

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

Accuracy of 2017–2018 Influenza Season Forecasting Challenge

US National and Regional Competition

Scott Dahlgren
CDC

Influenza Applied Research and Modeling Team
iot0@cdc.gov

August 30, 2018

ILINet Overview

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

- Health care providers count
 - outpatient visits and
 - outpatients with influenza-like illness (ILI)
- CDC
 - tabulates these counts each week,
 - weights the counts from each state,
 - aggregates the counts into % ILI for each week, and
 - publishes % ILI online each Friday.

ILINet Overview

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

- Baseline % ILI is 2.2% nationally, but varies by region
- Previously published % ILI are updated each week
 - health care providers update numerator and denominator after deadline
 - can change previously published values
 - this process is known as backfill

Forecasting Overview

Targets

What are the forecasting targets?

- Season Onset
 - First week above baseline that
 - stays above baseline for 3 weeks
- Season Peak Percentage: the highest % ILI of the season
- Season Peak Week: the week with highest % ILI of the season
- 1 week ahead: the % ILI published in 4 days
- 2 week ahead: the % ILI published in 11 days
- 3 week ahead: the % ILI published in 18 days
- 4 week ahead: the % ILI published in 25 days

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

Forecasting Overview

Competition Calendar

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

When are the forecasts collected?

- Seasonal influenza starts on week 40 and ends on week 39 the following year (October to September)
- CDC collects forecasts for week 43 through week 18 (November to May)

Forecasting Overview

Geography

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

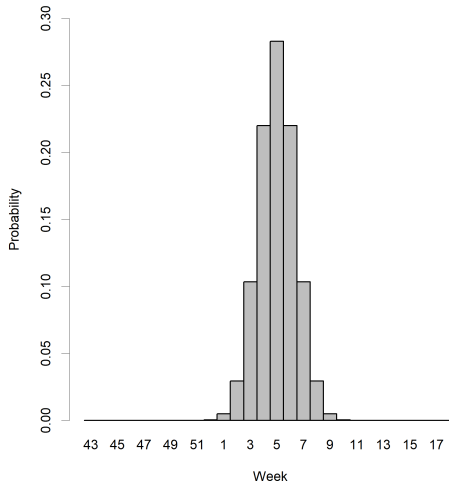
Acknowledge

What are the areas for the forecasts?

- The United States and
- HHS Regions: groups of states

Forecasting Overview

Scoring Example



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

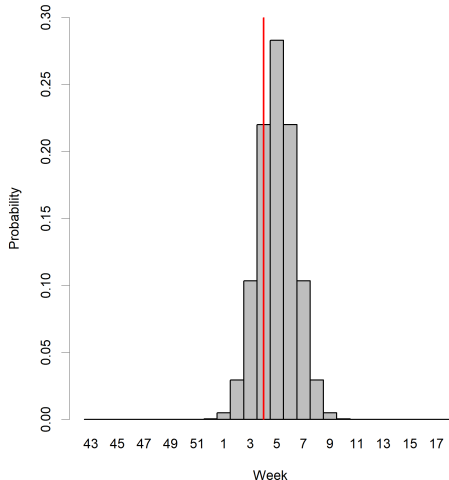
Conclusions

Acknowledge

Forecasting Overview

Scoring Example

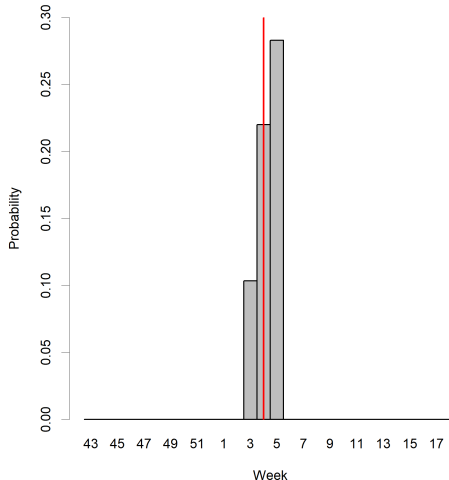
Scored against % ILI published on week 28



Forecasting Overview

Scoring Example

Scored against % ILI published on week 28



Forecasting Overview

Scoring

Score:

$$s = \log(p(x_3) + p(x_4) + p(x_5))$$

$$s = \log(0.103 + 0.220 + 0.283)$$

$$s = \log(0.606)$$

$$s = -0.500$$

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

Forecasting Overview

Scoring

Score:

$$s = \log(p(x_3) + p(x_4) + p(x_5))$$

$$s = \log(0.103 + 0.220 + 0.283)$$

$$s = \log(0.606)$$

$$s = -0.500$$

Except, we want to place a lower bound on our scores:

$$s = \max\{-10, \log(p(x_3) + p(x_4) + p(x_5))\}$$

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

Forecasting Overview

Scoring

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

Average Score

$$s = \frac{s_1 + s_2 + \dots + s_n}{n}$$

Forecasting Overview

Scoring

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

Skill:

$$\sigma = e^s$$

$$\sigma = p(x_3) + p(x_4) + p(x_5)$$

$$\sigma = 0.103 + 0.220 + 0.283$$

$$\sigma = 0.606$$

Forecasting Overview

Scoring

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

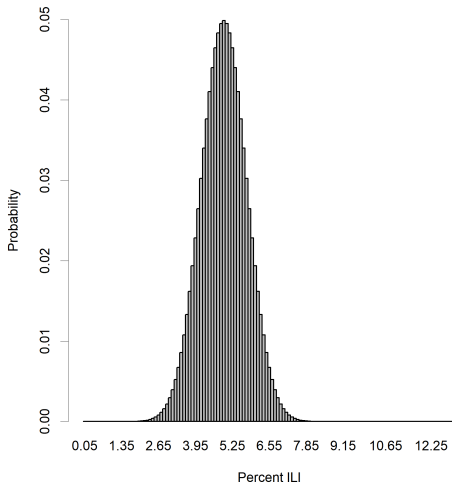
Average Skill

$$\sigma = e^s$$

$$\sigma = e^{\left(\frac{s_1 + s_2 + \dots + s_n}{n}\right)}$$

Forecasting Overview

Scoring Example



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

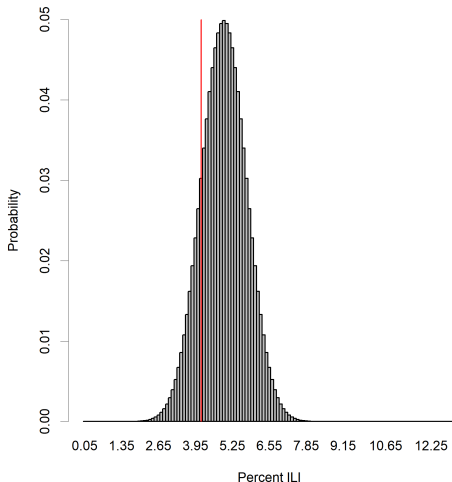
Conclusions

Acknowledge

Forecasting Overview

Scoring Example

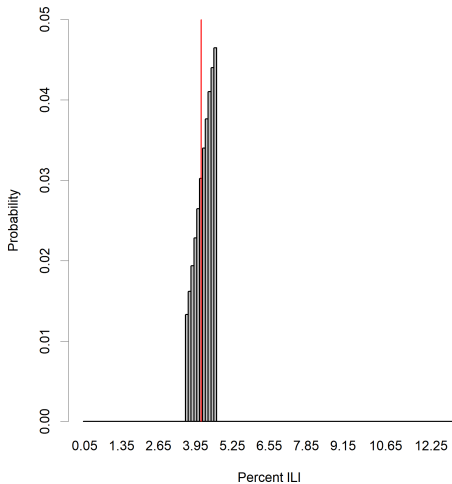
Scored against 4.2% ILI



Forecasting Overview

Scoring Example

Scored against 4.2% ILI



Forecasting Overview

Scoring

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

We only consider scores in the evaluation period.
The evaluation period is specific to each target.

- Season Onset
 - Starts with week 43
 - Ends 6 weeks after season onset
- Season Peak Week and Peak Percentage
 - Starts with week 43
 - Ends after ILI goes below baseline
- 1, 2, 3, and 4 weeks ahead
 - Starts 4 weeks before ILI goes above baseline
 - Ends 3 weeks after ILI goes below baseline

Forecasting Overview

CDC Models

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

- Historical Average: smoothed average of past seasons
- Average Forecast: simple average of teams' forecasts

US National

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

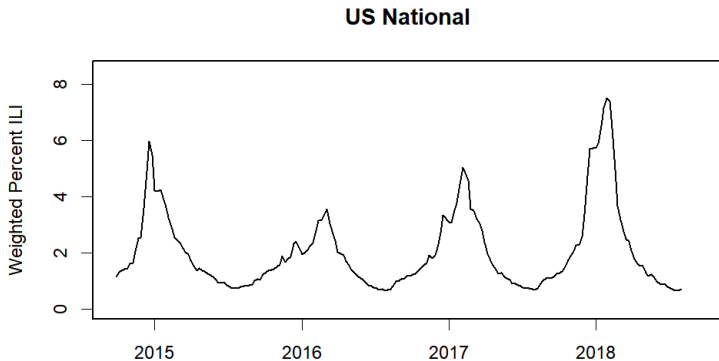
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



US National

Season onset

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

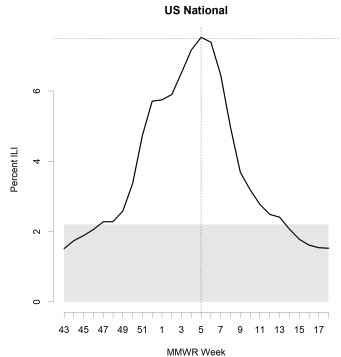
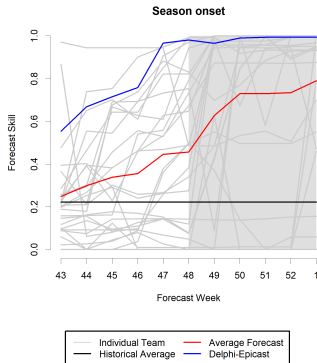
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

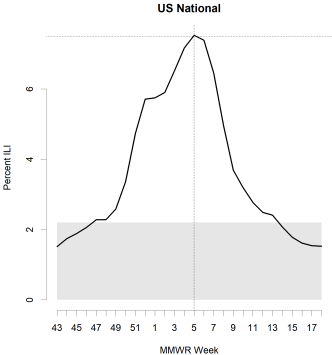
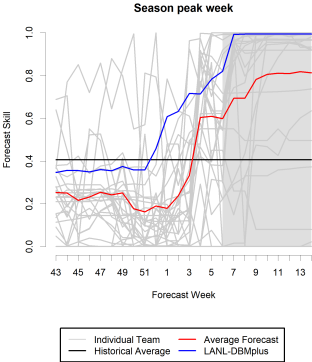
HHS Region 10

Conclusions

Acknowledge

US National

Season peak week



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

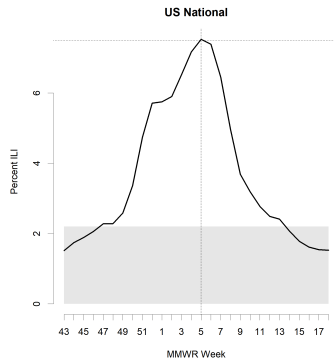
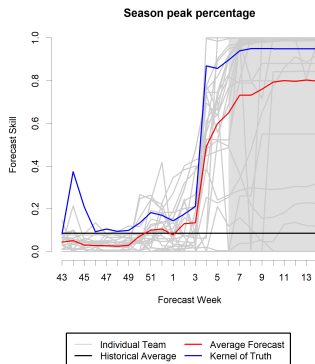
HHS Region 10

