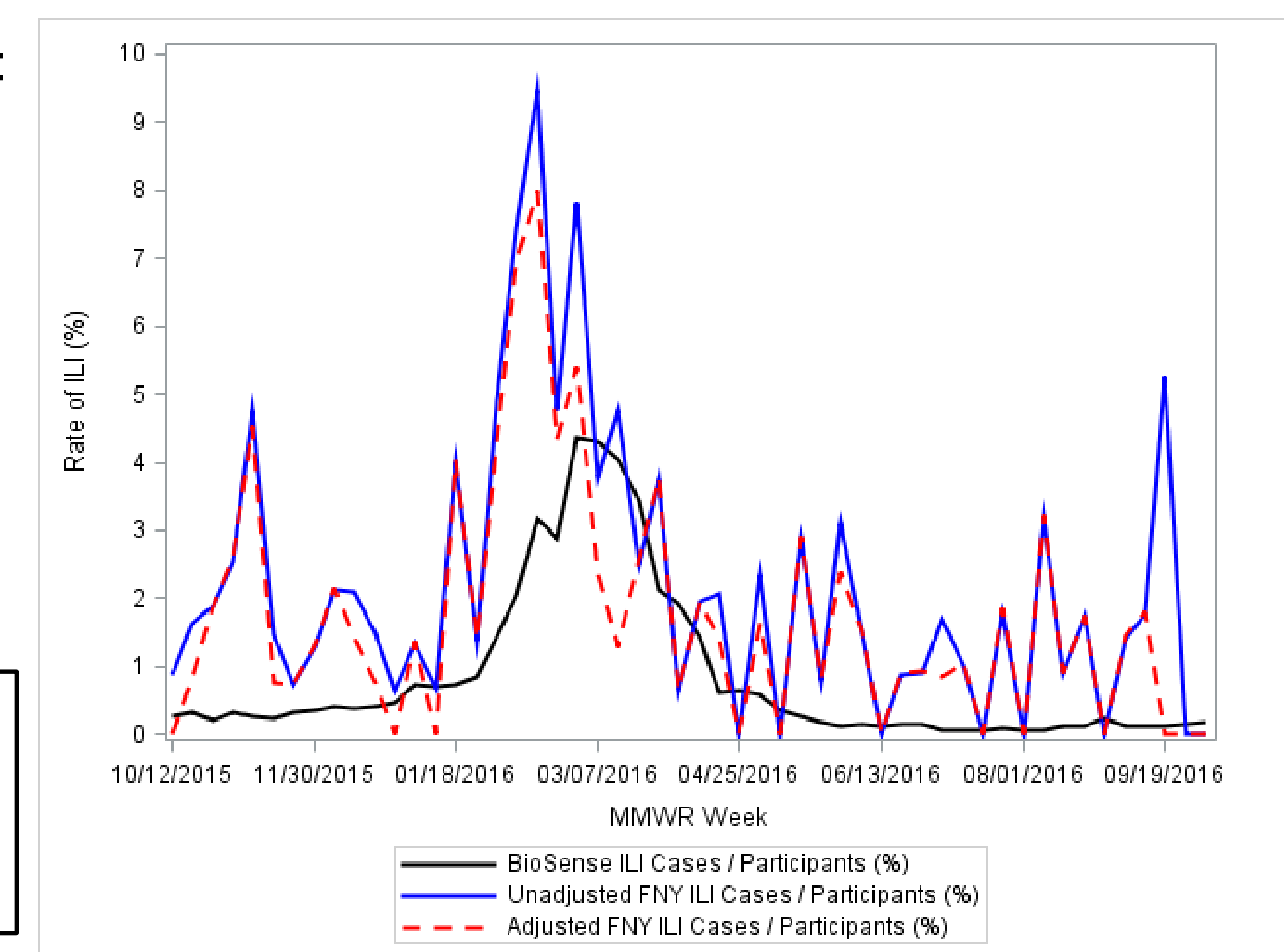
RESULTS

Data Quality

- Mean = 130
- Min = 19
- Max = 232

Both unadjusted and adjusted Flu Near You data were significantly correlated with BioSense 2.0 data

Of the 162 users who reported ILI symptoms, 74 (45.7%) did not seek healthcare.



*Significant at $p < 0.05$ level

CONCLUSIONS & NEXT STEPS

- FNY captured data from persons who did not seek healthcare & identified a peak in ILI three weeks earlier than BioSense 2.0, but was not representative of the county
- Next steps:
 - Compare FNY to other influenza data sources and evaluate the 2016-17 season
 - Continue ongoing efforts to improve representativeness and regular use of FNY in Maricopa County
 - Decide how the health department will incorporate FNY into existing surveillance

This study was supported in part by an appointment to the Applied Epidemiology Fellowship Program administered by the Council of State and Territorial Epidemiologists (CSTE) and funded by the Centers for Disease Control and Prevention (CDC) Cooperative Agreement Number 1U38OT000143-04. The Maricopa County Department of Public Health receives funding for this project through a joint organizational partnership between the CSTE and the Skoll Global Threats Fund (SGTF), provided by CSTE through sub-awards from the SGTF award #15-03126. The contents of this poster are solely the responsibility of the authors and do not necessarily represent the official views of SGTF or CSTE.

Evaluation of the Flu Near You application in Maricopa County, Arizona

Introduction

In the United States, influenza (flu) continues to be a condition of public health importance. Each year, an average of 5 to 20 percent of the U.S. population contracts the flu. [1] In more severe cases, an average of 200,000 people in the U.S. are hospitalized each year for conditions associated with influenza virus infections. [2]

Almost 60 percent of flu hospitalizations are adults aged 18-64 years. [1] However, certain population groups are more at risk for developing flu-related complications, such as children younger than 5, adults 65 years and older, pregnant women, residents of nursing homes or other long-term care facilities, and American Indians and Alaskan Natives. [3] Similarly, individuals who have medical conditions such as asthma, heart disease, metabolic disorders, and others may be at increased risk as well.

Influenza may be prevented through receiving an annual flu vaccination and taking everyday preventive actions such as covering coughs and sneezes and frequent hand washing. Although a vaccine is available, only around 40 percent of adults and 40 to 60 percent of children received the vaccine annually from the 2009-2010 flu season to 2014-2015 flu season, with an overall trend of increasing coverage. [4] It is important for health departments to monitor influenza activity and encourage preventative measures as influenza rates increase.

Year-round, the Maricopa County Department of Public Health (MCDPH) Office of Epidemiology collaborates with Centers for Disease Control and Prevention (CDC), Arizona Department of Health Services, and local agencies to monitor and prevent influenza transmission in the county. To capture individuals across the disease course of influenza, surveillance activities rely on data generated by schools, healthcare facilities, laboratories, Office of the Medical Examiner, and Office of Vital Registration.

‘Flu Near You’ (FNY) is a participatory surveillance application designed to capture symptom data directly from the community. The application was originally branded to monitor the influenza-like illness syndrome (ILI; defined as a fever and either sore throat or cough), but now captures 16 individual symptoms. To register, users 13 years and older must provide their gender, month and year of birth, zip code, and e-mail address where they would like to receive their weekly surveys. Users may elect to add household members to their account and report their symptoms each week. After registering, users receive an e-mail asking how they are feeling. The link leads them to their individual health report, where they can select symptoms experienced during the previous week, or quickly select that they did not have any of the symptoms. If they indicate that they experienced symptoms, a few follow-up questions appear, such as what day they started feeling ill, if they were traveling while experiencing the symptoms, and if they sought healthcare for their illness. Once the user completes these questions, they submit their survey, which completes the process. Users are reminded by e-mail to complete a new survey every Monday. Surveys remain open for one week.

Weekly survey data are cleaned by the FNY app developers at Boston Children’s Hospital and Skoll Global Threats Fund. Cleaned datasets are uploaded to the password-protected FNY dashboard weekly. The dashboard provides health departments with FNY data from 2011 (the beginning of FNY) through

the most currently available week. Health departments may seek access to the dashboard directly from the FNY developers. Aggregate data are readily available on the dashboard, while access to line-level data requires a data use agreement between the health department and Boston Children's Hospital. In general, the health department only needs to dedicate a few resources to maintaining this type of surveillance (after initial set-up). The team of developers at Boston Children's Hospital Skoll Global Threats Fund are responsible for ensuring the system runs effectively. The health department must dedicate staff time to downloading data every Monday morning. That dataset is then run in a pre-existing SAS code, which creates a weekly influenza-like illness report.

MCDPH has not previously used on FNY data as part of their influenza surveillance, but it may provide added benefits. It is estimated that about 55% of adults and 43% of children with influenza-like illness do not seek care at a healthcare facility. [5] Flu Near You allows community members to report symptoms directly to the application, allowing them to report even if they do not seek healthcare. This may allow the health department to have a more representative idea of illness incidence in the general population, not only among health-care seeking individuals. Further, it may allow us to gather the data more quickly than traditional surveillance, since we avoid delays associated with laboratory testing and mandatory reporting.

With the potential to capture near real-time data from anyone 13 years or older in Maricopa County, FNY has the potential to add valuable information to MCDPH's influenza surveillance. The objective of this evaluation was to assess whether Flu Near You provided MCDPH with more timely or additional information about community level influenza-like illness (ILI) compared to our existing surveillance systems.

Methods

In July 2016, the Maricopa County Department of Public Health (MCDPH) was selected to participate in the Flu Near You Data Implementation Project for 2016-2017 influenza season in collaboration with the Skoll Global Threats Fund and the Council of State and Territorial Epidemiologists (CSTE). The project period began August 1, 2016 and ended May 30, 2017.

Engage stakeholders

We identified three groups of stakeholders that would be impacted by this evaluation: the developers of Flu Near You, MCDPH, and FNY users. Throughout the project period, the MCDPH evaluation team communicated with FNY developers on a weekly basis. MCDPH brought problems or complaints about the application to the developers' attention, so they could address the needs of the users. MCDPH served a critical link between the developers and new users.

MCDPH has an invested interest in this evaluation in that findings may influence their decision about incorporating Flu Near You data into their routine influenza surveillance efforts and reporting the data to healthcare providers and the public. On August 29, 2016, the evaluation team met with the Director for the MCDPH Disease Control Division, the Program Manager of the Office of Epidemiology, and three key staff from the Office of Program Operations and the Office of Communication and Marketing. A follow-up meeting was held on September 13, 2016, which included six attendees representing the

MCDPH evaluation team, Office of Program Operations, Office of Communication and Marketing, and Office of Epidemiology.

We engaged with MCDPH Office of Epidemiology staff and encourage them to become new users. A presentation was given to educate MCDPH staff on Flu Near You and how the data could be used in their related surveillance tasks. We recruited our colleagues to become active users throughout the 2016-2017 flu season. By engaging 20 employees to become active users of FNY, it became easier to get user feedback. These users informed us of any issues with the application, and completed two evaluation surveys – one month and eight months after the initial presentation – to provide user feedback on many attributes of the application. We also participated in many community events where interacted with potential FNY users.

