

Early detection of influenza activity using telephone helpline data

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Early detection

- Better planning
- Adequate healthcare resources
- Improve messages for population

S24 Helpline

- 24h Help Line
 - Trained nurses / Supervisors
 - Triage / Counseling / Referral
 - Public health line
 - General health information
- 115 Computer aided algorithms
 - Clinical outcomes
- Realtime electronic database



Sentinel Network

- Started in 1989
- Voluntary notification of health and disease events
 - Influenza
 - Diabetes / Pregnancy / Stroke / (50 events)
- Family Doctors / GPs
- Denominator based on patient list (around 200.000)
- Influenza
 - “Gold standard” for calculating incidence
 - Weekly bulletin
 - Naso-pharyngeal swabbing

Methods

- Selection of relevant algorithms for ILI
- Data from June 2010 to June 2013
- S24
 - Daily data, converted to ISO weeks
- Sentinel Network
 - Weekly data, available on Thursday
- Analysis (Excel, STATA, R)
 - Cross Correlation function
 - MEM
- Tested signal detection in 2013-14 season

Relevant algorithms (Case definition)

- **2 Wheezing or asma in Adults or children 5-16 years**
- **27 Coughing in adults**
- **28 Coughing in children 5-16 years**
- **29 Coughing in children 0-1 year**
- **30 Coughing in children 1-4 years**
- **42 Diarrhea in children 0-4 anos**
- **44 Respiratory difficulties in Adults or children 5-16 years**
- **47 Ear Problems**
- **53 Fever in Adults and children 5-16 years**
- **55 Fever in Children 0-4 years**
- **66 Headache**
- **78 Hoarseness**
- **103 Nasal problems**
- **130 Oropharyngeal problems**
- **150 Vomiting in children 0-4 years**
- **208 Respiratory difficulties in children 0-4 years**
- **213 "Flu like Syndrome"**