Conclusions

Acknowledge

US National

Season peak percentage



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

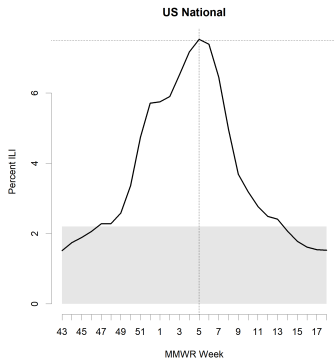
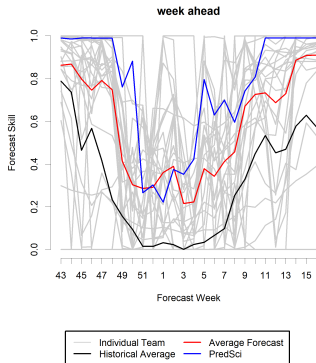
HHS Region 10

Conclusions

Acknowledge

US National

1 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

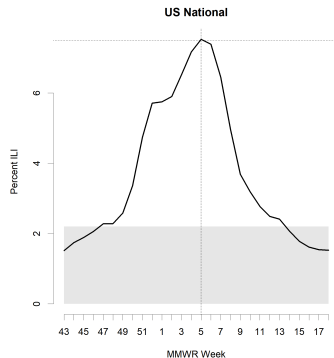
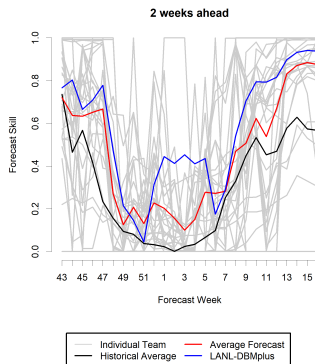
HHS Region 10

Conclusions

Acknowledge

US National

2 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

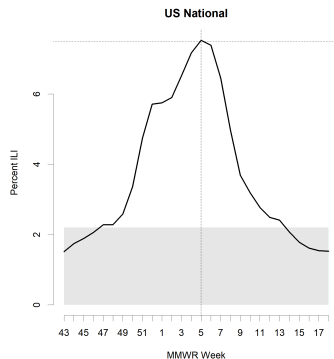
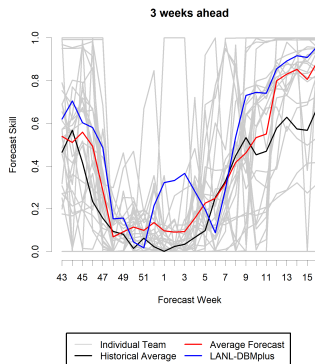
HHS Region 10

Conclusions

Acknowledge

US National

3 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

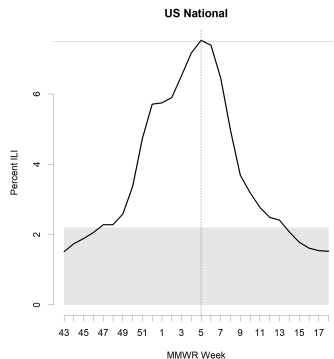
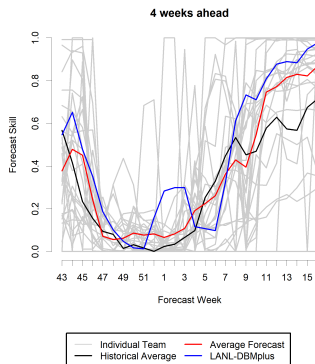
HHS Region 10

Conclusions

Acknowledge

US National

4 wk ahead



HHS Region 1

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

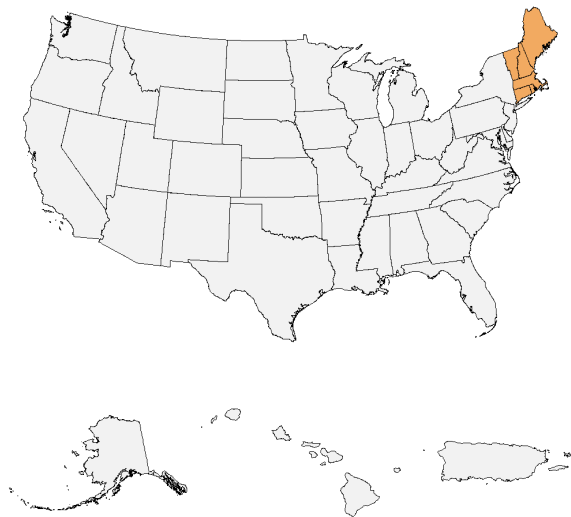
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



HHS Region 1

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

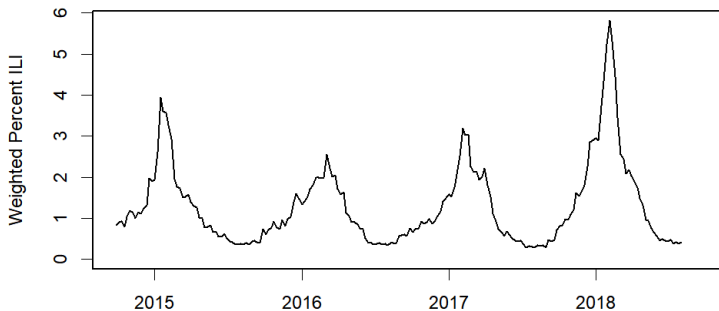
HHS Region 9

HHS Region 10

Conclusions

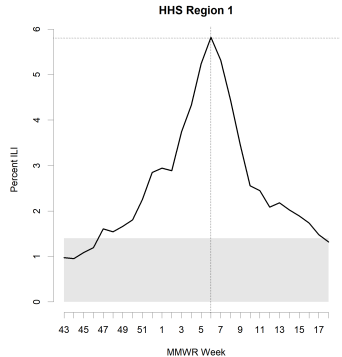
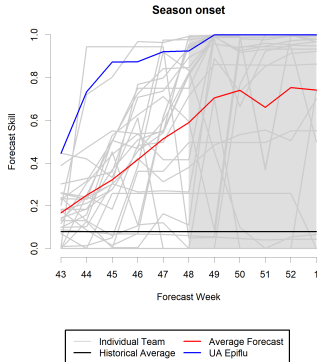
Acknowledge

Region 1



HHS Region 1

Season onset



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

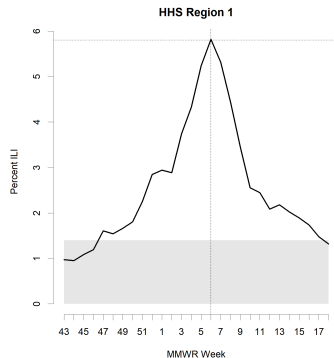
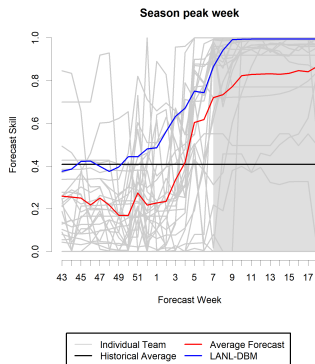
HHS Region 10

Conclusions

Acknowledge

HHS Region 1

Season peak week



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

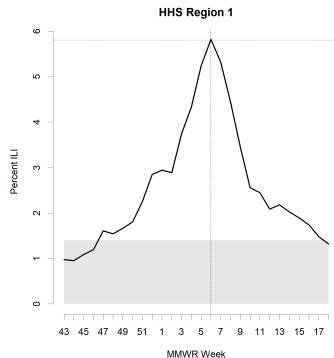
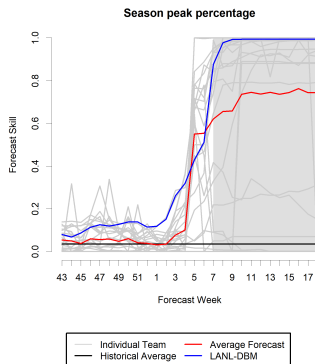
HHS Region 10

Conclusions

Acknowledge

HHS Region 1

Season peak percentage



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

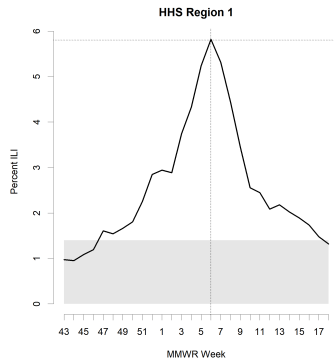
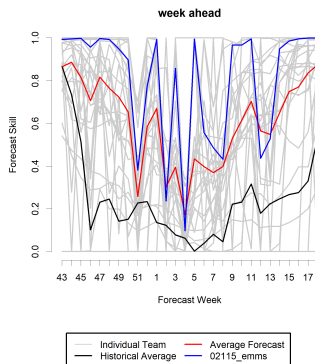
HHS Region 10

Conclusions

Acknowledge

HHS Region 1

1 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

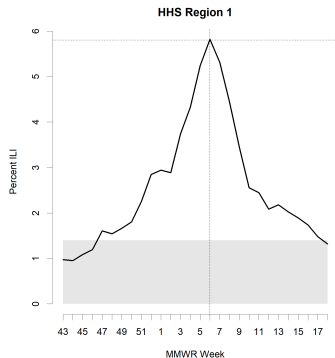
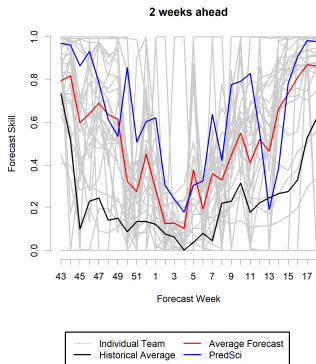
HHS Region 10

Conclusions

Acknowledge

HHS Region 1

2 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

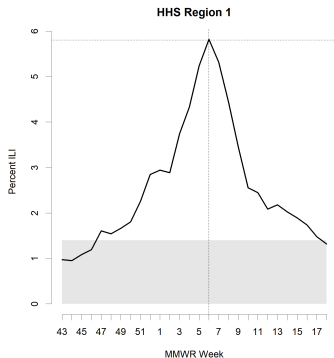
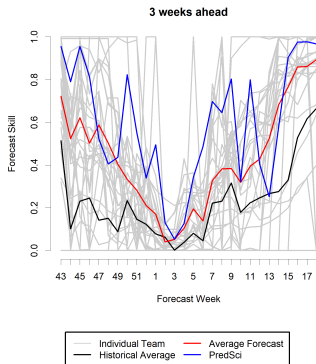
HHS Region 10

Conclusions

Acknowledge

HHS Region 1

3 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

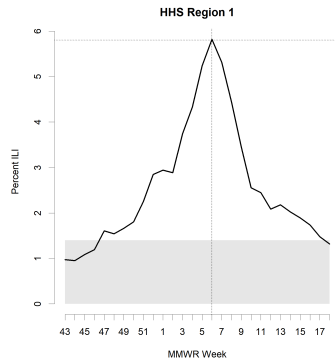
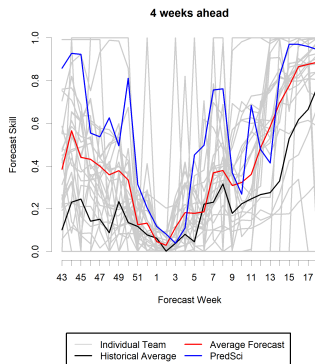
HHS Region 10

Conclusions

Acknowledge

HHS Region 1

4 wk ahead



HHS Region 2

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

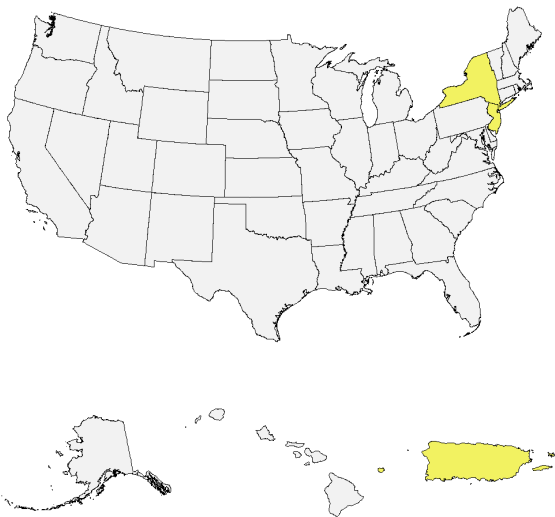
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