Focus the evaluation design

The evaluation focused on three system attributes: data quality, representativeness and timeliness. These attributes were important because they would help answer our main questions for the evaluation:

- Are the data from FNY consistent and reliable?
- Are the FNY data providing additional information that we miss from traditional flu surveillance, such as data from those who otherwise would not seek healthcare?
- Are we capturing information earlier than the traditional flu surveillance systems at MCDPH?
- Do we want to add FNY data to the MCDPH flu surveillance?

Data quality was assessed by analyzing the correlation between FNY and both CDC ILI-Net data and BioSense/ESSENCE Syndromic data for each flu season between October 2, 2011 and May 6, 2017. We adjusted for one time users, with the adjusted FNY data deleting all participants who only reported once during the given influenza season. To assess data quality, we also looked at the number and percentage of one-time users, and the number of users reporting every week throughout the season.

Representativeness was analyzed by comparing the demographics of FNY users to the U.S. Census data for each calendar year. We also determined how many users who reported ILI symptoms sought healthcare for their illness.

Timeliness was analyzed through two methods. The first method was looking at the days between symptom onset and actual notification to a health department. The second method was to compare peak ILI weeks using FNY, CDC ILI-Net and BioSense syndromic surveillance data.

Results

Stakeholder feedback

The initial meeting with MCDPH administration was critical for the project to move forward. The MCDPH Disease Control Division Director, Dr. Sunenshine, approved MCDPH's promotion of FNY. The key selling point of the application was its potential for reaching the bottom of the surveillance pyramid (i.e., those who are ill, but have not sought healthcare; Figure 1), which may help us better visualize illness within the community. With buy-in from the director, we discussed options for promoting the application. The group recommended targeting healthcare providers, pharmacists,

mothers, and youth. Posters, postcards, and local public television were mentioned as possible communication channels. Through this discussion, The Arizona Partnership for Immunization (TAPI) was named as a potential partner for advertising FNY and administering incentives. TAPI is a non-profit, statewide coalition of over 400 public and private partners with close ties to pharmacists and clinics (<https://www.whylimmunize.org>).

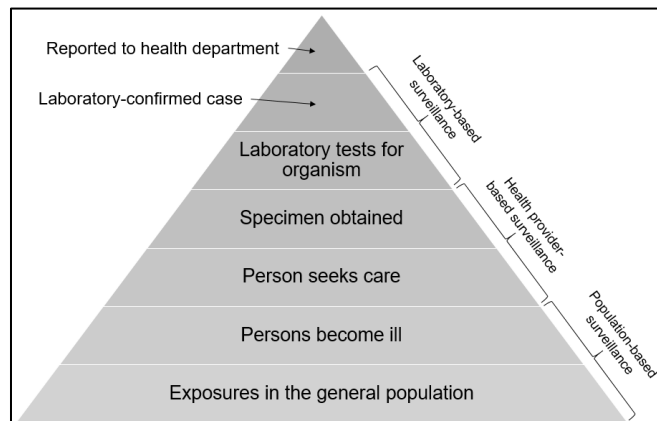
During the meeting with MCDPH administration, attendees identified a key technical issue -- the FNY app was not found in the Apple App Store. The MCDPH evaluation team altered CSTE and SGTF staff by email, and the problem was resolved over the next few days. The group also wondered if there would be a method for tracking individuals who signed-up after seeing our promotional material. Questions included, “How can we track those who sign up?” and “Can new users receive a tracking code when they sign up?” A tracking features would help us understand whether our promotional efforts were effective at encouraging new enrollment.

At the follow-up meeting in September, the group discussed methods for operationalizing the campaign. To launch the social media campaign, the CSTE Applied Epidemiology Fellow (Kaitlyn Sykes) would compile a list of messages for Facebook and Twitter that would be posted by the MCDPH Office of Communication and Marketing on the MCDPH accounts each Monday and Thursday from mid-October through May. The group noted that the app could be improved and may increase enrollment by offering the content in Spanish.

The group of MCDPH users who signed on as committed FNY users for the season provided feedback through anonymous surveys that were administered in November 2016 and May 2017. These users provided the following recommendations for improving Flu Near You:

- Give guidance on reporting symptoms. Some individuals may experience the symptoms from the same cold for a few weeks. It should be specified if they should report their symptoms every week, or if they should only be reporting *NEW* symptoms.
- Fix the question about if the user has received the flu vaccine since the last report. It is not always on schedule for when a new flu vaccine comes out, and may deter users from reporting if they become irritated having to answer the question every week. It may also cause some users to lie and say “yes” to keep the question from appearing again, giving incorrect data.
- Fix the phone application. Users like the idea of being able to report on their phone rather than use the internet.
 - We received some complaints that the reminder comes early in the morning and makes a chime while the user or household members are still sleeping (5:30am)
- Ensure that there are reliable email reminders sent out every Monday morning

Figure 1. Surveillance pyramid [CDC]



- Provide the ability to share or publish your ‘congratulations on reporting’ message to social media as a recruiting tool
- Have an incentive to make people report
 - Ideas included a small game, gif, picture, or even a “feel better soon” message if you reported symptoms
- Edit the weekly emails to not advertise “flu-like symptoms” as diarrhea and nausea/vomiting

MCDPH users overwhelmingly reported that this was a low burden application, and a good idea for collecting data.

Data quality

MCDPH aims to have at least 200 participants reporting every week. [6] However, the number of users reporting to FNY has varied over time (Table 1). During the 2016-17 influenza season, the maximum number of users was 185 in a given week. In an effort to increase the number of active and consistent reporters, MCDPH launched a promotional campaign. Consistent with previous years, more than 400 users reported to FNY only once. (Table 2) Since 2011, roughly 30 to 35 percent of users only reported, but the number of one time users is decreasing over time. We considered the impact of these one-time users and removed them from the dataset to calculate adjusted ILI rates.

Beginning in 2011, FNY did not have a strong user base in Maricopa County. As a result, data quality was poor. As shown in Table 3, both unadjusted and adjusted FNY ILI rates did not correlate significantly with CDC ILI-Net data until the 2013-2014 influenza season. However, from 2013 to present, FNY ILI data have been significantly correlated with both CDC ILI-Net and BioSense syndromic surveillance data, indicating good data quality.

Representativeness

Representativeness of FNY data to the Maricopa County population was poor. Each year, there was an overrepresentation of female users in comparison to the U.S. Census population in Maricopa County every year (Table 4). There was also an overrepresentation of the older users compared to the census population in the county. This indicates that the FNY data may not be representative of the population as a whole.

Flu Near You recently added a question about healthcare seeking behavior. During the 2015-16 influenza season, 45.7 percent of the 162 who reported ILI did not seek healthcare. (Table 5).

Timeliness

The timeliness of data from FNY is fair, but there is still potential for a large delay between the onset of symptoms and data analysis by the health department. As displayed in Figure 2, users receive a survey every Monday morning asking about their symptoms experienced in the previous 7 days. This survey remains open for one week, and closes for finalization and release to the dashboard the following Monday. This timeline allows for a delay of 8-14 days between the onset of symptoms and data release to the health department.

Despite this delay, FNY indicated a spike in ILI earlier than both CDC ILI-Net and BioSense/ESSENCE syndromic surveillance data every year. In particular, in the 2015-2016 influenza season displayed in Figure 3, the only season with all three data sources available, FNY had a peak 3 weeks earlier than BioSense, and 6 weeks earlier than CDC ILI-Net, indicating the benefit of syndromic surveillance, and particularly FNY, for timely data.

Conclusions

Based on this evaluation, Flu Near You has potential to be a useful source for influenza surveillance for Maricopa County. FNY offers a timely, unique dataset that may complement existing influenza surveillance systems well.

However, we still identified limitations that should be addressed in order to improve the FNY system. MCDPH staff identified a number of application issues and recommended enhancements to improve the user experience. A major limitation was the loss of data during the peak of our influenza season, which was due to technical complications. We were unable to analyze the most recent ILI trends as we attempted to increase the number of users in our area. This technical problem may have impacted users' decision to report (i.e. if they reported and did not show up on the map as a red circle, they may have discontinued use). Locally, our users did not represent the general public and were not reporting consistently. Representativeness could be improved through recruiting more male and youth reporters. In an effort to decrease the number of users who report only once or a few times, the developers may consider methods for providing incentives to keep users active throughout the entire flu season. With improvements to the user base size, representation, and consistency, FNY has potential to be a useful data source in Maricopa County.

Our next steps will include, comparing FNY to other influenza data sources (e.g. laboratory surveillance), evaluating the data quality over the 2017-18 influenza season, and deciding how MCDPH will incorporate FNY data in our existing influenza surveillance and reporting.

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Disclosures

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Table 1. Range of Flu Near You weekly users in Maricopa County, AZ
Flu Seasons 2011-2012 to 2016-2017

	2011-2012		2012-2013		2013-2014		2014-2015		2015-2016		2016-2017	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Range of users reporting on a given week	3	54	36	555	81	216	69	202	19	232	19	185

Table 2. Count and percent of one time Flu Near You users in Maricopa County, AZ
Flu Seasons 2011-2012 to 2016-2017

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
One-time users N (%)	20 (18.18%)	303 (37.13%)	177 (33.46)	205 (35.65)	172 (31.05)	125 (30.64)
Total Users	110	816	529	575	554	408

Table 3. System comparison for Flu Near You and CDC ILI-Net and BioSense/ESSENCE Syndromic data for Maricopa County, AZ
Flu Seasons 2011-2012 to 2016-2017

	2011-2012		2012-2013		2013-2014		2014-2015		2015-2016		2016-2017	
System Comparison	Pearson Correlation	RMSE (% ILI)	Pearson Correlation	RMSE (% ILI)	Pearson Correlation	RMSE (% ILI)	Pearson Correlation	RMSE (% ILI)	Pearson Correlation	RMSE (% ILI)	Pearson Correlation	RMSE (% ILI)
CDC ILI-Net	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
CDC ILI-Net vs Unadjusted FNY	0.18	2.41	-0.18	3.63	0.50*	1.79	0.44*	1.47	0.59*	1.71	0.46*	1.19
CDC ILI-Net vs Adjusted FNY	0.15	2.42	-0.18	3.25	0.46*	1.72	0.38*	1.53	0.52*	1.54	0.42**	0.88
BioSense	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.00	0.00	1.00	0.00
BioSense vs. Unadjusted FNY	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.65*	1.60	0.39*	1.24
BioSense vs. Adjusted FNY	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.55*	1.51	0.40**	0.89

*Indicates p-value <0.01

**Indicates p-value <0.05

Table 4. Representativeness of Flu Near You users in Maricopa County, AZ
Flu Seasons 2011-2012 to 2016-2017