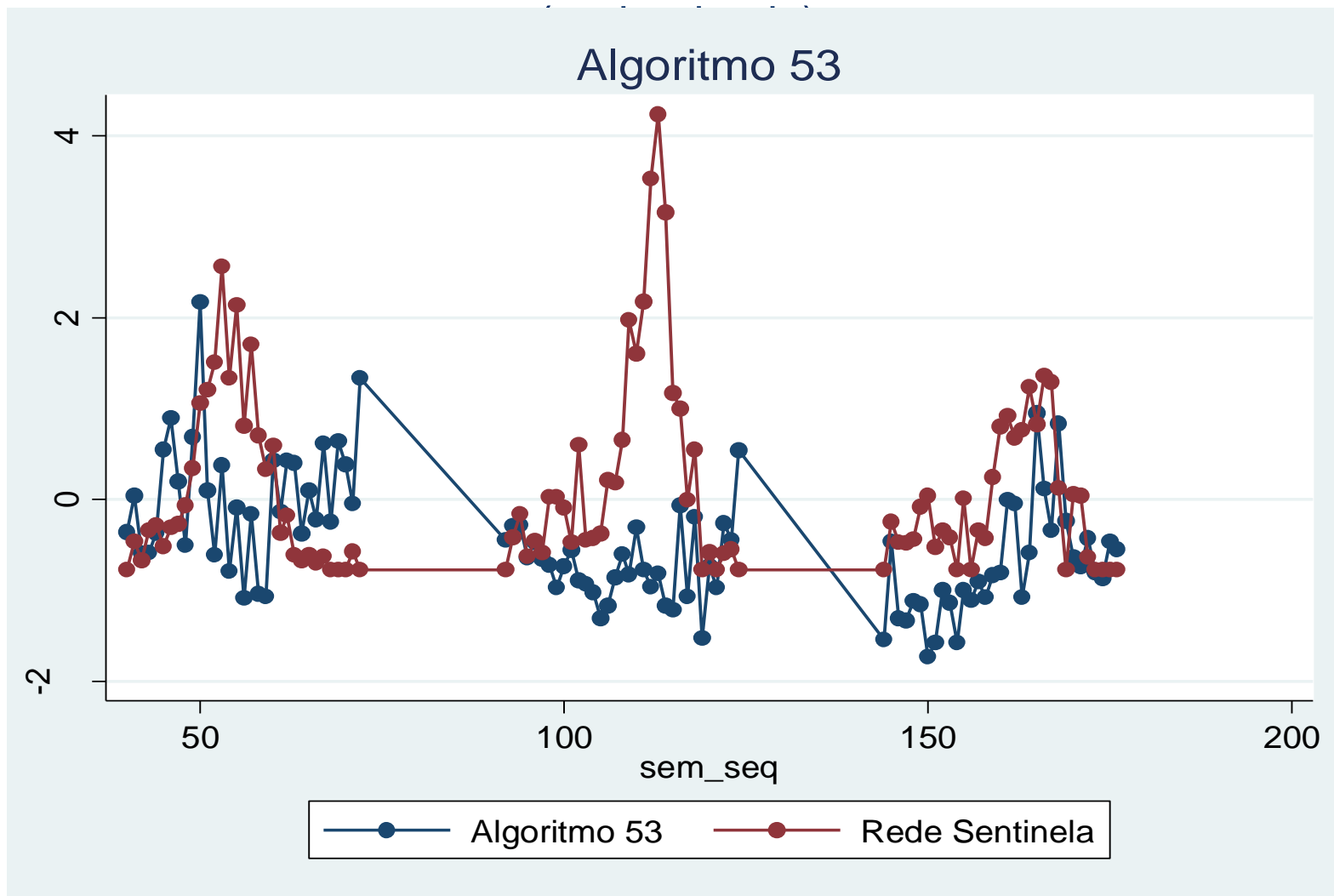
S24 Helpline data

- Number of calls per algorithm
- Total calls
- Weeks 40 to 20 of each influenza season
 - 33 weeks per season
- 1.032.724 total calls

Algorithms (weekly)