HHS Region 2

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

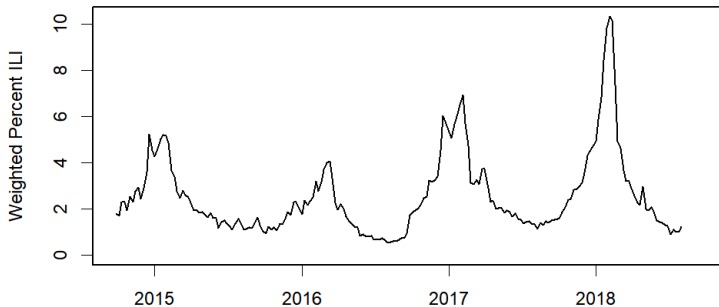
HHS Region 9

HHS Region 10

Conclusions

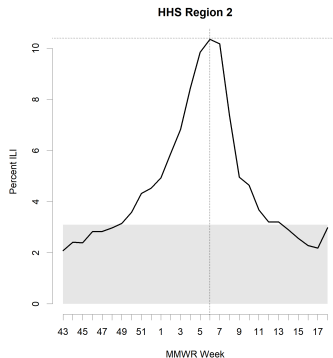
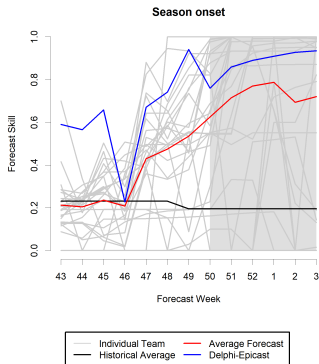
Acknowledge

Region 2



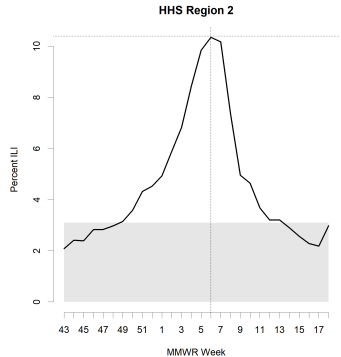
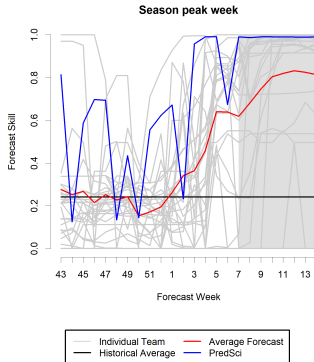
HHS Region 2

Season onset



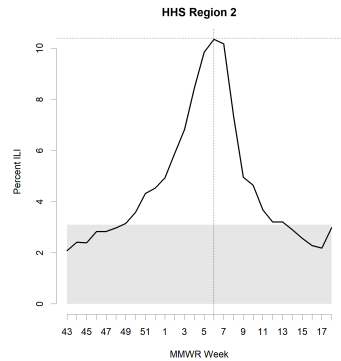
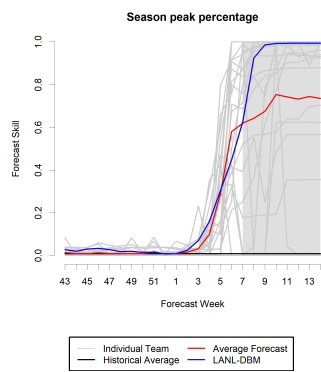
HHS Region 2

Season peak week



HHS Region 2

Season peak percentage



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

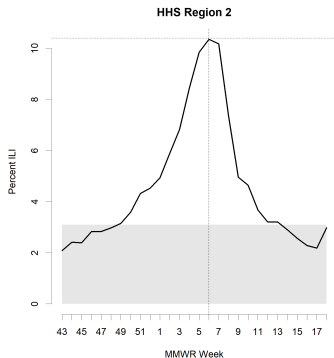
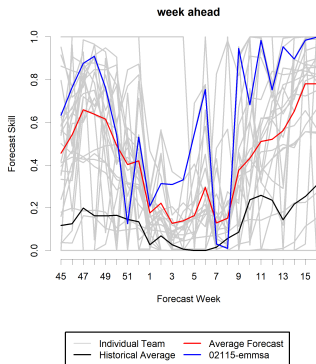
HHS Region 10

Conclusions

Acknowledge

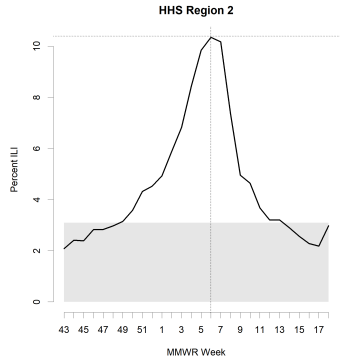
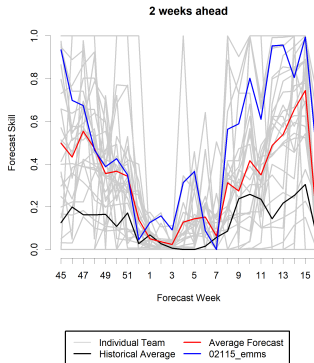
HHS Region 2

1 wk ahead



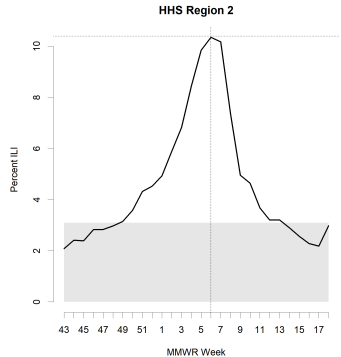
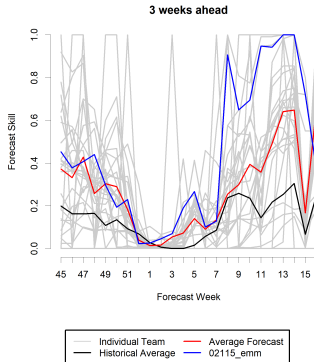
HHS Region 2

2 wk ahead



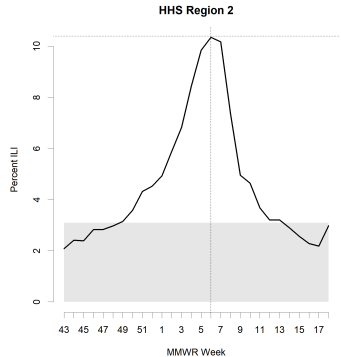
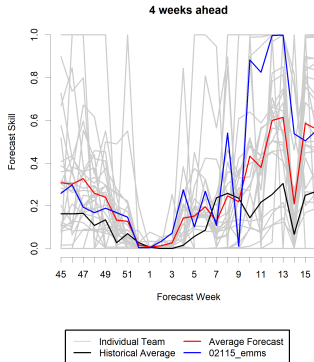
HHS Region 2

3 wk ahead



HHS Region 2

4 wk ahead



HHS Region 3

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

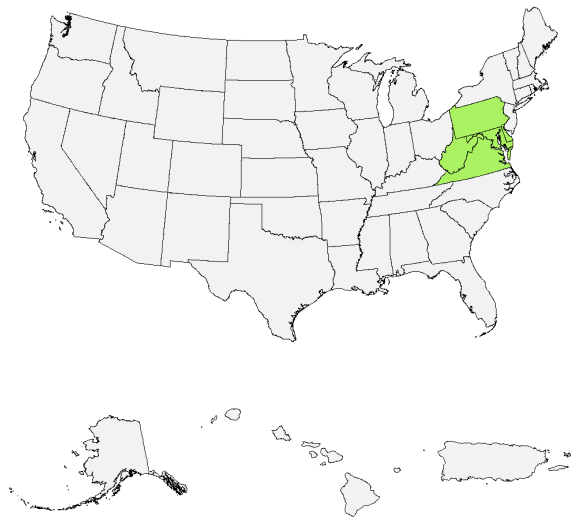
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



HHS Region 3

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

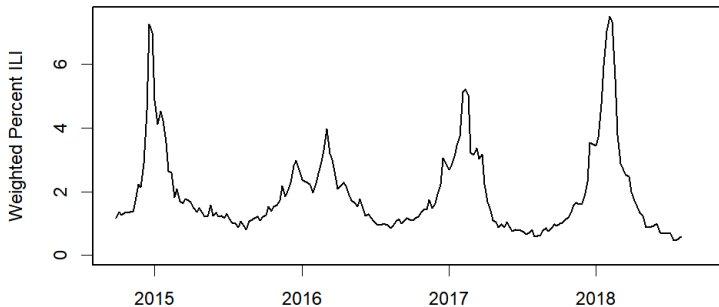
HHS Region 9

HHS Region 10

Conclusions

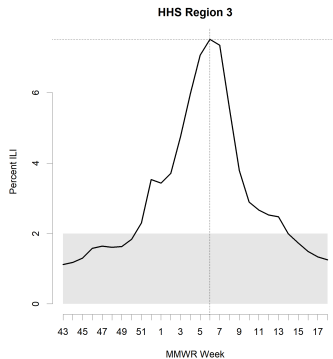
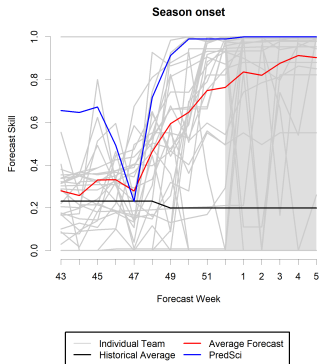
Acknowledge

Region 3



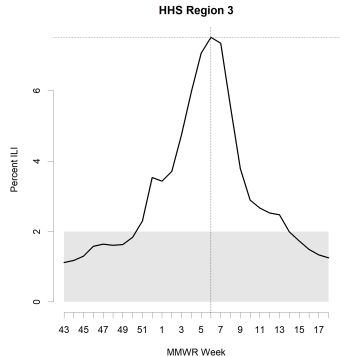
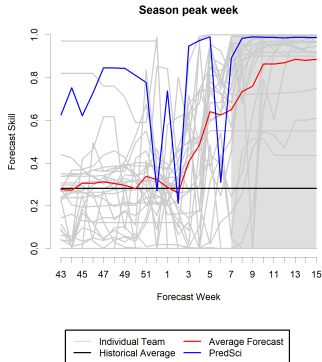
HHS Region 3

Season onset



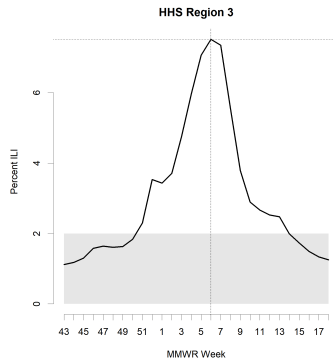
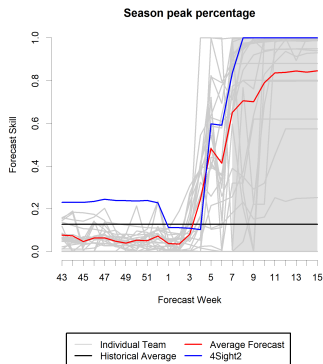
HHS Region 3

Season peak week



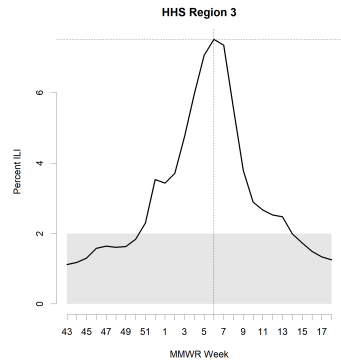
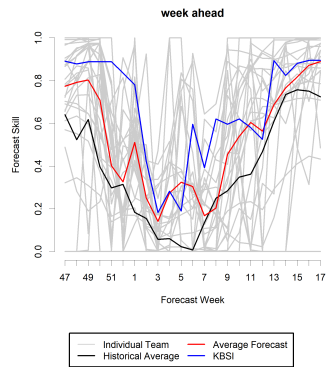
HHS Region 3