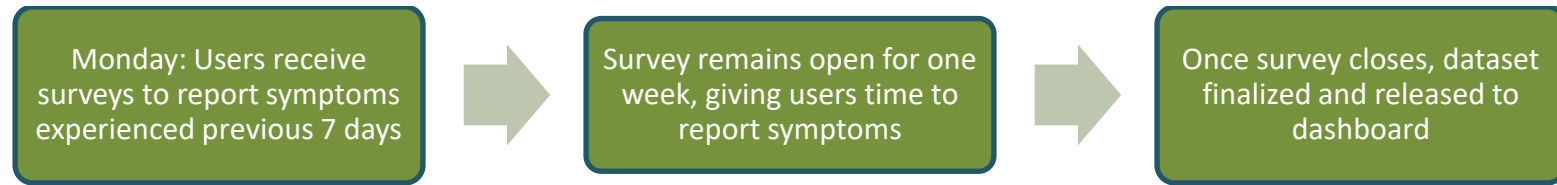
		2011-2012		2012-2013		2013-2014		2014-2015		2015-2016	
		FNY	Census	FNY	Census	FNY	Census	FNY	Census	FNY	Census
Gender	Female	76	1,916,554	531	1,939,994	341	1,964,913	377	1,996,141	402	2,031,985
	Male	32	1,882,120	262	1,901,825	185	1,924,248	195	1,951,241	154	1,986,158
Age Group	15-24	9	540,625	26	545,930	21	548,324	13	552,712	35	558,912
	25-34	15	549,118	125	549,662	77	552,448	66	558,791	78	569,970
	35-44	8	528,320	206	528,091	121	530,347	135	533,824	92	539,197
	45-54	30	495,804	180	502,692	103	510,068	116	516,327	135	522,995
	55-64	32	388,299	185	401,045	139	414,667	147	428,114	142	441,729
	65+	16	452,229	93	469,908	49	490,222	83	513,536	61	538,454

All are significant at <.0001 level (chi-square)

Table 5. Count and percent of Flu Near You users who seek healthcare in Maricopa County, AZ
Flu Seasons 2011-2012 to 2016-2017

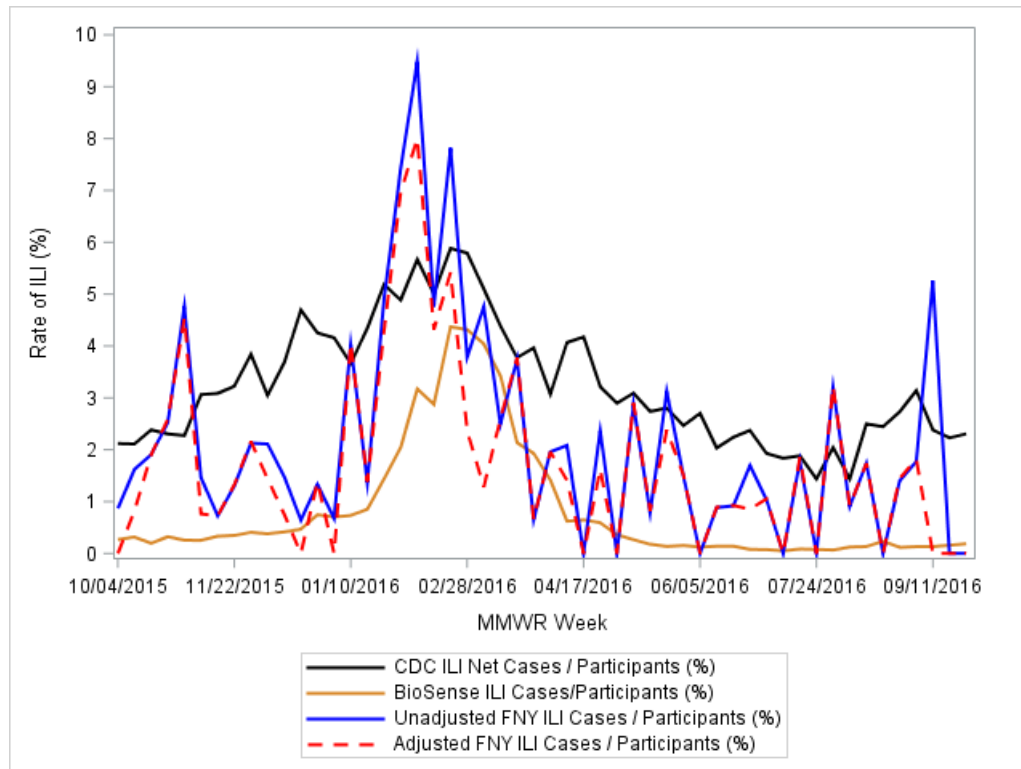
	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
Got healthcare, N (%)	0 (0)	0 (0)	0 (0)	1 (0.81%)	88 (54.3%)	32 (61.5%)
Did not get healthcare, N (%)	20 (100)	254 (100)	134 (100)	122(99.19%)	74 (45.7%)	20 (38.5%)
Total with ILI	20	254	134	123	162	52

Figure 2. Timeliness of Flu Near You



SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	SYMPTOMS					
	SURVEY OPEN FOR REPORTING					
	DATA AVAILABLE					

**Figure 2. Flu Near You, BioSense, and CDC ILI-Net Rates in Maricopa County, AZ
Flu Season 2015-2016**



Specific Aim #3: Increase reporting to Flu Near You by Maricopa County residents.

1. Summary of promotional campaign
2. Slides from TAPI presentations on 10/17/16 and 10/19/16

FNY introductory presentations to TAPI Provider Awareness Committee Meeting and TAPI Community Awareness Committee Meeting

3. Slides from TAPI presentations on 2/13/17 and 2/15/17

FNY follow-up presentations to TAPI Provider Awareness Committee Meeting and TAPI Community Awareness Committee Meeting

4. Slides from FNY Dashboard Meeting on 2/15/17

Campaign summary to FNY Dashboard Meeting

Specific Aim #3: Increase reporting to Flu Near You by Maricopa County residents

As with any surveillance system, participatory surveillance has its challenges. Data quality for FNY will decrease if users do not volunteer time to complete the survey on a weekly basis. Investigators have shown that 110 – 200 weekly users are sufficient to produce a FNY dataset that correlates with ILINet data. [1, 2] To improve and maintain FNY data quality in Maricopa County, we launched a campaign to increase recruitment and retention.

Social media campaign

Facebook and Twitter posts

Most US adults are connected to the internet (84%), a smartphone (64%), Facebook (62%), and / or Twitter (20%). [3-5] Since Maricopa County has over 4 million residents and millions connected to technology, we believed a social media campaign would have great potential. [6] We worked with the MCDPH Web Specialist, Angela Moreth, from the Office of Community Engagement, who manages social media channels for MCDPH.

Our CSTE Applied Epidemiology Fellow, Kaitlyn Sykes, provided Angela with a social media posting schedule based on the “Flu Near You Media Toolkit” file provided on the Flu Near You Basecamp site. We created the hashtag #FluNearYouAZ to help track social media posts from our partners (Figure 1). Angela published these FNY messages every Monday and Thursday from October 17, 2016 through the end of May 2017. Monday messages were intended to remind people to complete their surveys, while Thursday messages provided historical facts about influenza and included the #TBT hashtag (Throwback Thursday). In total, there were 30 messages posted on Mondays and 29 messages posted on Thursdays to both the MCDPH Twitter feed (over 4,500 followers as of May 2017) and MCDPH Facebook page (over 1,850 followers).

Figure 1. Examples of social media posts with the #FluNearYouAZ hashtag



The Arizona Partnership for Immunizations (TAPI) also agreed to post regular messages on behalf of our campaign. TAPI posted a total of 18 messages related to Flu Near You on their Facebook and Twitter pages from November 14, 2017 – May 1, 2017.

We recognized that our social media posts were limited to those who were already following MCDPH or TAPI. Those who chose to follow these public health organizations may not represent the general users of Facebook and Twitter. In order to reach the broader community, we used grant funding to purchase Facebook, Twitter, and Google ads, which were targeted to people within Maricopa County. The objective of these ad campaigns was to increase traffic to the Flu Near You website.

Facebook Ad Campaign

We created a single ad for the campaign that ran from Monday, May 1, 2017 through Wednesday, May 31, 2017, 7 days a week from 4 am until 10 pm (Figure 2). Adults aged 18 to 65+ in Maricopa County cities and towns were targeted. Facebook's marketing service charged us on a per-click basis and placed our customized Flu Near You ad on Facebook, Instagram, and the Audience Network. The Audience network imbeds ads on a variety of mobile apps (apps beyond Facebook and Instagram) and websites. This marketing strategy increased our potential reach from around 1,850 MCDPH Facebook followers to 3,300,000 people in the region.

Figure 2. Flu Near You Facebook ad previews for Facebook desktop and Instagram displays



During May 2017, the Facebook ad campaign was displayed to 50,722 unique people on 81,264 different occasions, which led to 1,122 link clicks (1,075 clicks from unique users; click through rate [CTR] = clicks / impressions = 1.38%; Table 1). The Audience Network reached more unique people and generated more link clicks than Facebook and Instagram (Table 2). Equal proportions of men and women clicked the link (Table 3). Nearly half of the men who clicked the link were between the ages of 18-24 years compared to only a third of the women in the same age group. The ad included a “call-to-action” button (i.e. “Sign up”), which was clicked 21 times.

Table 1. Facebook, Twitter, and Google ad campaign results (as of 5/30/17)

	Impressions*	Results	Amount Spent	Cost per Result
Facebook	81,264	1,122 link clicks	\$498.53	\$0.44 per link click
Twitter	18,106	637 link clicks	\$114.05	\$0.18 per link click
Google	17,209	966 link clicks	\$463.50	\$0.48 per link click

*Impressions: The number of times the ad was viewed

Table 2. Proportion of Facebook users who clicked on the Facebook ad, by age group and gender

	Reach to unique users (N = 50,722)	Link clicks (N = 1,122)
	Approx. N (%)	N (%)
Audience Network	~ 32.1 K (63.4)	973 (86.7)
Facebook	~ 16.5 K (32.6)	135 (12.0)
Instagram	~ 2.9 K (5.7)	14 (1.2)

Table 3. Demographics of individuals who clicked on the Facebook ad, by age group and gender

	Women (N = 556)	Men (N = 563)
	N (%)	N (%)
Age group		
18-24	179 (32.2)	276 (49.0)
25-34	71 (12.8)	87 (15.5)
35-44	58 (10.4)	59 (10.5)
45-54	78 (14.0)	49 (8.7)
55-64	77 (13.8)	49 (8.7)
65+	93 (16.7)	43 (7.6)

Twitter Ad Campaign

The Flu Near You ad created for Twitter (Figure 3) was targeted at those able to understand English in 122 postal codes in Maricopa County. During May 2017, the ad was viewed on 18,106 occasions and was clicked 637 times (CTR = 3.52%). Twitter operates on a pay-per-click basis.

Among the 637 users who clicked the link, 236 were female (37.0%), 83 were male (13.0%), and 317 were unknown gender (49.8%). Twitter did not provide statistics by age group.