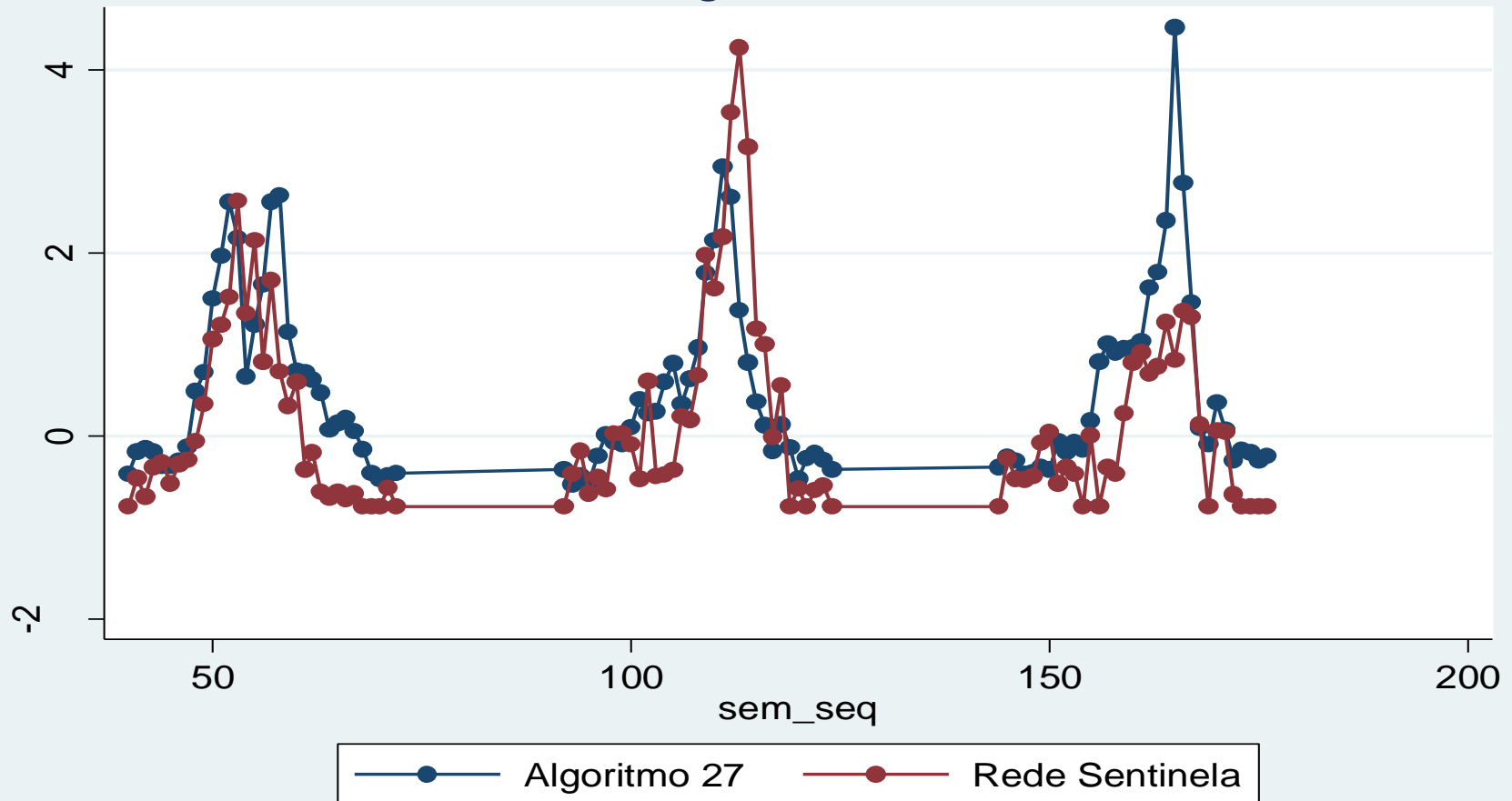
| Algorithm | Average | Mínimum | Maximum |
|--|----------------|----------|-------------|
| 2 Wheezing or asma in Adults or children 5-16 years | 13 | 4 | 26 |
| 27 Coughing in adults | 481.5 | 209 | 1457 |
| 28 Coughing in children 5-16 years | 189.2 | 47 | 1054 |
| 29 Coughing in children 0-1 year | 386.8 | 189 | 838 |
| 30 Coughing in children 1-4 years | 510.7 | 224 | 1183 |
| 42 Diarrhea in children 0-4 anos | 215.9 | 131 | 289 |
| 44 Respiratory difficulties in Adults or children 5-16 years | 38.8 | 19 | 67 |
| 47 Ear Problems | 227.2 | 134 | 407 |
| 53 Fever in Adults and children 5-16 years | 44.8 | 23 | 103 |
| 55 Fever in Children 0-4 years | 124.2 | 80 | 228 |
| 66 Headache | 333.1 | 251 | 548 |
| 78 Hoarseness | 12 | 3 | 22 |
| 103 Nasal problems | 349.7 | 222 | 668 |
| 130 Oropharyngeal problems | 413.3 | 265 | 788 |
| 150 Vomiting in children 0-4 years | 367.8 | 222 | 561 |
| 208 Respiratory difficulties in children 0-4 years | 23.1 | 8 | 46 |
| 213 "Flu like Syndrome" | 266.4 | 0 | 4316 |
| 999 "Total" | 10431.5 | 8260 | 16932 |

Fever in Adults and children above 5 years old (standardized)