Season peak percentage



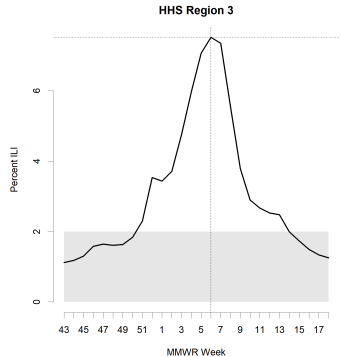
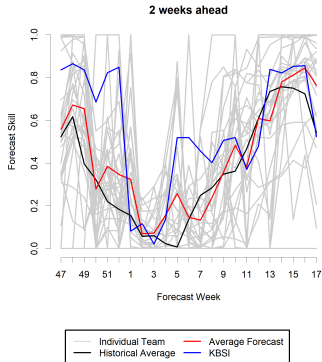
HHS Region 3

1 wk ahead



HHS Region 3

2 wk ahead



HHS Region 3

3 wk ahead

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

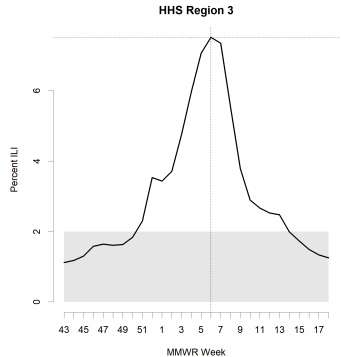
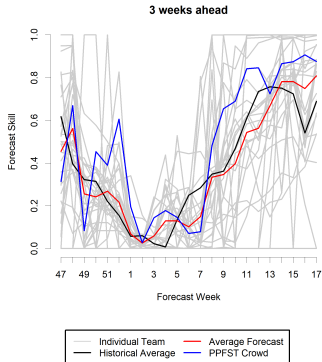
HHS Region 8

HHS Region 9

HHS Region 10

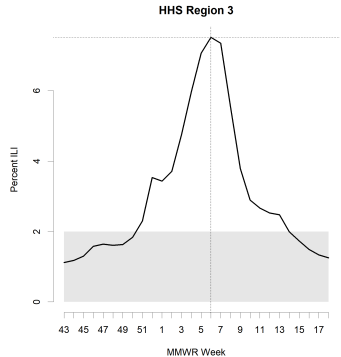
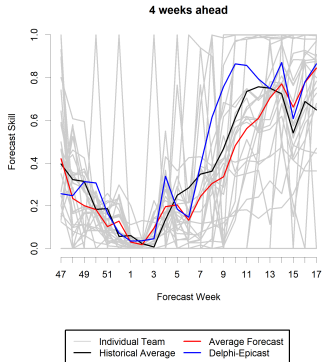
Conclusions

Acknowledge



HHS Region 3

4 wk ahead



HHS Region 4

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

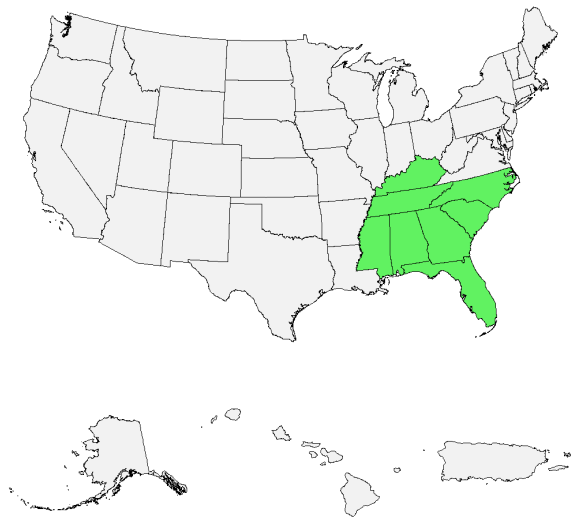
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



HHS Region 4

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

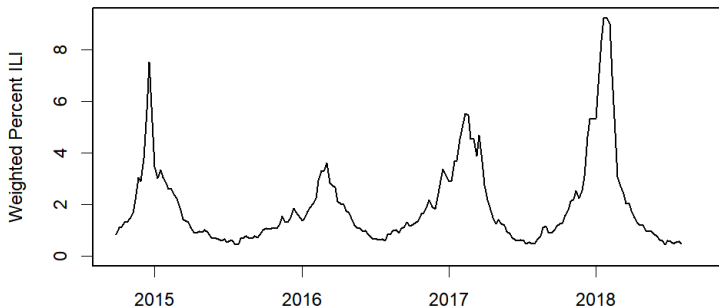
HHS Region 9

HHS Region 10

Conclusions

Acknowledge

Region 4



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

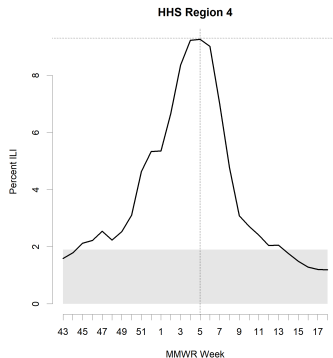
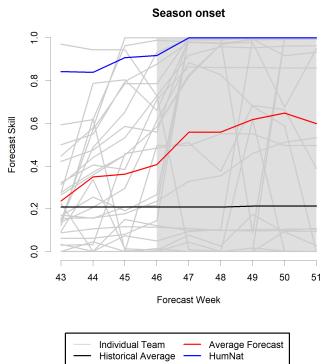
HHS Region 10

Conclusions

Acknowledge

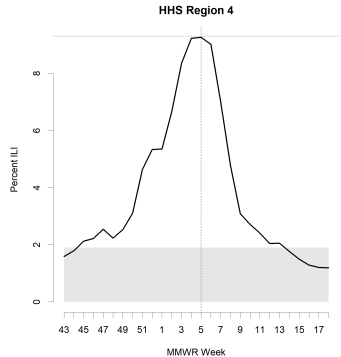
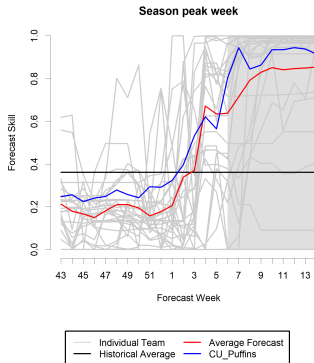
HHS Region 4

Season onset



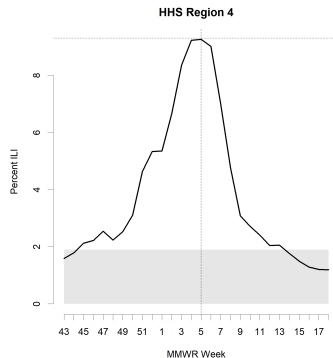
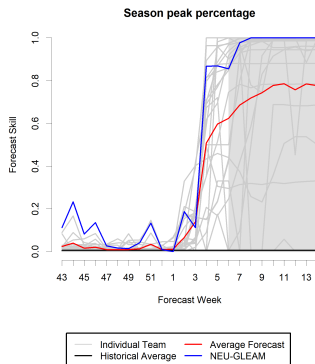
HHS Region 4

Season peak week



HHS Region 4

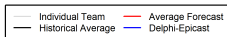
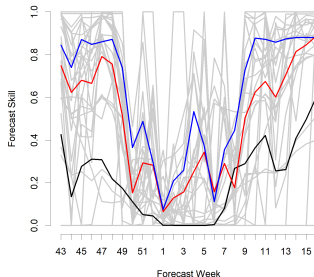
Season peak percentage



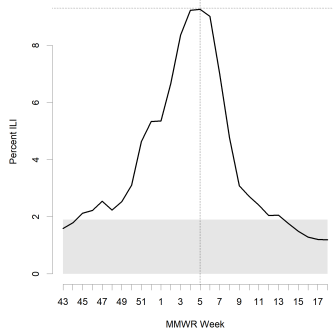
HHS Region 4

1 wk ahead

week ahead

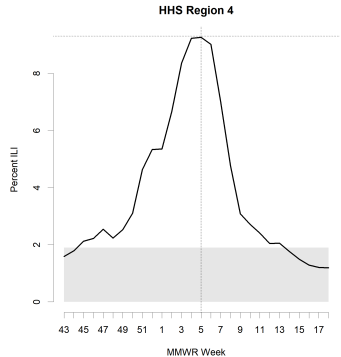
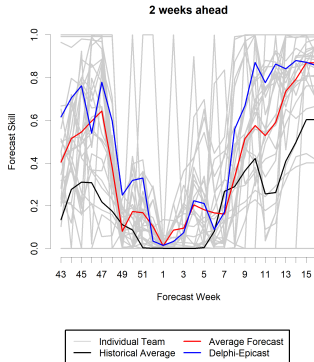


HHS Region 4



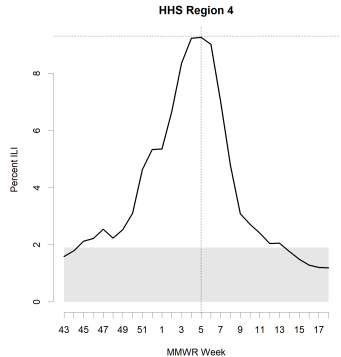
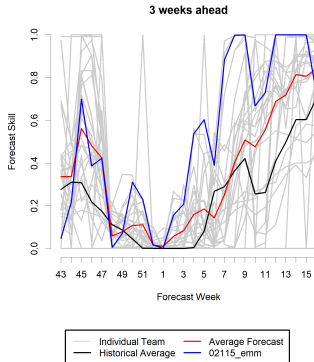
HHS Region 4

2 wk ahead



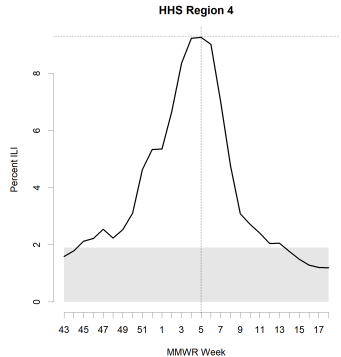
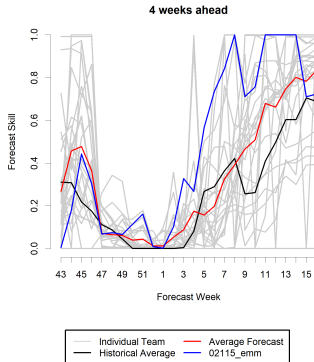
HHS Region 4

3 wk ahead



HHS Region 4

4 wk ahead



HHS Region 5

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

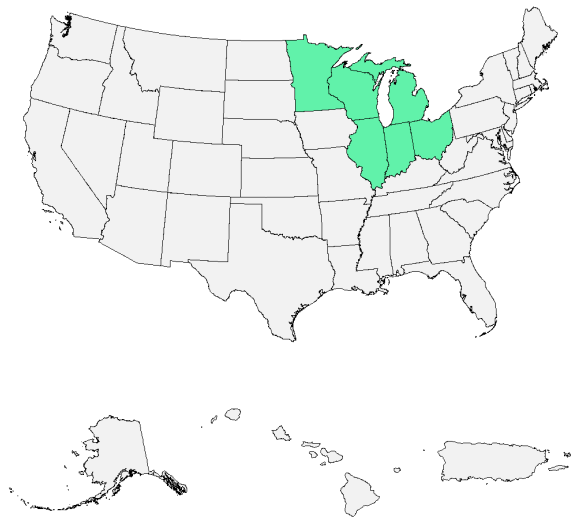
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