Figure 3. Twitter ad preview for desktop display



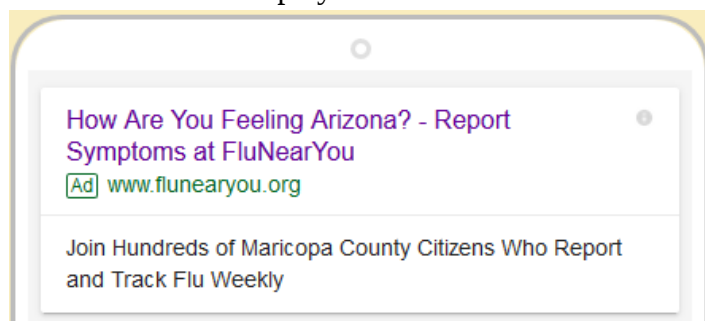
Google AdWords Campaign

Google AdWords is a marketing service that links keywords from Google searches to advertisements. When people in our targeted area performed Google searches with any of the keywords displayed in Table 4, our Google Ad for Flu Near You would appear as one of the first two links. (Figure 4) Our campaign heavily relied on Google searches that included “the flu”.

Table 4. Demographics of individuals who clicked on the Google AdWords ad, by age group and gender

Keyword	Clicks	Impressions	CTR	Avg. CPC	Cost	Avg. Pos.
the flu	689	9,409	7.32%	\$0.50	\$342.53	1.6
flu	80	1,519	5.27%	\$0.50	\$39.77	1.5
flu symptoms	68	1,253	5.43%	\$0.61	\$41.30	2.1
symptoms of the flu	28	399	7.02%	\$0.24	\$6.58	1.7
influenza	14	221	6.33%	\$0.42	\$5.88	1.7
how long does the flu last	13	165	7.88%	\$0.32	\$4.21	1.7
symptoms of flu	11	237	4.64%	\$0.43	\$4.77	1.7
<i>flu season – paused</i>	0	1	0.00%	\$0.00	\$0.00	2.0
<i>flu shot – paused</i>	0	2	0.00%	\$0.00	\$0.00	2.0

Figure 4. Google AdWords ad preview for mobile device display

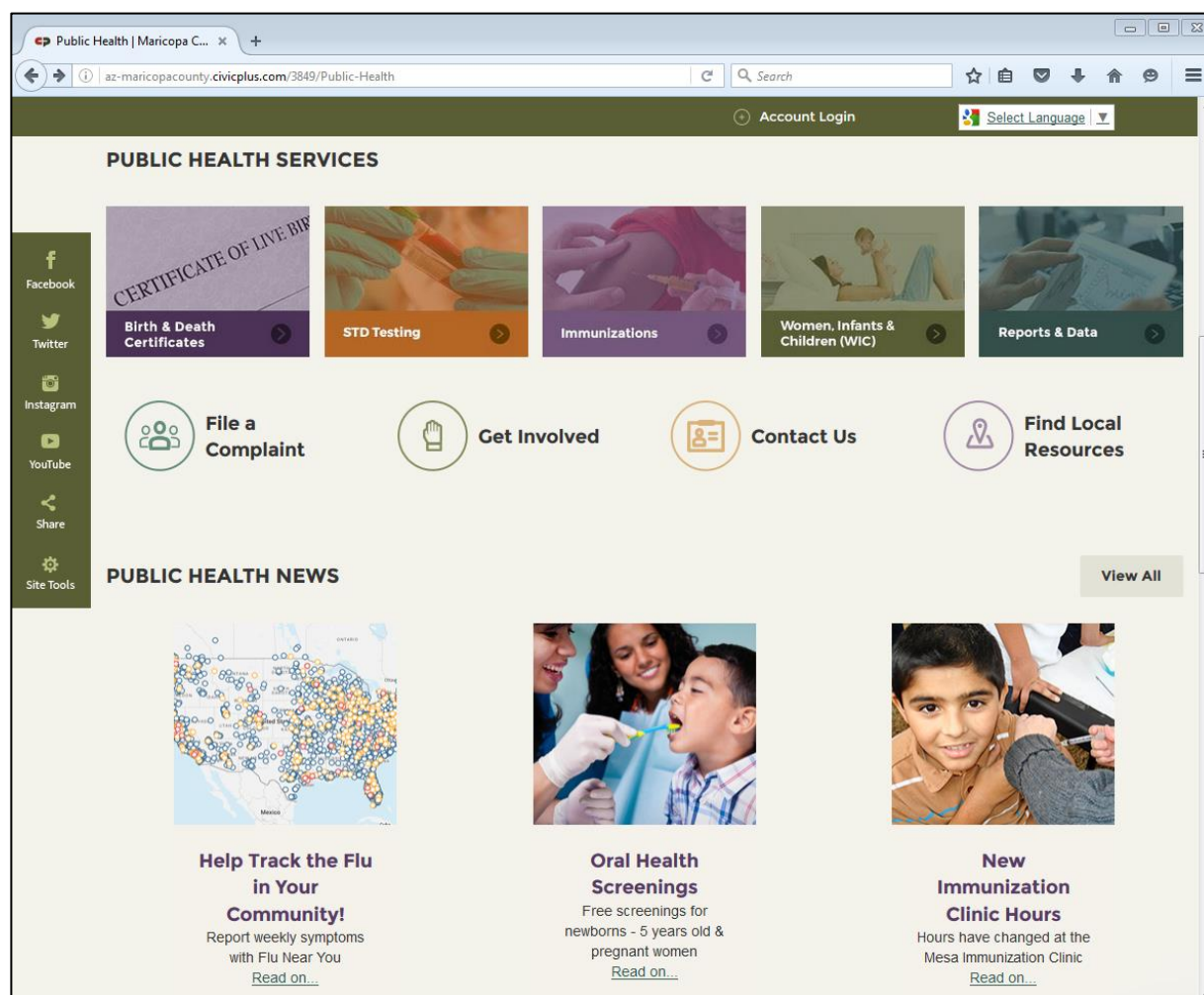


The Google ad was viewed 17,209 times and the link received 966 clicks (CTR = 5.6%). Females contributed to 57% of the clicks, while 21% were male and 21% were unknown gender. The age was unknown for 35% of the clicks. The remaining age group breakdown was: 18-24 years (4%), 25-34 (10%), 35-44 (10%), 45-54 (14%), 55-64 (16%), and 65+ (10%).

MCDPH Website

Our county website was under renovation for much of the influenza season, but in January 2017, it was launched with links to FNY (Figure 5).

Figure 5. Flu Near You mentioned on the MCDPH website



Community and healthcare provider campaigns

Early in the project, we met with leadership from The Arizona Partnership for Immunization (TAPI) (9/22/16 and 10/13/16). MCDPH has worked closely with this organization over the years, and our administration felt that TAPI would be a good partner for promoting FNY.

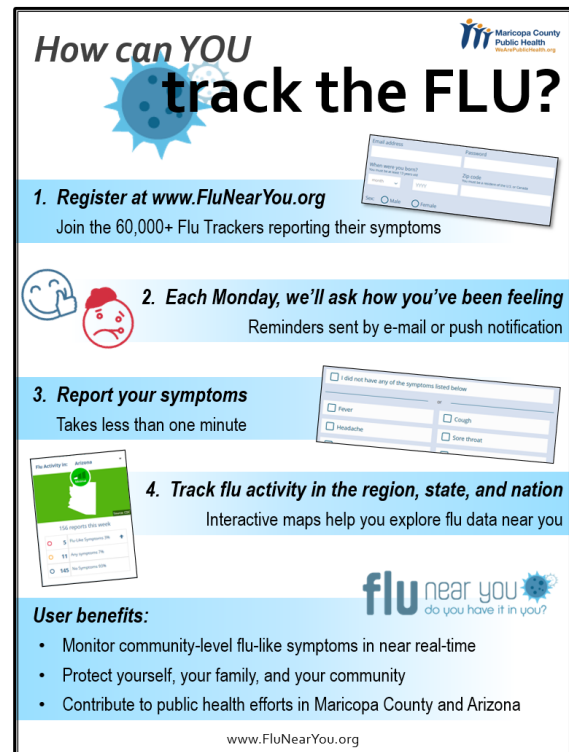
We began our FNY collaboration with TAPI with two presentations. Kaitlyn was asked to present on FNY at TAPI's regularly scheduled Provider Awareness Meeting (10/17/16) and Community Awareness Meeting (10/19/16). The presentation provided basic information about FNY data collection, preliminary analyses from the 2015-16 influenza season, benefits of becoming a regular FNY, and directions on how to register. Following the presentations, we worked closely with Pamelle Easterling, TAPI's Program Manager for Community Partnership, to plan for the distribution of promotional material. Pamelle had reserved a vendor table for TAPI at several events for healthcare providers, and she offered to promote FNY at the events. We were excited for the opportunity to advertise, and created a one-page flyer on standard printing paper, which included an Arizona map and the MCDPH logo (Figure 6).

As shown in Table 5, TAPI (especially Pamelle Easterling) greatly contributed to our FNY promotional campaign in Maricopa County. Their knowledge and connections were invaluable.

Table 5. List of events attended and activities facilitated by TAPI on behalf of FNY

Name of event	Date	Visitors / Attendees	Event type / activity
Banner Health; Innovations in Medicine that are Changing Women's Lives Symposium	9/30-10/1/2016	120-140	Exhibit, disseminate materials
Beginning in October all orders shipped out of TAPI through the end of the year contain FNY enrollment flyers	10/1/2016 – 12/31/2016	unknown	
Pharmacy brainstorming meeting	10/4/2016	12	Meeting, disseminate materials
Meeting with Christine Ditter, Health Educator from ASU	10/6/2016	3	Meeting, presented materials and passed along files
Hard to Reach Populations Call	10/6/2016	unknown	Meeting, gave update and included FNY information

Figure 6. Promotional flyer for FNY



Name of event	Date	Visitors / Attendees	Event type / activity
4th Quarter Immunization Services Meeting (ISM)	10/12/2016	40	Meeting, FNY presentation, disseminate materials
AzNA Symposium 2016	10/14/2016	200+	Exhibit, disseminate materials
Provider Awareness Committee	10/17/2016	25	Meeting, FNY presentation, disseminate materials
Adult/Community Awareness Committee	10/19/2016	25	Meeting, FNY presentation, disseminate materials
2016 Annual Invaluable Medical & Dental Assistant Seminar	10/22/2016	220	Exhibit with information, disseminate materials through conference attendee bags
Beginning in November weekly social media promotion of FNY on Facebook and Twitter	11/1/2016 – 11/30/2016	unknown	
HAI Meeting	11/2/2016	unknown	Infection Prevention Overview, presentation and update on FNY
1st Annual AZ Pediatric Symposium	11/5/2016	50	Exhibit, disseminate materials
Protect You and the Zoo from the Flu - Farm Days	11/5/2016	200	Exhibit, disseminate materials
McChip Executive Committee Meeting	11/9/2016	10	Presented update and disseminated materials
AOMA Fall Seminar	11/12/2016	150 - 175	Exhibit, disseminate materials
Steering Committee Meeting	11/14/2016	33	Meeting, disseminate materials
Adult/Community Awareness Committee	11/16/2016	25	Meeting
Hard to Reach Populations Meeting	11/17/2016	unknown	Meeting, presented update
Hard to Reach Populations Partners Teleconference	12/1/2016		Meeting, presented update
Hard to Reach Populations End of Year Luncheon	12/7/2016	40	Meeting/Hosted disseminated materials
Provider Awareness Committee	12/12/2016	25	Meeting, disseminate materials
Reached out to Pharmacy Association via Kelly Fine on behalf of FNY	12/13/2016		disseminate materials
McChip Executive Committee Meeting	12/14/2016	10	Presented update and disseminated materials
Hard to Reach Populations Meeting	12/15/2016	unknown	Meeting, presented update
Community Awareness Committee	12/21/2016	25	Meeting, Presented update and disseminated materials

Early in the campaign, Pamelle mentioned that a postcard-sized handout may be better suited for mass distribution compared to the 8.5” x 11” flyer on standard paper. Figure 7 shows the updated product.