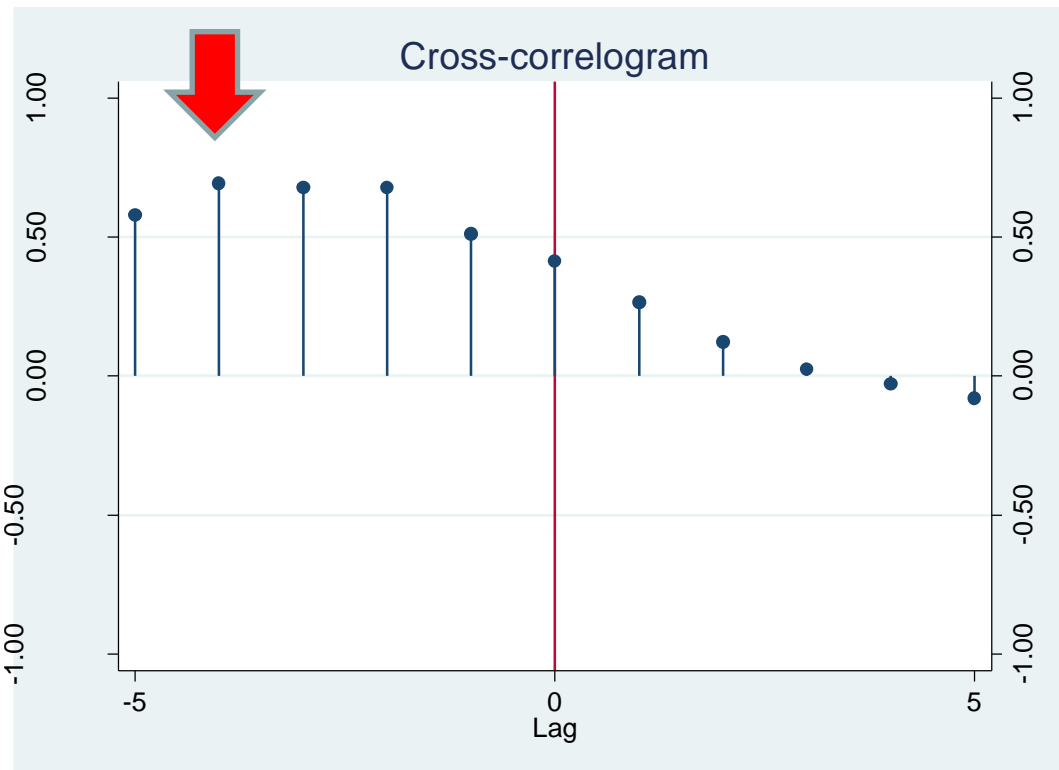
Coughing in Adults (standardized)

Algoritmo 27



Cross Correlation Function

(Algorithm / Sentinel Network)



| LAG | CORR |
|-----|---------|
| -5 | 0.5788 |
| -4 | 0.6945 |
| -3 | 0.6784 |
| -2 | 0.6778 |
| -1 | 0.5120 |
| 0 | 0.4136 |
| 1 | 0.2659 |
| 2 | 0.1231 |
| 3 | 0.0235 |
| 4 | -0.0297 |
| 5 | -0.0800 |

Lags with highest correlation for each algorithm, in each season

| Algorithm | 2010/2011 | 2011/2012 | 2012/2013 |
|--|-----------|-----------|-----------|
| 27 Coughing in Adults | 0 | -2 | -1 |
| 28 Coughing in children 5-16 years | -4 | -2 | -2 |
| 29 Coughing in children 0-1 year | 3 | -5 | -4 |
| 30 Coughing in children 1-4 years | -2 | -5 | -3 |
| 42 Diarrhea in children 0-4 anos | 0 | | |
| 47 Ear Problems | | -4 | -4 |
| 55 Fever in Children 0-4 years | 2 | -3 | -3 |
| 78 Hoarseness | | -3 | -3 |
| 103 Nasal problems | | -2 | -2 |
| 150 Vomiting in children 0-4 years | -1 | | |
| 208 Respiratory difficulties in children 0-4 years | | | |
| 213 "Flu like Syndrome" | 0 | 1 | 1 |
| 282930 Coughing in children 0-16 years | -2 | -3 | -3 |
| 27282930 Coughing all ages | 0 | -3 | -1 |
| 5355 Fever all ages | 2 | | |



MEM

- Moving Epidemic Method Algorithm
 - Developed in R
 - Tomás Vega (Castilla y Leon)
- Used by ECDC
- Based in incidence data time series
- Calculates base lines
- Divides seasons in pre-epidemic, epidemic and post-epidemic periods