HHS Region 5

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

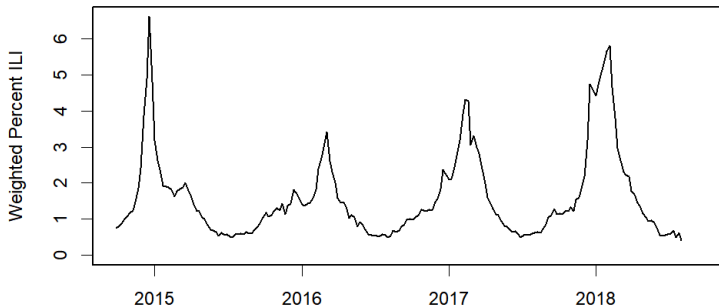
HHS Region 9

HHS Region 10

Conclusions

Acknowledge

Region 5



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

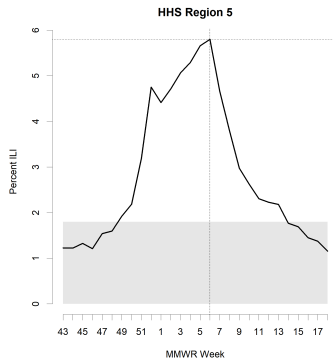
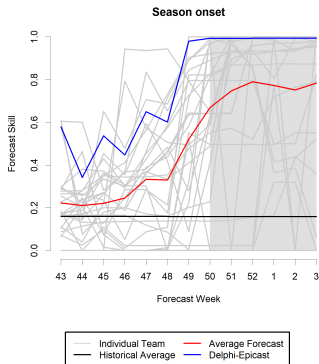
HHS Region 10

Conclusions

Acknowledge

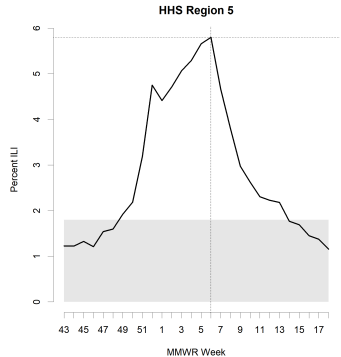
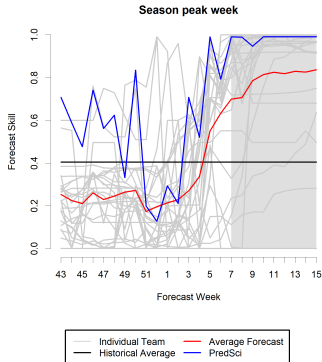
HHS Region 5

Season onset



HHS Region 5

Season peak week



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

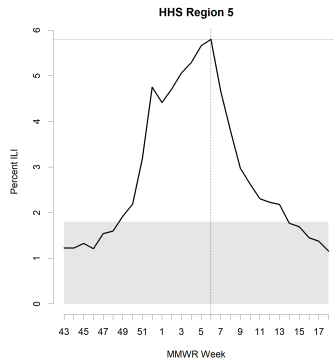
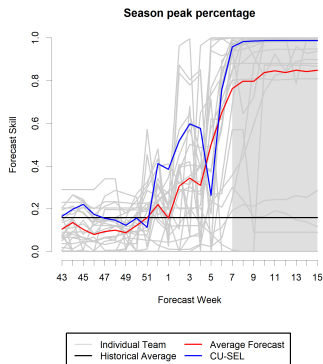
HHS Region 10

Conclusions

Acknowledge

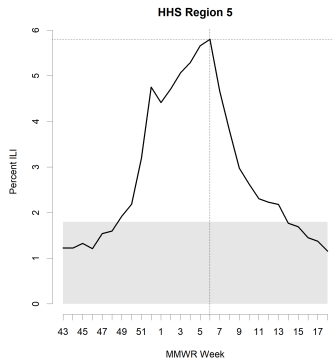
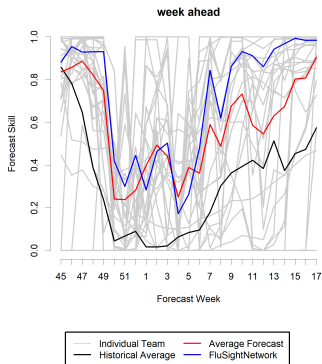
HHS Region 5

Season peak percentage



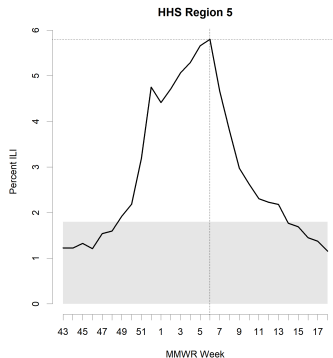
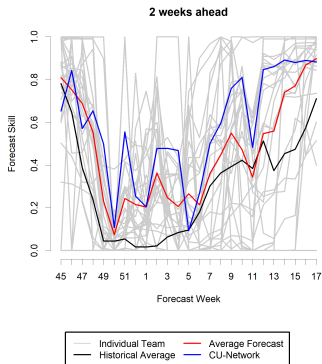
HHS Region 5

1 wk ahead



HHS Region 5

2 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

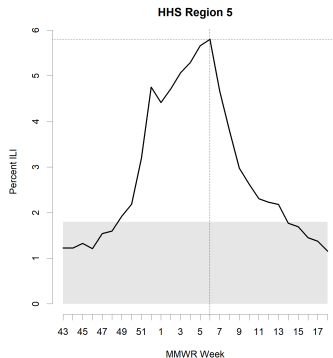
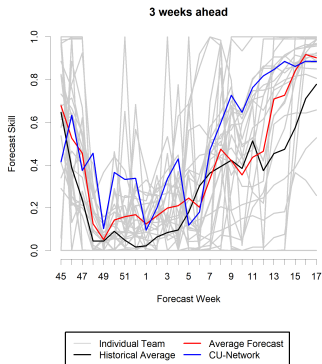
HHS Region 10

Conclusions

Acknowledge

HHS Region 5

3 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

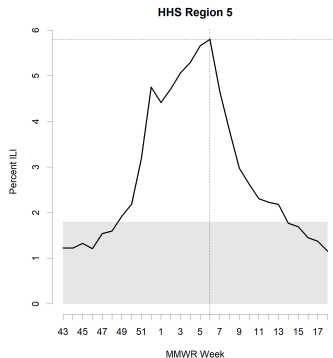
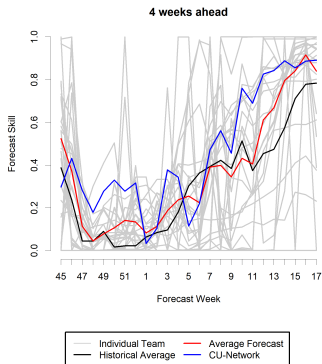
HHS Region 10

Conclusions

Acknowledge

HHS Region 5

4 wk ahead



HHS Region 6

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

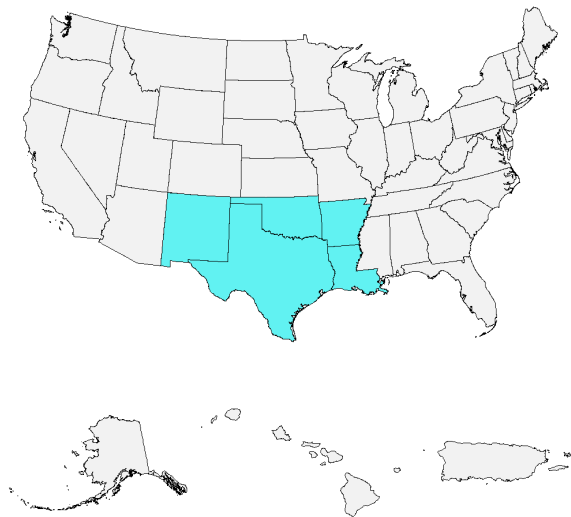
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



HHS Region 6

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

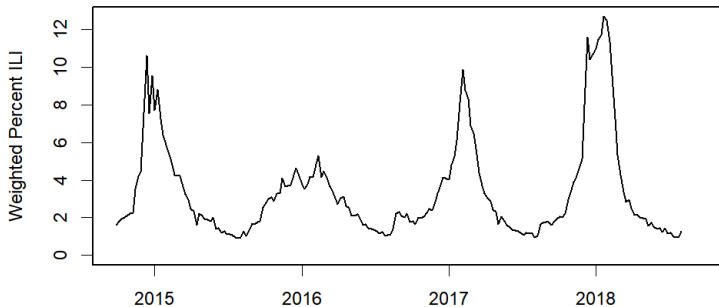
HHS Region 9

HHS Region 10

Conclusions

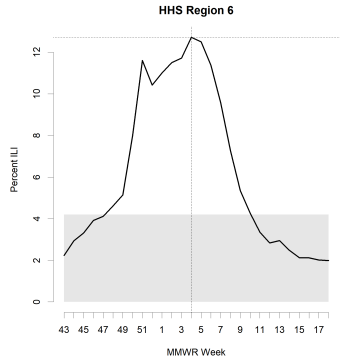
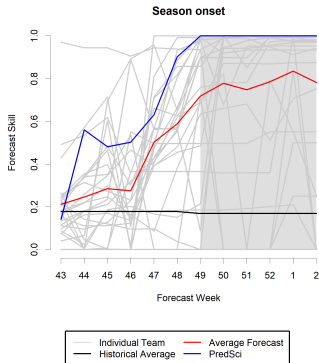
Acknowledge

Region 6



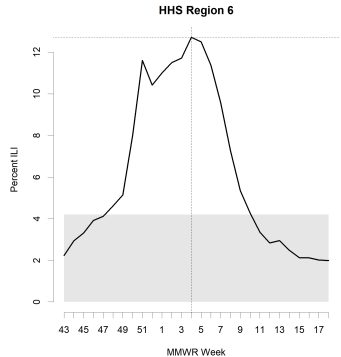
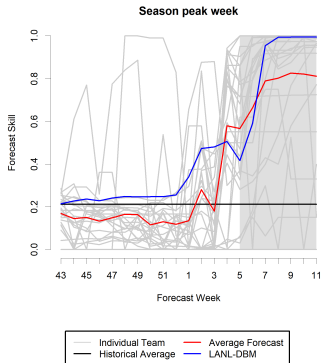
HHS Region 6

Season onset



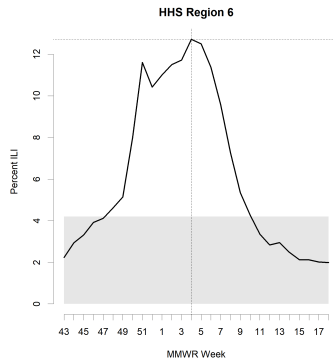
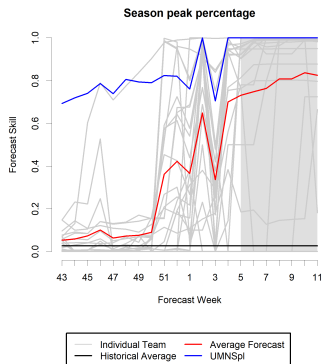
HHS Region 6

Season peak week



HHS Region 6

Season peak percentage



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

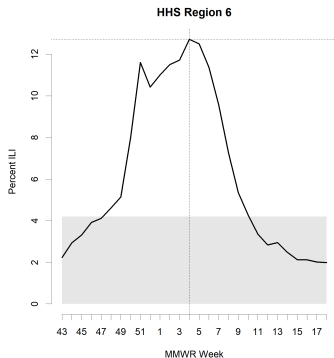
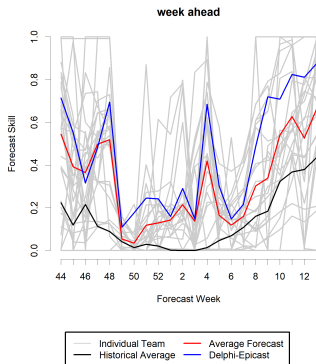
HHS Region 10