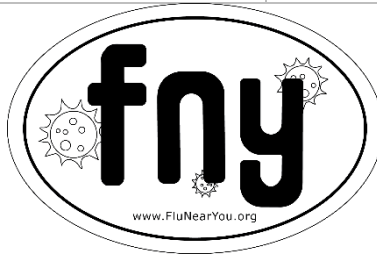
Figure 7. Promotional postcard for FNY



We attended some events with TAPI and found that the vendor table was a great method for interacting with a captive audience. The table gave us an opportunity to greet community members and/or healthcare providers, demo the FNY app, and encourage enrollment onsite. To increase our odds of drawing people to our table, we decided to create numerous FNY-branded products. The following page shows custom images that we created for printing on magnets, stickers, hand sanitizer, foam stress balls, and t-shirts. The bottom 2 images were printed on display stands. By the end of the project period, we had created our own vendor-type display (Figure 8).

Figure 8. FNY vendor table at MCDPH All Hands Meeting





How did you
feel last week?

😊 OR 😞

FluNearYou.org

— 🦠 —
www.FluNearYou.org
— 🦠 —



As we developed our own material and display, we started to sign-up as a vendor for events as we learned about them. We set up a display table at the following events:

- Arizona One Health Exploration Day; sponsored by Arizona Department of Health Services (8/16/16) – high school students
- Protect You & the Zoo from the Flu; sponsored by Arizona Department of Health Services (10/24/16) – families and youth visiting the zoo
- HealthFest; sponsored by Junior League of Phoenix (1/21/17) – youth / families
- School Health Office Educational Series (SHOES) Event; sponsored by MCDPH (2/9/2017) – school nurses
- Maricopa County Department of Public Health All Hands Meeting (5/2/2017) – employees from MCDPH Office of Epidemiology, Office of Preparedness and Response, Community Health Nursing, and Office of Vital Registration

Campaign challenges

Our campaign did face challenges with our proposed plan for recruiting youth by partnering with 4-H and for recruiting community members by setting up display tables in clinics and pharmacies.

We were able to reach the 4-H leader who oversees clubs at a state level. Though she would not provide us with a list of contacts, she was willing to distribute information via the 4-H club leader list serve. We created a letter for club leaders (Figure 9), but did not receive any responses.

We tried to reach a younger population through events such as:

- Arizona One Health Exploration Day; sponsored by Arizona Department of Health Services (8/16/16) – high school students
- Protect You & the Zoo from the Flu; sponsored by Arizona Department of Health Services (10/24/16) – families and youth visiting the zoo
- Chill ‘N Chat (11/7/16) – Arizona State University Downtown Campus nursing students

Figure 9. Letter to 4-H leadership



TAPI provided us with a list of community health clinics and pharmacies. We contacted clinics and pharmacies regarding distribution of FNY promotional materials, but we were not successful in setting up an event. Fortunately, we were able to reach community members at the numerous events previously mentioned.

Conclusions

Creating this promotional campaign was resource intensive. In addition to the monetary resources required for advertising, this effort required a great deal of human capital. We spent a great deal of time planning communication strategies, writing emails to potential partners, scheduling events, designing images, ordering material, attending events, and promoting the app. We found it difficult to identify a suitable intern who could dedicate all of their time to making this campaign a success. The skills required for this work include communications, salesmanship / marketing, graphic design, and event planning, while most people looking for internships in the Office of Epidemiology are not specifically trained in these areas. We believe we now have the right material to carry out a successful campaign, but it took a majority of the project period to get to this point.

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Flu Near You

Kaitlyn Sykes, MPH

Maricopa County Department of Public Health

WwvPublicHealth.org | twitter.com/MaricopaHealth | facebook.com/MCDPH



Objectives

1. Background of public health surveillance
2. Flu Near You
 1. Background
 2. Data collection
 3. Data uses
3. Benefits of registration for Flu Near You
4. How to register for Flu Near You

Public Health Surveillance

- “Continuous, systematic collection, analysis and interpretation of health-related data essential to the planning, implementation, and evaluation of public health practice” (WHO)
- Early warning system
- Detection and notification of health events
- Estimate magnitude and measure trends

Participatory Surveillance

- Collects voluntarily submitted symptom data from the general public in real-time
- Complement to existing systems
- Internet-based participatory surveillance emerging

Flu Near You

- Participatory surveillance system
- Registered users report symptoms using a quick, weekly survey
- Reach community members who do not seek healthcare

Influenza-like illness (ILI) Syndrome

Fever AND at least one of the following: cough or sore throat



Data Collection

flu near you

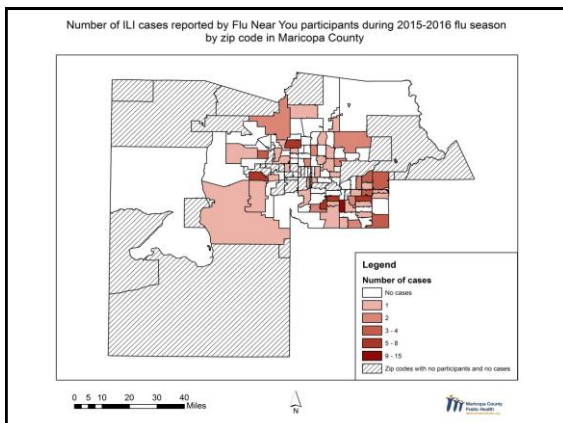
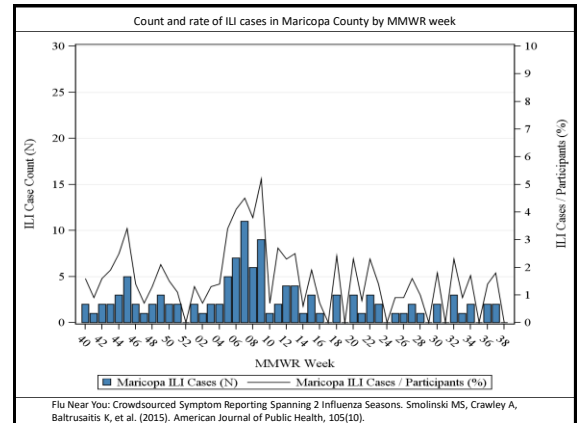
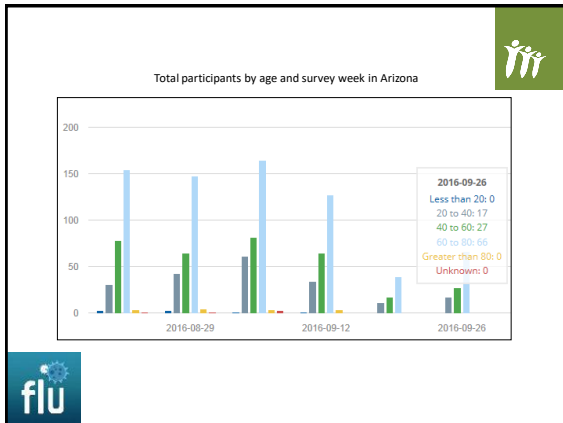
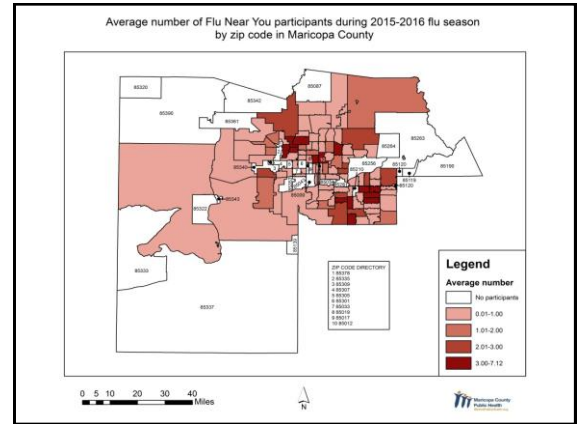
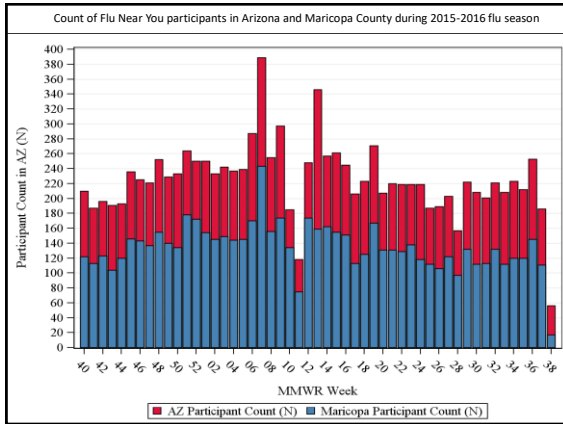


Health Report

Symptoms - (optional)

☐ Did you experience any of these symptoms since last Monday?

☐ Fever	☐ Cough
☐ Headache	☐ Sore throat
☐ Stomach	☐ Body aches
☐ Fatigue	☐ Chills/shivers/night sweats
☐ Nausea or vomiting	☐ Shortness of breath
☐ Rash	☐ Eye pain
☐ Yellow discharge	☐ Joint/muscle pain
☐ Head lightheaded	☐ Dark, tea-colored urine



Why participate in FNY?

- Contribute your data to surveillance
- Access to different benefits
 - Map of ILI symptoms in the US and your region
 - Map of places to receive vaccines
 - Updated news on ILI, vaccines, and more



How to register

<https://flunearyou.org>

This report was supported in part by an appointment to the Applied Epidemiology Fellowship Program administered by the Council of State and Territorial Epidemiologists (CSTE) and funded by the Centers for Disease Control and Prevention (CDC) Cooperative Agreement Number 1U38OT000143-04

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Public Health Scientist | JessicaWhite@mail.maricopa.gov

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Enroll at: flunearyou.org

Oct. 2016

Updates from Flu Near You

Kaitlyn Sykes, MPH



Maricopa County
Department of Public Health

Website: www.maricopahealth.org | Twitter: twitter.com/MaricopaHealth | Facebook: [facebook.com/MaricopaHealth](https://www.facebook.com/MaricopaHealth)

Objectives

1. Review the Flu Near You application
2. Evaluation
 - Timeliness
 - Representativeness
 - Data Quality
3. How to sign up for Flu Near You

Flu Near You

- Participatory surveillance system
- Registered users report symptoms using a quick, weekly survey
- Reach community members who do not seek healthcare

Influenza-like illness (ILI) Syndrome
Fever AND (cough or sore throat)



Data Collection



Health Report

Did you experience any of these symptoms since last Monday?