MEM - Algorithm 27 Coughing in Adults

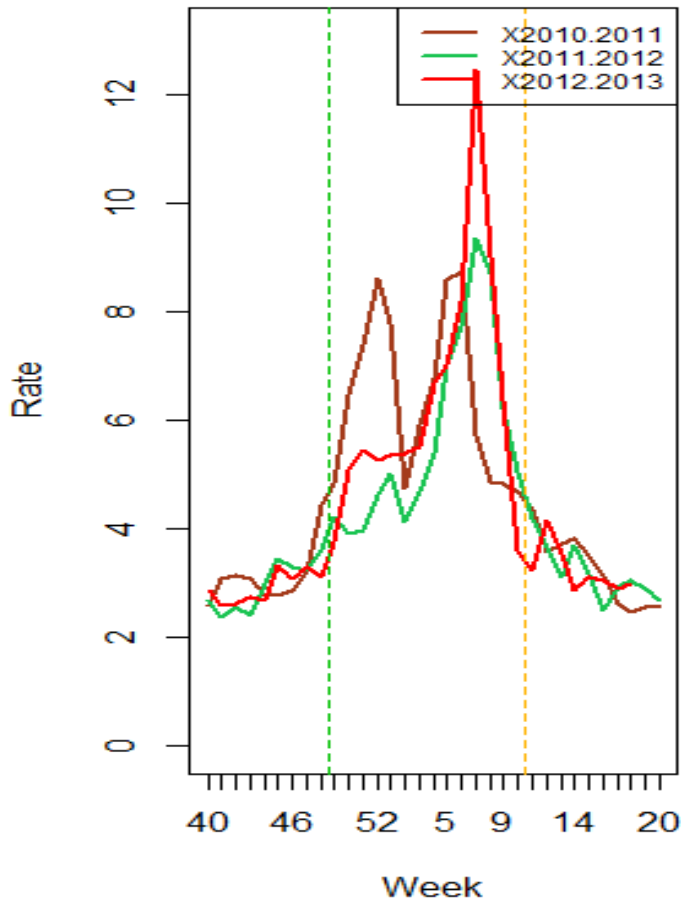


Figure 1: Comparison of the rates of the seasons matching their relative

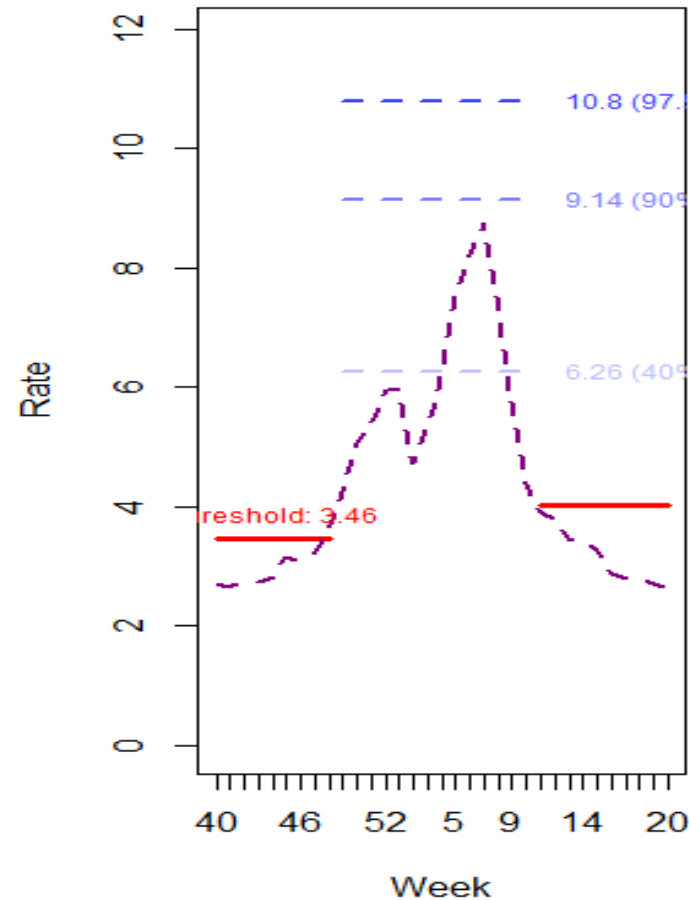
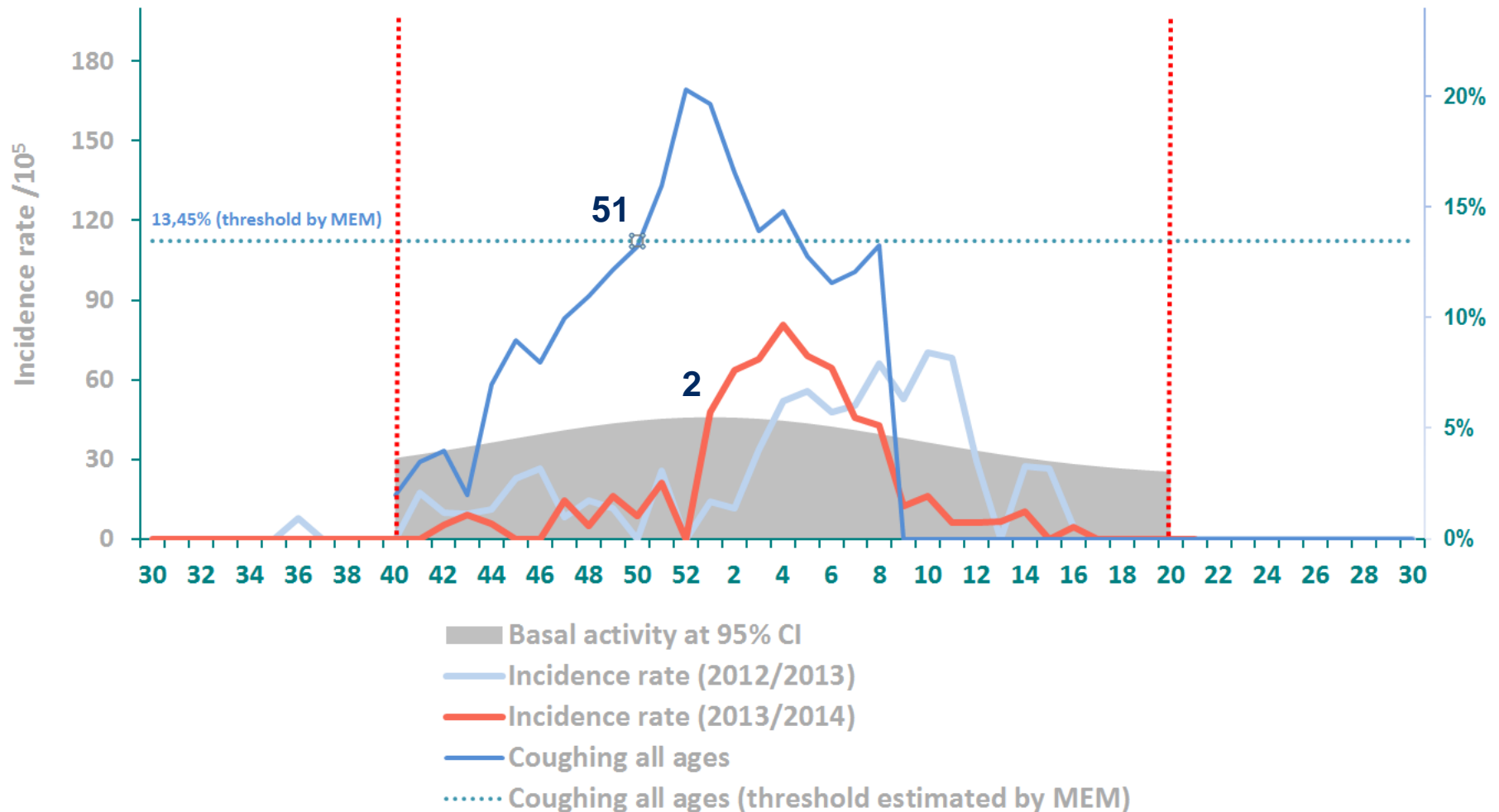


Figure 2: MEM Threshold

Early detection

| | INSA | MS_ MEM | 27 | 28 | 29 | 30 | 2829 30 | 2728 2930 | 213 |
|-------|-------------|--------------------|-----------|-----------|-----------|-----------|--------------------|----------------------|------------|
| 10/11 | 50 | 50 | 49 | 46 | 51 | 47 | 47 | 47 | 52 |
| | Ref. | 0 | -1 | -4 | 1 | -3 | -3 | -3 | 2 |
| 11/12 | 4 | 5 | 49 | 3 | 52 | 48 | 52 | 52 | 9 |
| | Ref. | 1 | -7 | -1 | -4 | -8 | -4 | -4 | 5 |
| 12/13 | 4 | 4 | 52 | 51 | 50 | 47 | 49 | 49 | 12 |
| | Ref. | 0 | -4 | -5 | -6 | -9 | -7 | -7 | 8 |

2013-2014 Season



Limitations

- Inconsistency in Lags
- Demographic of S24 users

- Refine by age / region
- More seasons
- Better “signal”

Opportunities

- Promising approach
- Earlier detection of influenza season
- Low on resources (no additional data collection)
- Complement other systems
- Expand to other disease / events?

Thank you!

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