Conclusions

Acknowledge

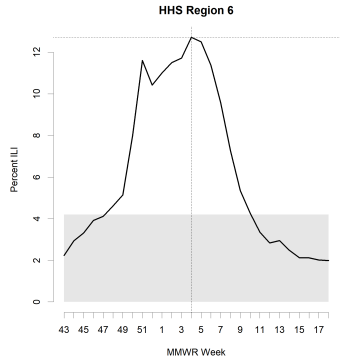
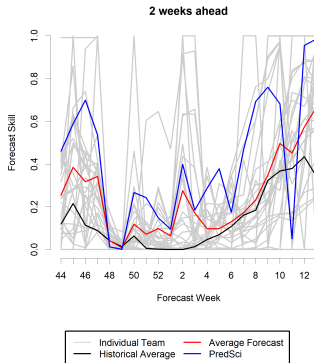
HHS Region 6

1 wk ahead



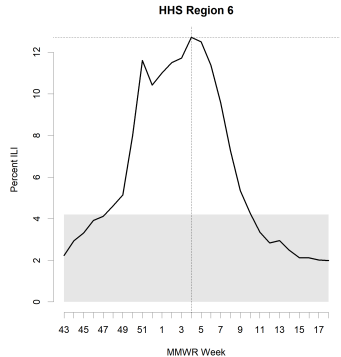
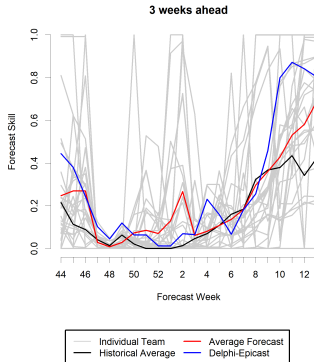
HHS Region 6

2 wk ahead



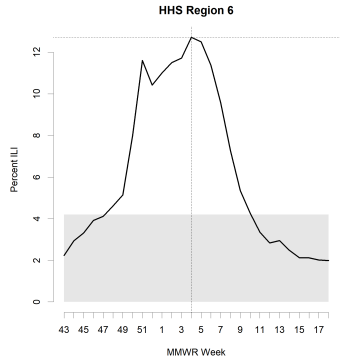
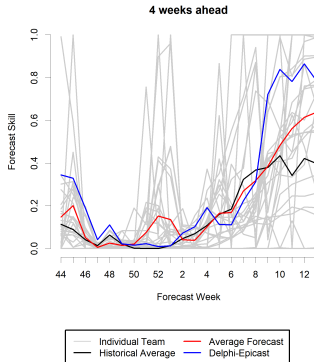
HHS Region 6

3 wk ahead



HHS Region 6

4 wk ahead



HHS Region 7

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

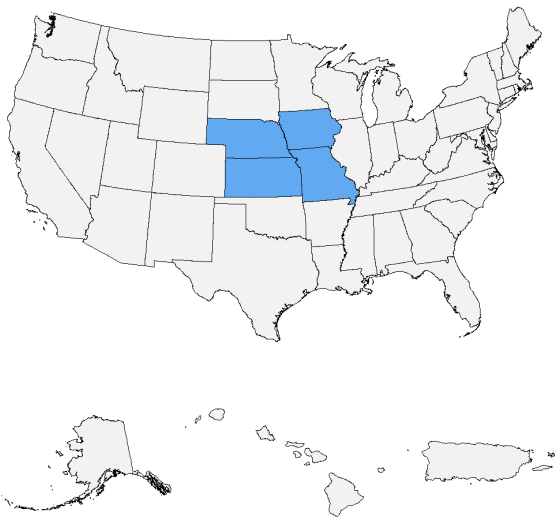
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



HHS Region 7

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

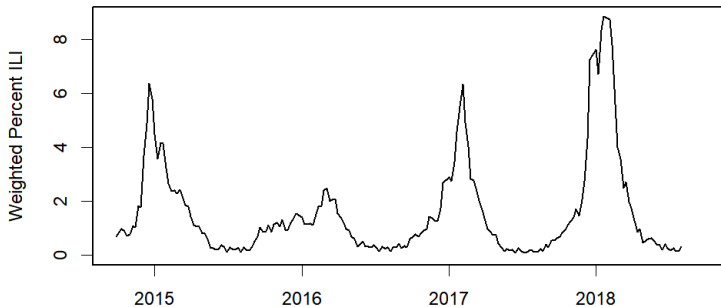
HHS Region 9

HHS Region 10

Conclusions

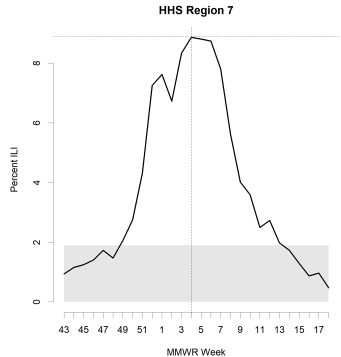
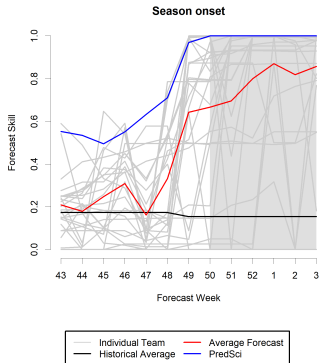
Acknowledge

Region 7



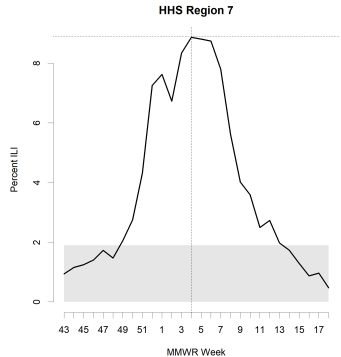
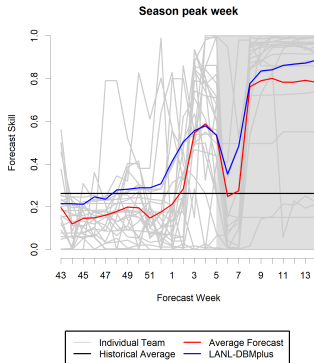
HHS Region 7

Season onset



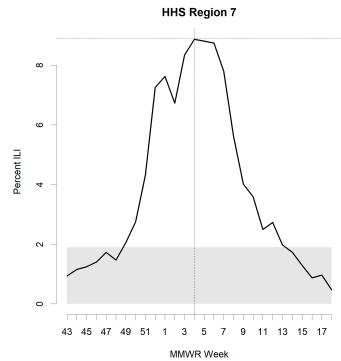
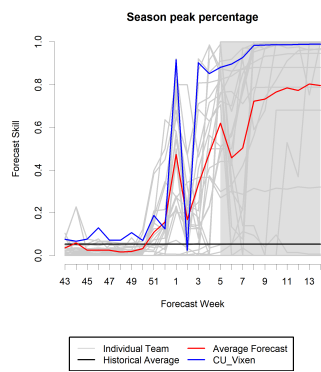
HHS Region 7

Season peak week



HHS Region 7

Season peak percentage



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

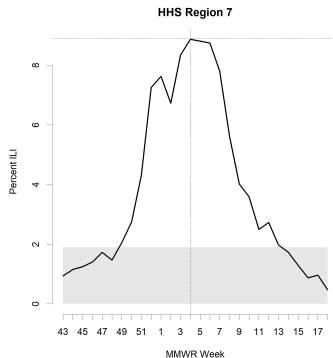
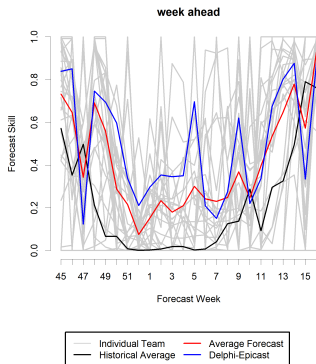
HHS Region 10

Conclusions

Acknowledge

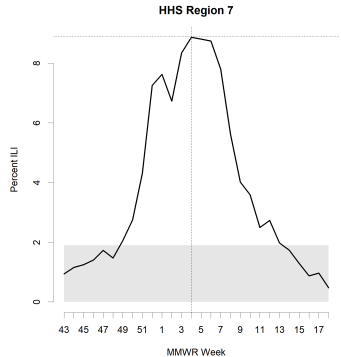
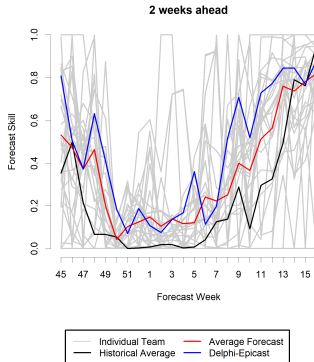
HHS Region 7

1 wk ahead



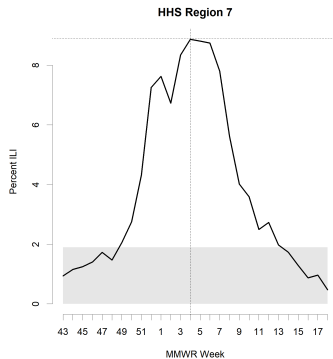
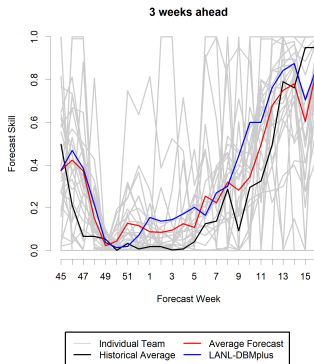
HHS Region 7

2 wk ahead



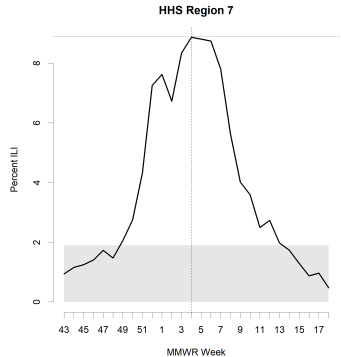
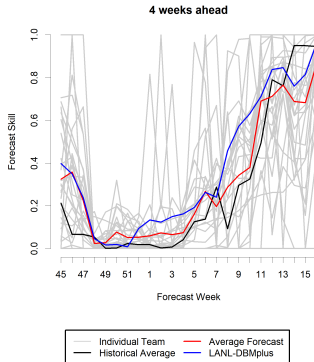
HHS Region 7

3 wk ahead



HHS Region 7

4 wk ahead



HHS Region 8

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

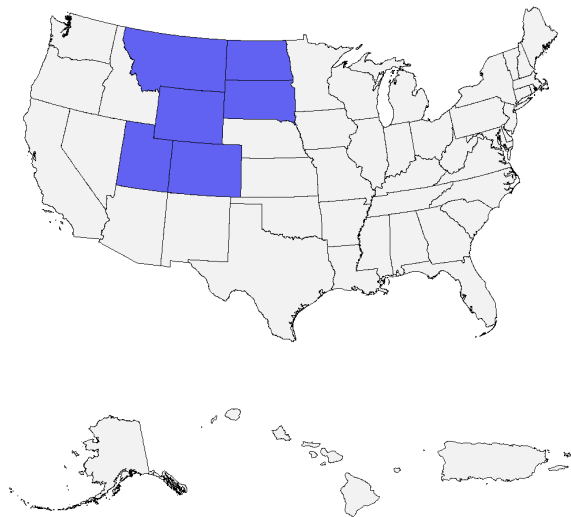
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