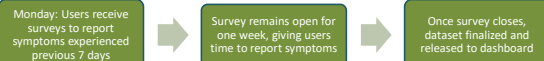
☐ You did not have any of the symptoms listed below

☐ Fever	☐ Cough
☐ Headache	☐ Sore throat
☐ Stomach	☐ Body aches
☐ Fatigue	☐ Chills/rigors/sweats
☐ Nausea or vomiting	☐ Shortness of breath
☐ Rash	☐ Eye pain
☐ Yellow discharge	☐ Joint/muscle pain
☐ Red eyes	☐ Dark, tea-colored urine

Evaluation Methods

- 2015-2016 influenza season
- Data sources:
 - Flu Near You
 - National Syndromic Surveillance Program BioSense Platform
- Attributes:
 - Timeliness
 - Representativeness
 - Data Quality

Timeliness



SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY

Representativeness

Variable		Flu Near You	Census*
Gender	Female	402 (72.3%)	2,108,009 (50.6%)
	Male	154 (27.7%)	2,059,938 (49.4%)
Age Group	16-24 years	14 (2.6%)	286,266 (18.4%)
	25-34 years	64 (11.8%)	288,756 (18.6%)
	35-44 years	98 (18.0%)	268,926 (17.3%)
	45-54 years	98 (18.0%)	258,624 (16.6%)
	55-64 years	152 (27.9%)	209,784 (13.5%)
	65+ years	118 (21.7%)	241,483 (15.5%)

*Census data comes from the "2015 American Community Survey 1-Year Estimates"

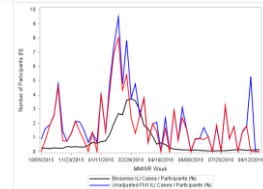
Of the 162 users who reported ILI symptoms, 74 (45.7%) did not seek healthcare.

Data Quality

System Comparison	Pearson Correlation	RMSE	Peak ILI Week
BioSense	1.00	0.00% ILI	2/29/2016 (Week 9)
BioSense vs. Unadjusted FNY	0.65*	1.60% ILI	2/8/2016 (Week 6)
BioSense vs. Adjusted FNY	0.55*	1.51% ILI	2/8/2016 (Week 6)

*Indicates p-value <0.01

Flu Near You and BioSense ILI Rates in Maricopa County
Flu Season 2015-2016



Discussion

- Timely, unique data may complement existing influenza surveillance
- Limitations:**
 - Not representative of Maricopa County residents
 - Inconsistent reporting
- Next steps:**
 - Increase representativeness of FNY users through encouraging enrollment in Maricopa County
 - Evaluate previous influenza seasons

How to register

<https://flunearyou.org>

This report was supported in part by an appointment to the Applied Epidemiology Fellowship Program administered by the Council of State and Territorial Epidemiologists (CSTE) and funded by the Centers for Disease Control and Prevention (CDC) Cooperative Agreement Number 1U38OT000143-04

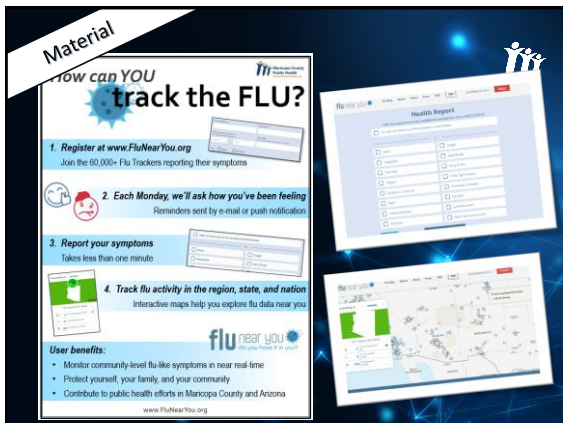
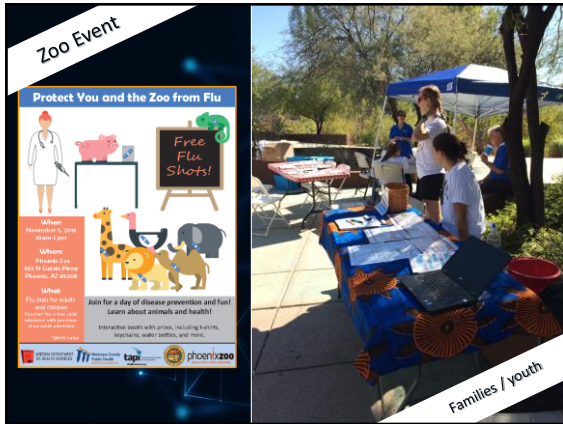


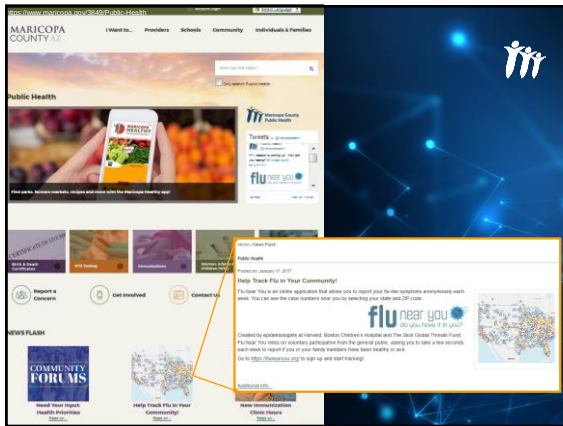
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Jessica White, DrPH, MS, MLS(ASCP)^{CM}, CPH

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Promoting Flu Near You in Maricopa County, Arizona

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Maricopa County Public Health
Vallejo Hall 4th Floor

Specific Aim #4: Develop new analyses for non-ILI FNY data.

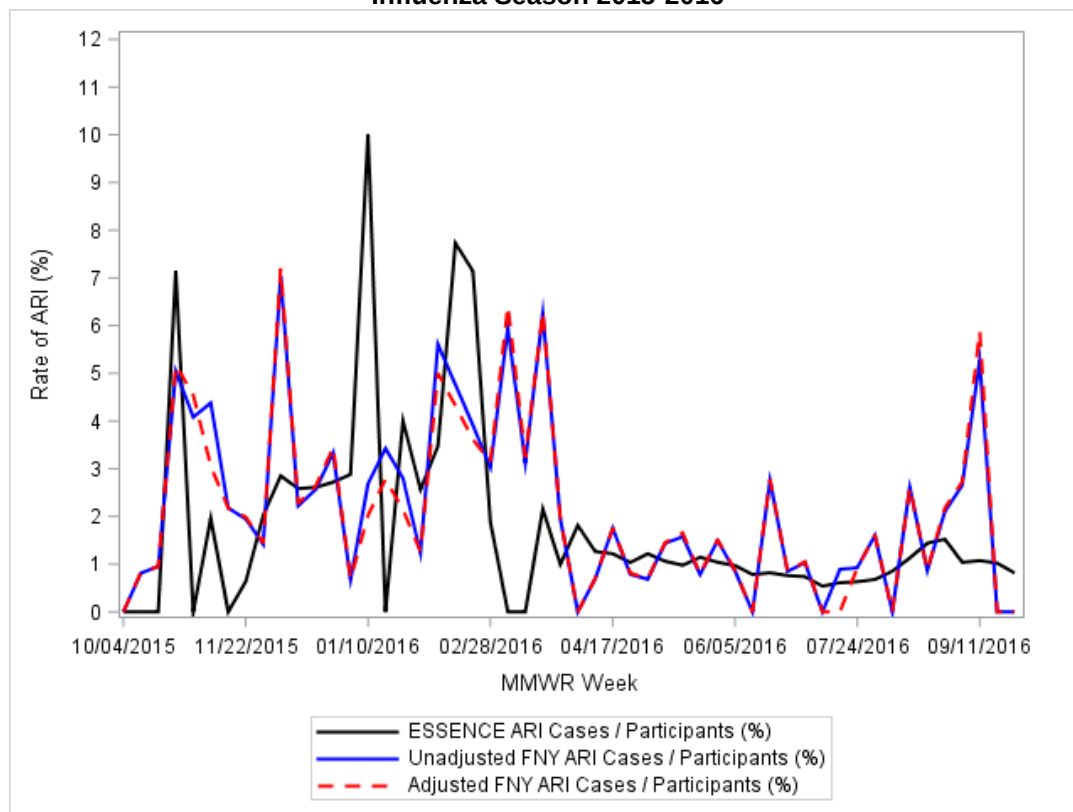
1. Report that shows time series of non-ILI rates and correlations between FNY data and BioSense data (ARI, RSV, fever+rash)
2. Brief report that provides recommendations for using non-ILI syndromes from FNY data

Correlation between Flu Near You and NSSP BioSense acute respiratory illness rates for Maricopa County, AZ

2015-2016 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and the National Syndromic Surveillance Program BioSense Platform from October 2015 to October 2016 (MMWR weeks 2015-40 to 2016-39). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. The definition of ARI in FNY is two respiratory symptoms (cough or sore throat or shortness of breath) and not fever. The definition of ARI in BioSense was an ICD 9-CM code 460 – 466 or an ICD 10-CM code J00 – J06 or J20 – J22. This report aims to assess the correlation of acute respiratory illness rates between the two datasets.

**Figure 1. Flu Near You and BioSense Rates in Maricopa County, AZ
Influenza Season 2015-2016**



**Table 1. System comparison for Flu Near You and BioSense for Maricopa County, AZ
Influenza Season 2015-2016**

System Comparison	Pearson Correlation	RMSE	Peak ARI Week
ESSENCE	1.00000	0.00000% ARI	1/10/2016 (week 2)
ESSENCE vs. Unadjusted FNY	0.37778*	1.69989% ARI	12/6/2015 (week 49)
ESSENCE vs. Adjusted FNY	0.31407**	1.75829% ARI	12/6/2015 (week 49)