HHS Region 8

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

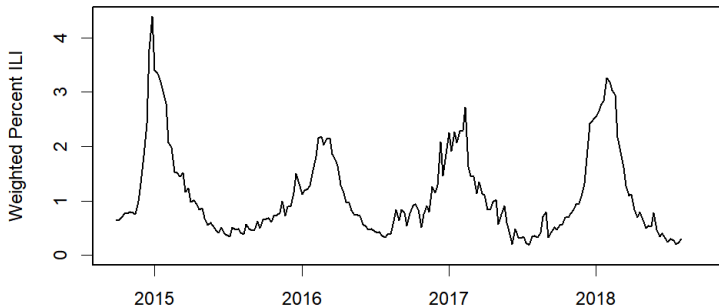
HHS Region 9

HHS Region 10

Conclusions

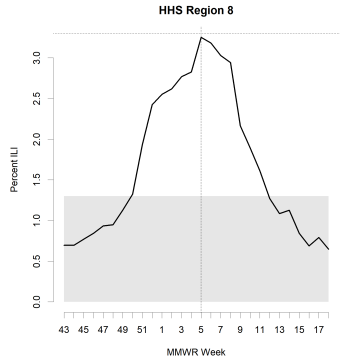
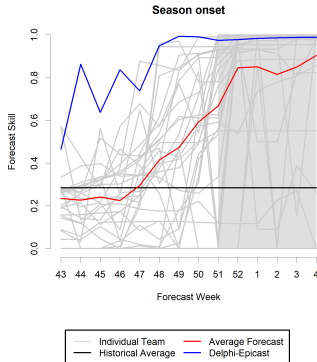
Acknowledge

Region 8



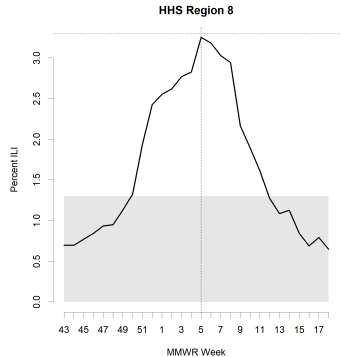
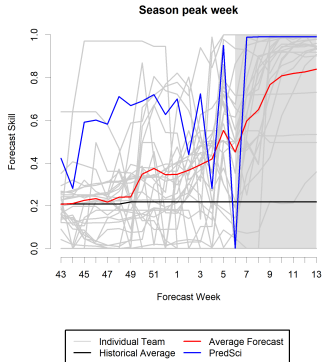
HHS Region 8

Season onset



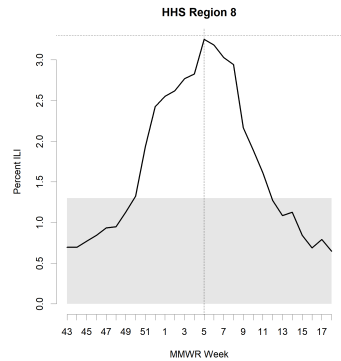
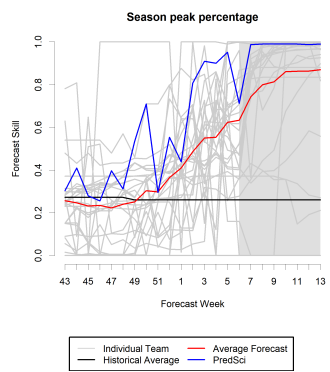
HHS Region 8

Season peak week



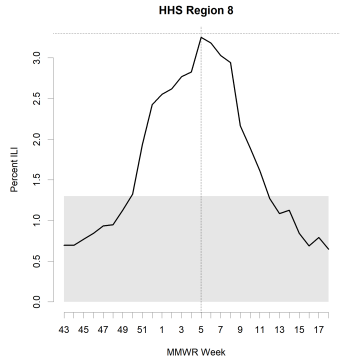
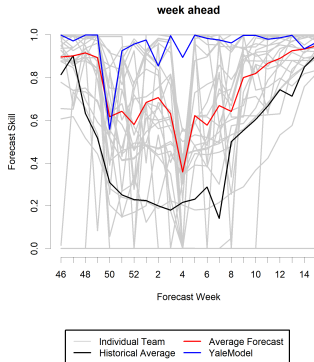
HHS Region 8

Season peak percentage



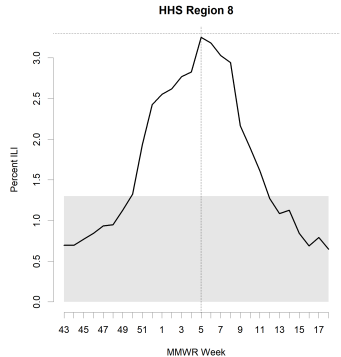
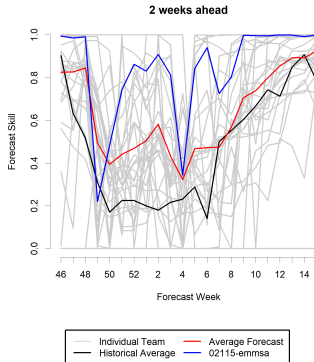
HHS Region 8

1 wk ahead



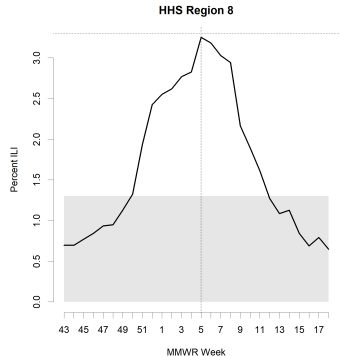
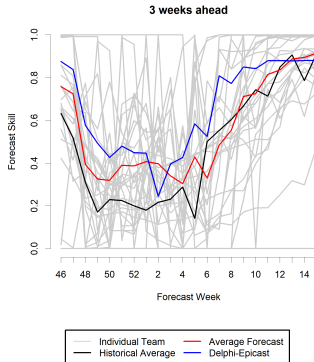
HHS Region 8

2 wk ahead



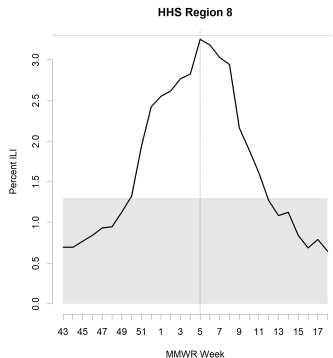
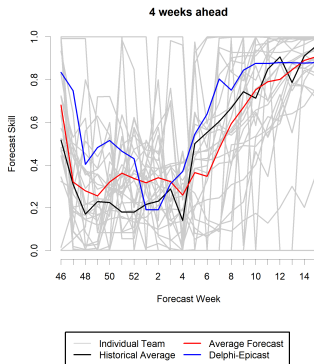
HHS Region 8

3 wk ahead



HHS Region 8

4 wk ahead



HHS Region 9

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

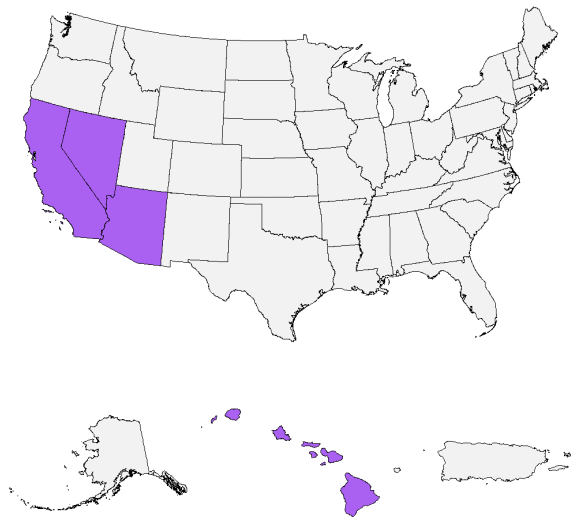
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



HHS Region 9

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

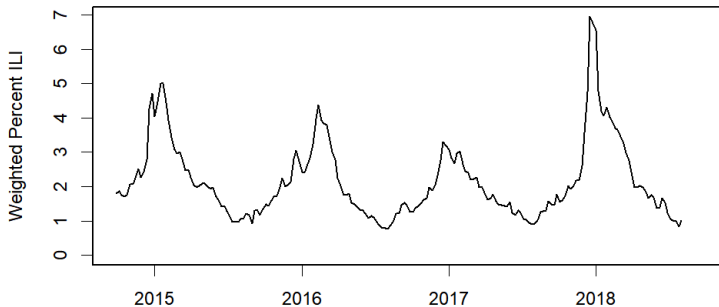
HHS Region 9

HHS Region 10

Conclusions

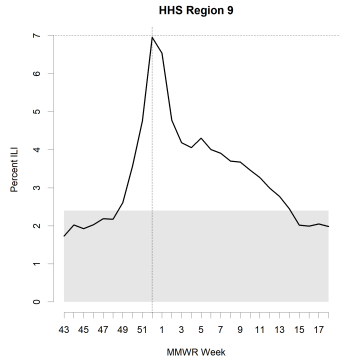
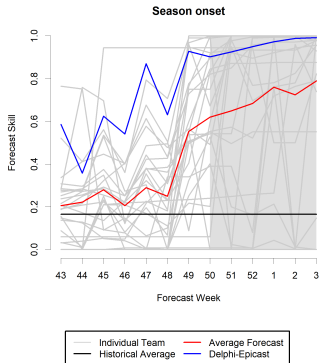
Acknowledge

Region 9



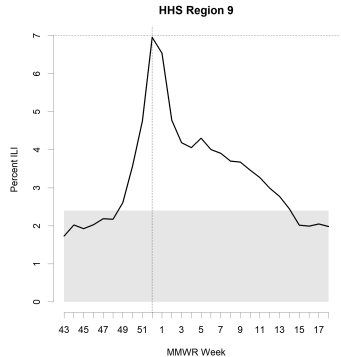
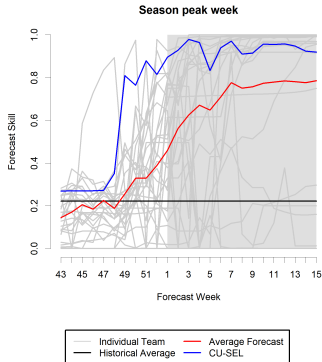
HHS Region 9

Season onset



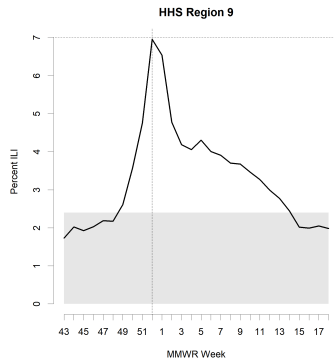
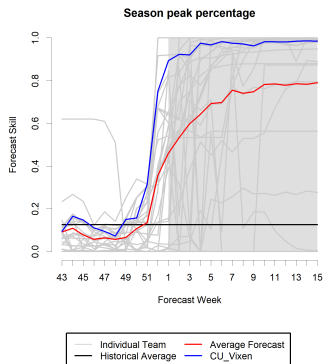
HHS Region 9

Season peak week



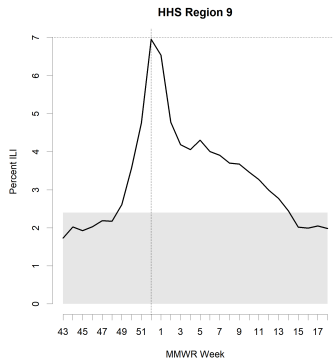
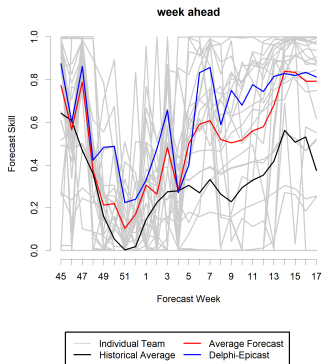
HHS Region 9

Season peak percentage



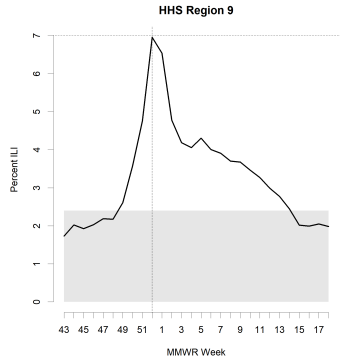
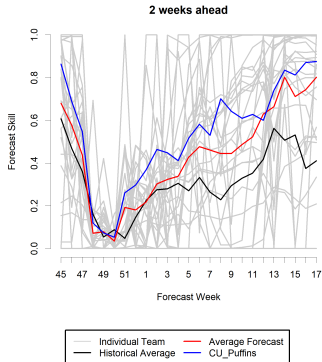
HHS Region 9