*Indicates p-value <0.01

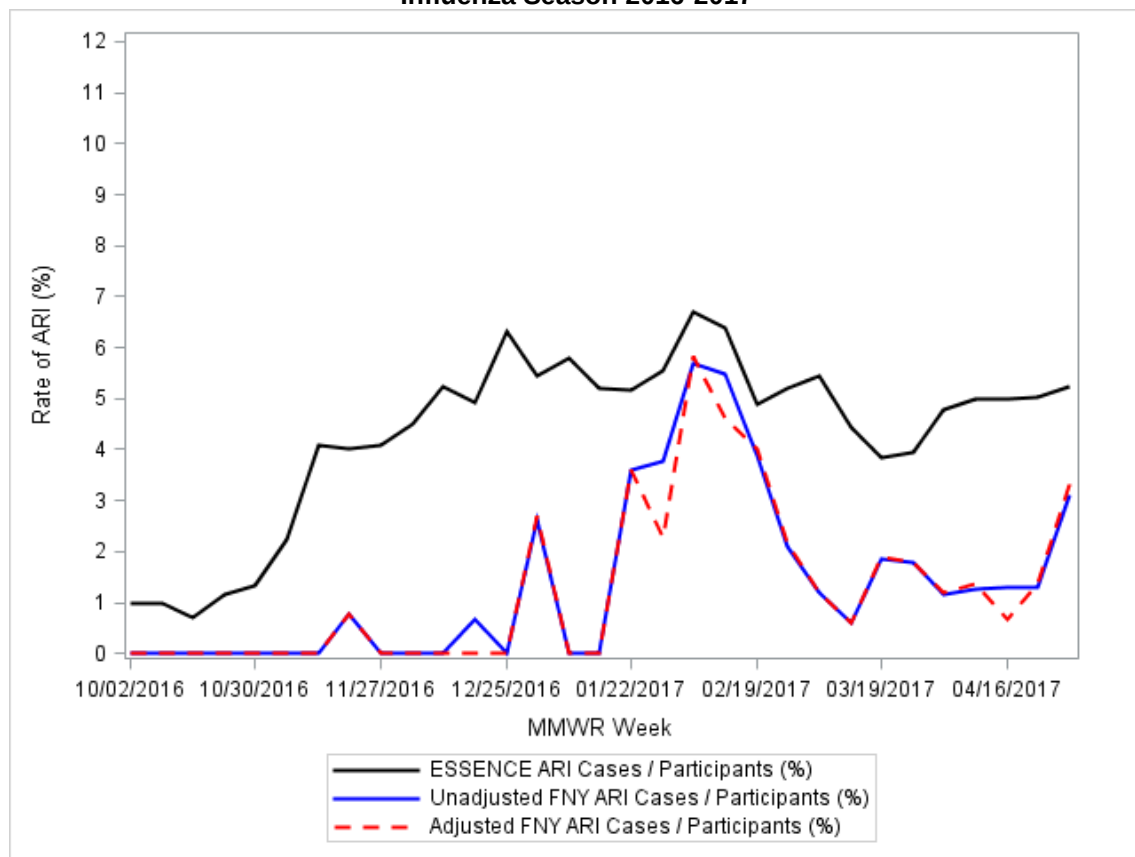
**Indicates p-value <0.05

Correlation between Flu Near You and NSSP BioSense acute respiratory illness rates for Maricopa County, AZ

2016-2017 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and the National Syndromic Surveillance Program BioSense Platform from October 2016 to May 2017 (MMWR weeks 2016-40 to 2017-18). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. The definition of ARI in FNY is two respiratory symptoms (cough or sore throat or shortness of breath or running nose) and not fever. The definition of ARI in BioSense was an ICD 9-CM code 460 – 466 or an ICD 10-CM code J00 – J06 or J20 – J22. This report aims to assess the correlation of acute respiratory illness rates between the two datasets.

**Figure 1. Flu Near You and ESSENCE Rates in Maricopa County, AZ
Influenza Season 2016-2017**



**Table 1. System comparison for Flu Near You and ESSENCE for Maricopa County, AZ
Influenza Season 2016-2017**

System Comparison	Pearson Correlation	RMSE	Peak ARI Week
ESSENCE	1.00000	0.00000% ARI	2/5/2017 (week 6)
ESSENCE vs. Unadjusted FNY	0.54433*	1.42986% ARI	2/5/2017 (week 6)
ESSENCE vs. Adjusted FNY	0.52318*	1.39424% ARI	2/5/2017 (week 6)

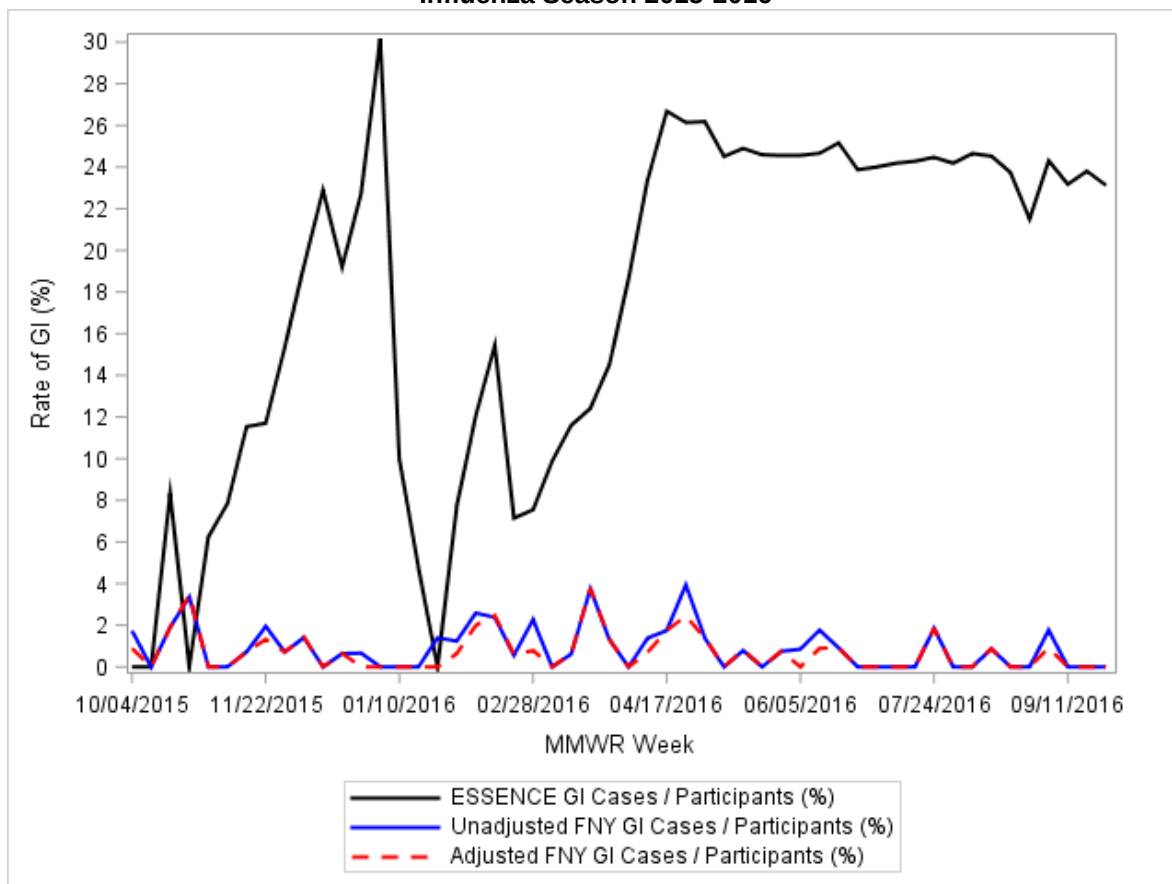
*Indicates p-value <0.01

Correlation between Flu Near You and NSSP BioSense gastrointestinal illness rates for Maricopa County, AZ

2015-2016 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and the National Syndromic Surveillance Program BioSense Platform from October 2015 to October 2016 (MMWR weeks 2015-40 to 2016-39). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. The definition of gastrointestinal illness in FNY is nausea and diarrhea. The definition of gastrointestinal illness in BioSense is the built in query (see appendix). This report aims to assess the correlation of gastrointestinal illness rates between the two datasets.

**Figure 1. Flu Near You and BioSense Rates in Maricopa County, AZ
Influenza Season 2015-2016**



**Table 1. System comparison for Flu Near You and BioSense for Maricopa County, AZ
Influenza Season 2015-2016**

System Comparison	Pearson Correlation	RMSE	Peak GI Week
ESSENCE	1.00000	0.00000% GI	1/3/2016 (week 1)
ESSENCE vs. Unadjusted FNY	-0.20838	1.03292% GI	4/24/2016 (week 17)
ESSENCE vs. Adjusted FNY	-0.16794	0.91434% GI	3/20/2016 (week 12)

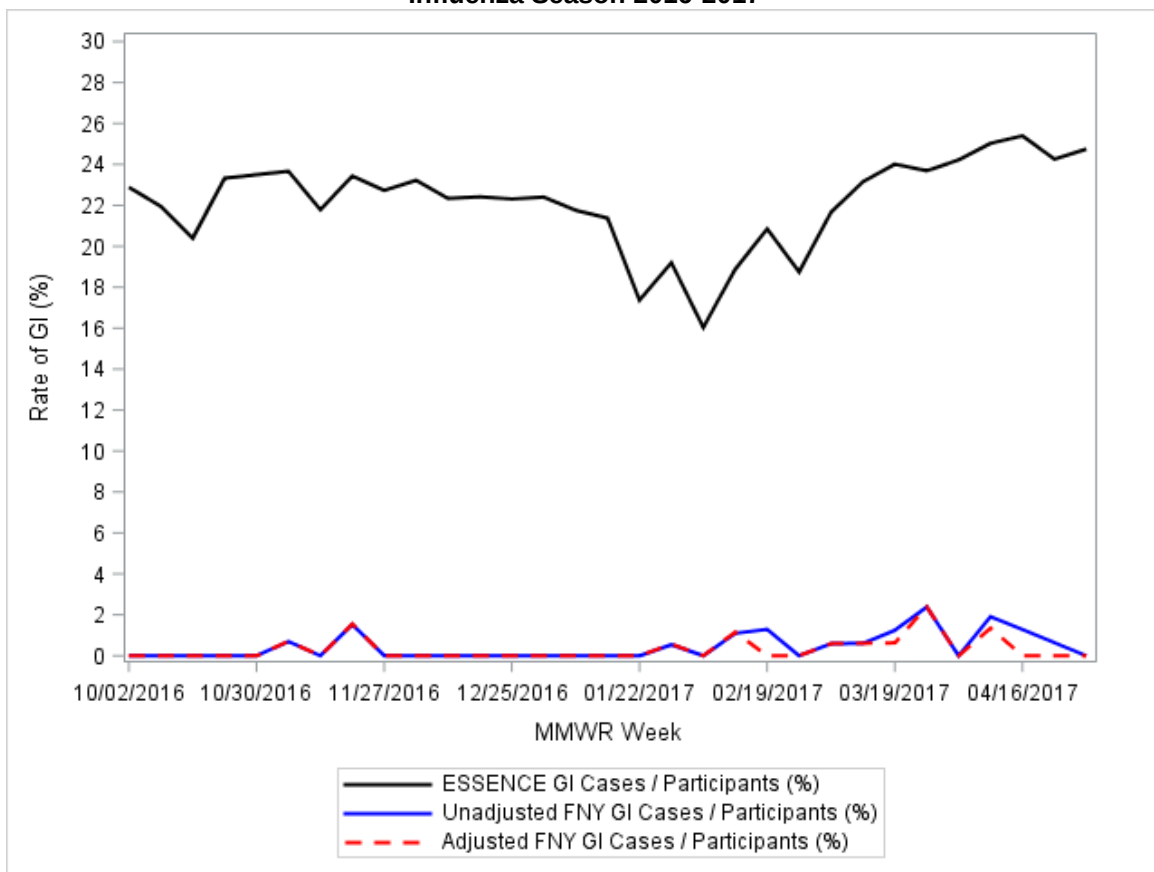
*Indicates p-value <0.01

Correlation between Flu Near You and NSSP BioSense gastrointestinal illness rates for Maricopa County, AZ

2016-2017 Influenza Season

The following report summarizes data captured from the Flu Near You participatory surveillance application and the National Syndromic Surveillance Program BioSense Platform from October 2016 to May 2017 (MMWR weeks 2016-40 to 2017-18). The adjusted Flu Near You rate removed one-time users of the application from the dataset for analysis. The definition of gastrointestinal illness in FNY is nausea and diarrhea. The definition of gastrointestinal illness in BioSense is the built in query (see appendix). This report aims to assess the correlation of gastrointestinal illness rates, defined as nausea and diarrhea, between the two datasets.

**Figure 1. Flu Near You and ESSENCE Rates in Maricopa County, AZ
Influenza Season 2016-2017**



**Table 1. System comparison for Flu Near You and ESSENCE for Maricopa County, AZ
Influenza Season 2016-2017**

System Comparison	Pearson Correlation	RMSE	Peak GI Week
ESSENCE	1.00000	0.00000% GI	4/16/2017 (week 16)
ESSENCE vs. Unadjusted FNY	0.30064	0.64987% GI	3/26/2017 (week 13)
ESSENCE vs. Adjusted FNY	0.17039	0.58713% GI	3/26/2017 (week 13)

*Indicates p-value <0.01

Appendix. Binning algorithm for gastrointestinal illness in BioSense

AbdominalPain		
ABDOMINAL (4)	ACHE (2)	ACHING (2)
ADBOMEN (4)	BELLY (4)	BELLYACHE (6)
BURNING (2)	EPIGASTRIC (4)	GASTRIC (4)
HURTING (2)	HURTS (2)	PAIN (2)
PAINFUL (2)	QUADRANT (4)	STOMACH (4)
STOMACHEACHE (6)	TUMMY (4)	
Bloating		
ABDOMEN (2)	ABDOMINAL (2)	BELLY (2)
BLOAT (4)	BLOATED (10)	BLOATING (10)
CHEMICAL (-6)	CHLORINE (-6)	DISTENDED (4)
DISTENTION (4)	EXPOSED (-6)	EXPOSURE (-6)
FLATULENCE (6)	FLATULENT (6)	FUEL (-6)
FUMES (-6)	GAS (6)	GAS IN (-6)
GASEOUS (6)	GASSINESS (6)	GASSY (6)
GASTRIC (2)	INGESTED (-6)	INGESTION (-6)
INHALATION (-6)	INHALE (-6)	INHALED (-6)
INHALING (-6)	LEAK (-6)	LIQUID (-6)
METHANE (-6)	NATURAL GAS (-6)	POISON (-6)
POISONED (-6)	POISONING (-6)	POISONOUS (-6)
PUMP (-6)	QUADRANT (2)	SIP (-6)
SPILL (-6)	SPILLED (-6)	SPILLING (-6)
SPLASHED (-6)	STOMACH (2)	TANK (-6)
TOXIC (-6)	TOXIN (-6)	TUMMY (2)
Gastroenteritis		
GASTROENTERITIS (10)		
GIBleeding		
BELLY (4)	BELLY ACHE (-4)	BELLY PAIN (-4)
BLACK (2)	bled (2)	BLEED (2)
BLEEDING (2)	BLOOD (2)	BLOOD PRESSURE (-2)
BLOOD SUGAR (-2)	BLOODY (2)	BOWEL (4)
DIARRHEA (4)	FECAL (4)	FECES (4)
GASTROINTESTINAL (4)	HEMATOCHEZIA (6)	HEMORRHAGE (2)
HEMORRHAGING (2)	INTESTINAL (4)	INTESTINE (4)
MELENA (6)	RECTAL (4)	RECTUM (4)
STOMACH (4)	STOMACH ACHE (-4)	STOMACH PAIN (-4)
STOOL (4)	TARRY (2)	TOILET PAPER (4)
VOIDED (4)		
LossOfAppetite		
ANOREXIA (10)	APPETITE (10)	CANT (2)
COULDNT (2)	DECREASED (3)	DIDNT (2)
EATEN (4)	EATING (4)	FOOD (3)
HASNT (2)	HAVENT (2)	HUNGRY (3)
NERVOSA (-10)	NO (3)	NOT (3)
WONT (2)	WOULDNT (2)	
NVD		
Nausea		
GAGGING (6)	NAUS* (10)	NAUSEA (10)
QUEASINESS (6)	QUEASY (6)	RETCHING (6)
SICK (3)	STOMACH (3)	UNSETTLED (3)
UPSET (3)		
Vomiting		

BARF (10)	BARFED (10)	BARFING (10)
CANT (2)	DOWN (2)	DRY HEAVES (10)
EMESIS (10)	HEMATEMESIS (10)	HYPEREMESIS (10)
KEEP (2)	KEEPING (2)	NOT (2)
SPIT UP (10)	SPITTING UP (10)	THREW UP (10)
THROW UP (10)	THROWING UP (10)	UNABLE (2)
UPCHUCK (10)	VOMIT* (10)	
Diarrhea		
DIA*A (10)	DIA*AH (10)	DIARRHEA (10)
LOOSE (3)	RUNNING (3)	RUNNY (3)
RUNS (6)	STOOL (3)	STOOLS (3)
WATERY (3)		
FoodPoisoning		
FOOD POISON (10)	FOOD POISONED (10)	FOOD POISONING (10)
ALLERGY (-20)	ALLERGIC (-20)	CIGUATERA (10)
SHELLFISH (10)		

Evaluation of non-ILI syndromes in the Flu Near You application in Maricopa County, Arizona

Introduction

Flu Near You is a participatory surveillance system that aims to collect weekly symptom data in order to track influenza-like illness (ILI) in the U.S. and Canada. In the future, Flu Near You developers hope to rebrand the application and track other syndromes in addition to ILI. With this in mind, the Maricopa County Department of Public Health (MCDPH) analyzed potential syndromes that could be utilized within FNY data.

Methods

To begin, Table 1 was created to determine frequencies of symptoms reported each year.

Table 1. Frequencies of symptoms reported in Flu Near You in Maricopa County, AZ 2011-2012 through 2015-2016 influenza seasons

Symptom	2011-2012 Season	2012-2013 Season	2013-2014 Season	2014-2015 Season	2015-2016 Season
Fever	26	289	171	161	202
Diarrhea	44	184	147	115	127
Chills	31	269	165	152	155
Nausea	33	183	123	128	127
Cough	141	681	383	401	385
Sore throat	96	485	353	303	318
Body ache	79	412	242	214	262
Headache	112	492	303	273	331
Fatigue	101	551	324	299	359
Breath	52	185	95	94	128
Rash	0	0	0	0	9
Red eyes	0	0	0	0	27
Joint pain	0	0	0	0	52
Eye pain	0	0	0	0	29
Dark urine	0	0	0	0	10
Yellow eyes	0	0	0	0	3

Based on the frequencies reported in Table 1, two syndromes were identified as potential syndromes for analysis: gastrointestinal illness (GI) and acute respiratory illness (ARI). Both syndromes were analyzed using the correlation of GI and ARI trends from FNY and BioSense by calculating the Pearson correlation statistics, root mean square error (RMSE), and the peak rate weeks.

Results

Gastrointestinal illness (GI)

Using Flu Near You data, we defined gastrointestinal illness as nausea AND diarrhea. In National Syndromic Surveillance (NSSP) BioSense, GI was defined using the syndrome built into the platform, which is (abdominal pain OR bloating OR gastroenteritis OR GI bleeding OR loss of appetite OR NVD OR food poisoning).

FNY GI data did not significantly correlate with BioSense GI data, as displayed in Table 2. GI did not follow a trend in either dataset, and the resulting peak GI weeks were not an early indication in FNY compared to BioSense.

Acute Respiratory Illness (ARI)

We defined ARI as 2 or more respiratory symptoms (cough OR sore throat OR shortness of breath) ANDNOT fever in Flu Near You. In BioSense, ARI was defined as having a discharge diagnosis with the following codes:

- ICD 9-CM: 460 – 466
- ICD 10-CM: J00 – J06 OR J20 – J22

As shown in Table 3, FNY ARI data correlated significantly with BioSense ARI data, indicating good data quality. In the 2015-2016 influenza season, FNY detected a peak 5 weeks prior to BioSense, but in the 2016-2017 season both FNY and BioSense data peaked during the same week.

Conclusions

Limitations

During the grant period, MCDPH transitioned from the NSSP BioSense Platform to ESSENCE (January 2017). With this transition, we lost access to the BioSense 2.0, and continue to wait for access to legacy data. Due to a lack of ESSENCE legacy data, it was not possible to analyze data reliably prior to April 2016.

During the 2016-2017 influenza season, FNY experienced poor data quality, losing a majority of the data reported from users from September 2016 through January 2017.

Future use

Based on results of the correlation analysis, we do not recommend using this GI syndrome for use in FNY data within Maricopa County. ARI could be a potential syndrome to utilize in the FNY dataset, but further analysis should be done when legacy data become available in ESSENCE.

With the name of the application being “Flu Near You” it is possible that Maricopa County users were biased to report only flu-related symptoms, leading to a potential explanation of the low case count of users reporting GI syndrome. With rebranding of the application, the bias may be eliminated, making it possible to evaluate and use other syndromes in the future.

Table 2. System comparison for Flu Near You and BioSense GI for Maricopa County, AZ
2015-2016 and 2016-2017 Influenza Seasons

System Comparison	2015-2016 Influenza Season			2016-2017 Influenza Season		
	Pearson Correlation	RMSE	Peak GI Week	Pearson Correlation	RMSE	Peak GI Week
ESSENCE	1.00	0.00% GI	1/3/2016 (week 1)	1.00	0.00% GI	4/16/2017 (week 16)
ESSENCE vs. Unadjusted FNY	-0.21	1.03% GI	4/24/2016 (week 17)	0.30	0.65% GI	3/26/2017 (week 13)
ESSENCE vs. Adjusted FNY	-0.17	0.91% GI	3/20/2016 (week 12)	0.17	0.59% GI	3/26/2017 (week 13)

*Indicates p-value<0.01

**Indicates p-value<0.05

Table 3. System comparison for Flu Near You and BioSense ARI for Maricopa County, AZ
2015-2016 and 2016-2017 Influenza Seasons

System Comparison	2015-2016 Influenza Season			2016-2017 Influenza Season		
	Pearson Correlation	RMSE	Peak ARI Week	Pearson Correlation	RMSE	Peak ARI Week
ESSENCE	1.00	0.00% ARI	1/10/2016 (week 2)	1.00	0.00% ARI	2/5/2017 (week 6)
ESSENCE vs. Unadjusted FNY	0.38*	1.70% ARI	12/6/2015 (week 49)	0.54*	1.43% ARI	2/5/2017 (week 6)
ESSENCE vs. Adjusted FNY	0.31**	1.76% ARI	12/6/2015 (week 49)	0.52*	1.39% ARI	2/5/2017 (week 6)

*Indicates p-value<0.01

**Indicates p-value<0.05