1 wk ahead



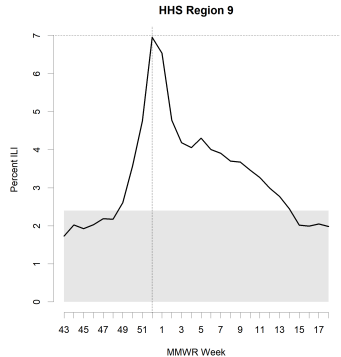
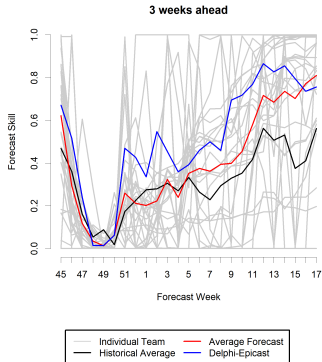
HHS Region 9

2 wk ahead



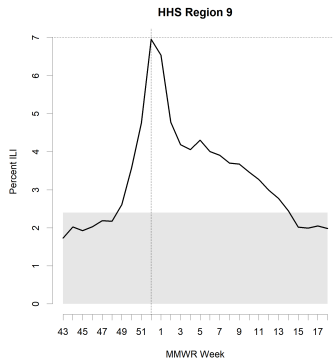
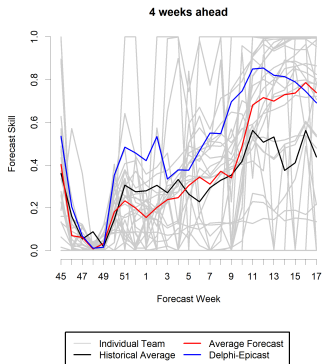
HHS Region 9

3 wk ahead



HHS Region 9

4 wk ahead



HHS Region 10

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

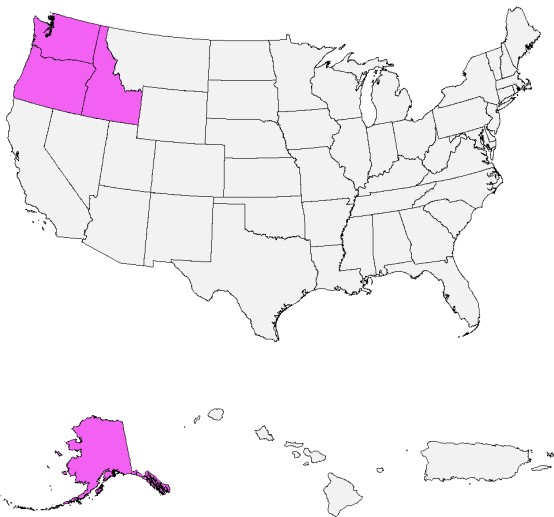
HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge



HHS Region 10

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

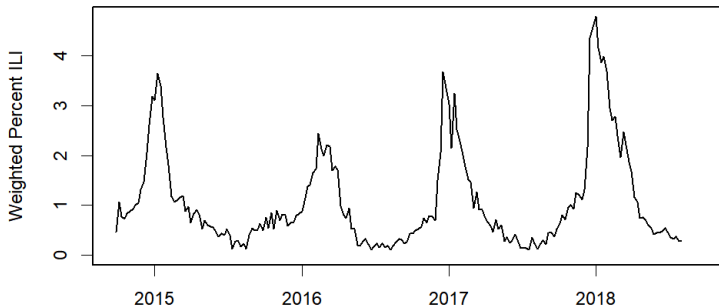
HHS Region 9

HHS Region 10

Conclusions

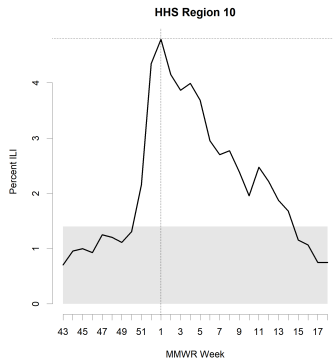
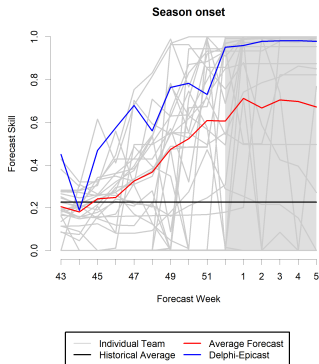
Acknowledge

Region 10



HHS Region 10

Season onset



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

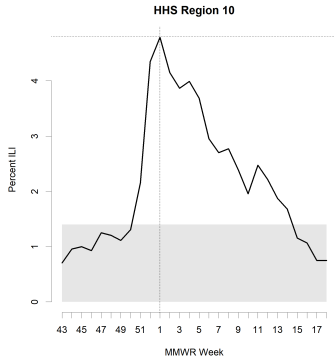
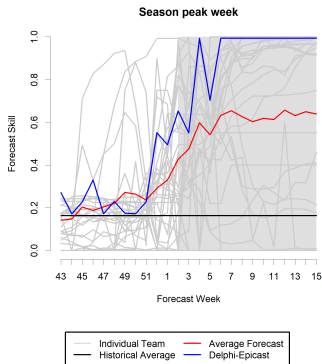
HHS Region 10

Conclusions

Acknowledge

HHS Region 10

Season peak week



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

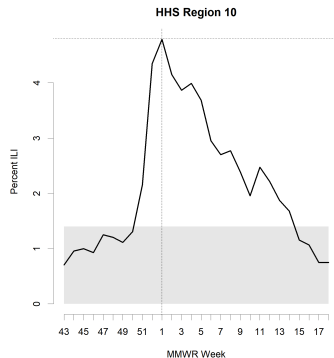
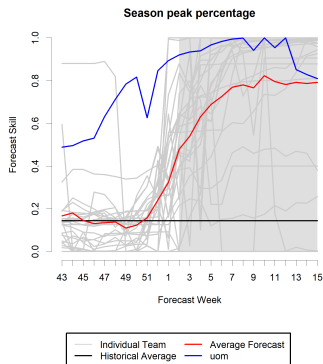
HHS Region 10

Conclusions

Acknowledge

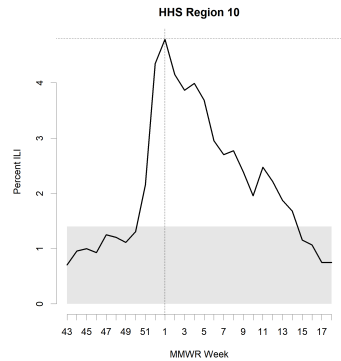
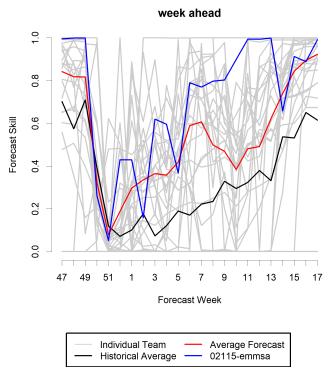
HHS Region 10

Season peak percentage



HHS Region 10

1 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

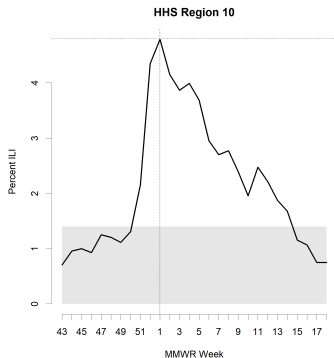
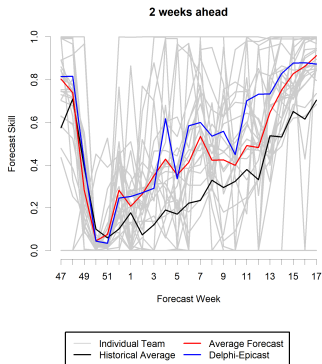
HHS Region 10

Conclusions

Acknowledge

HHS Region 10

2 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

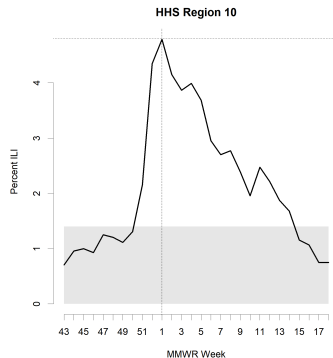
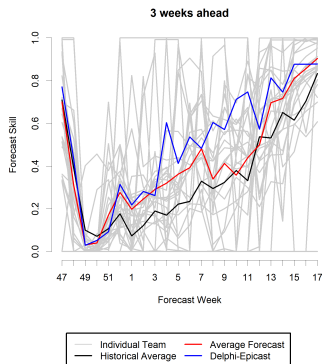
HHS Region 10

Conclusions

Acknowledge

HHS Region 10

3 wk ahead



Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

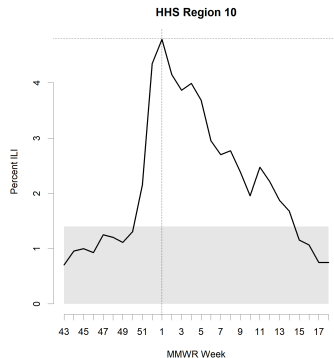
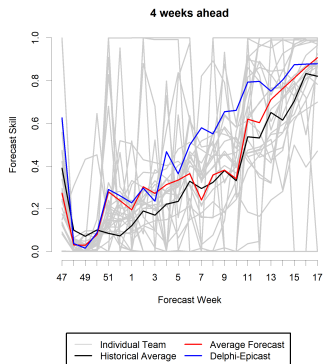
HHS Region 10

Conclusions

Acknowledge

HHS Region 10

4 wk ahead



Conclusions

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

- 2017–2018 flu season was unusually severe almost everywhere.
- Accuracy of seasonal targets generally increases as time goes on
 - Gives us confidence in the probability statements we make during the season
- Accuracy of short term targets generally decreases with higher % ILI.
 - Helps us quantify and communicate uncertainty of future % ILI.

Acknowledgements

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

Forecasters

Mauricio Santillana
Qian Zhang
Xinyue Xiong
Alessandro Vespignani
Naren Ramakrishnan
Debanjan Datta
Srinivasan Venkatramanan
Karyn Apfeldorf
Jessica Appler
Jason Asher
Carlos Arguello Ortiz
Haruka Morita
Jeffrey L. Shaman
Sasikiran Kandula
Teresa K. Yamana
Logan Brooks
David Farrow
Roni Rosenfeld
Jiaxian Sheng
Nicholas Reich
Abhinav Tushar

Yang Liu
Matteo Convertino
Joe Servadio
Nicholas Michaud
Jarad Niemi
Nehemias Ulloa
John Freeze
Madhav Erraguntla
Evan Ray
Nicholas Reich
Alexandria Brown
Mike Jackson
Sara Del Valle
David Osthus
Alessandro Vespignani
Jeffrey J Morgan
Steven Riley
Michal Ben-Nun
James Turtle
Pete Riley
Olivia J Smith
Desiree Mustaquim

Linh Thi Ngoc Dinh
James M Hyman
Joceline Lega
Hannah Biegel
Travis Porco
Tom Lietman
Fengchen Liu
Rob Moss
Alex Zarebski
Ted Cohen
Christoph Zimmer
Reza Yaesoubi
Sequoia Leuba

CDC
Carrie Reed
Matthew Biggerstaff
Chelsea Lutz
Craig McGowan
Michael Johansson
Juan Sanchez Montalvo

CDC Disclaimer

Definitions

US National

HHS Region 1

HHS Region 2

HHS Region 3

HHS Region 4

HHS Region 5

HHS Region 6

HHS Region 7

HHS Region 8

HHS Region 9

HHS Region 10

Conclusions

Acknowledge

The findings and conclusions in this presentation are those of the authors and do not necessarily represent the views of the CDC.