NorSySS

The Role of Statistics in Syndromic Surveillance

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The Norwegian Syndromic Surveillance System (NorSySS)

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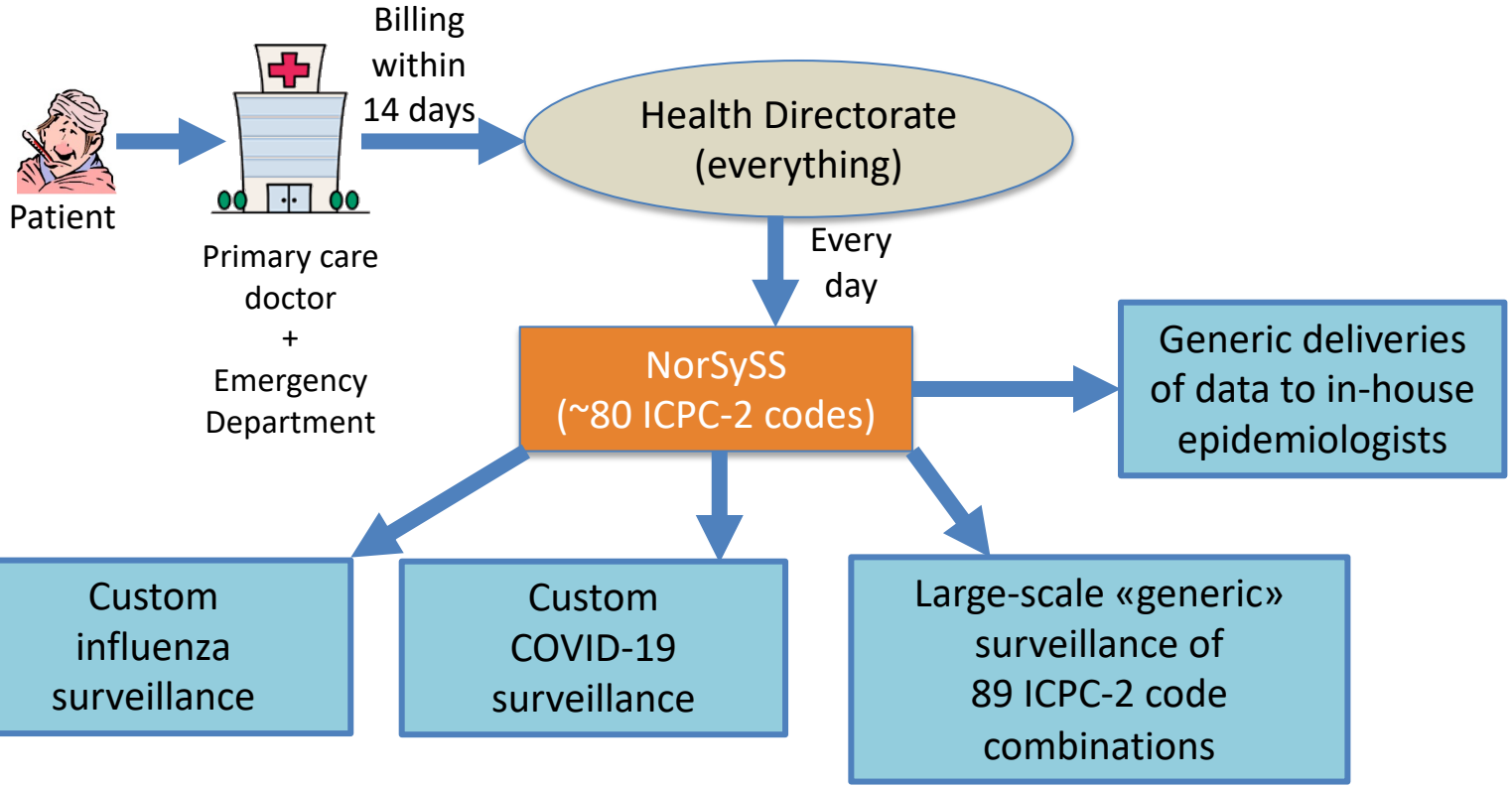
What do you want to achieve with syndromic surveillance?

	Simple aggregation	More complex statistics
Descriptive statistics	Basic	X
Detect signals (outbreaks)	Basic	X
Detect trends		X
Estimate attributable mortality		X
Predict risk of outbreaks		X

NorSySS in brief



Which metric to use?

Metric: Percentage of consultations for COVID-19				
Weeks after event	Day of week	Days delay	90% Margin of error	
			Nation	County
1	Monday	1	±11.9%	±25.7%
	Tuesday	2	±11.2%	±21.8%
	Wednesday	3	±9.2%	±18.6%
	Thursday	4	±8.2%	±16.1%
	Friday	5	±6.8%	±14.6%
	Saturday	6	±6.0%	±12.5%
	Sunday	7	±6.3%	±12.1%
2	Monday	8	±6.7%	±12.0%
	Tuesday	9	±5.9%	±10.7%
	Wednesday	10	±5.1%	±9.4%
	Thursday	11	±4.5%	±9.0%
	Friday	12	±4.3%	±8.3%
	Saturday	13	±3.8%	±7.0%
	Sunday	14	±3.8%	±6.9%

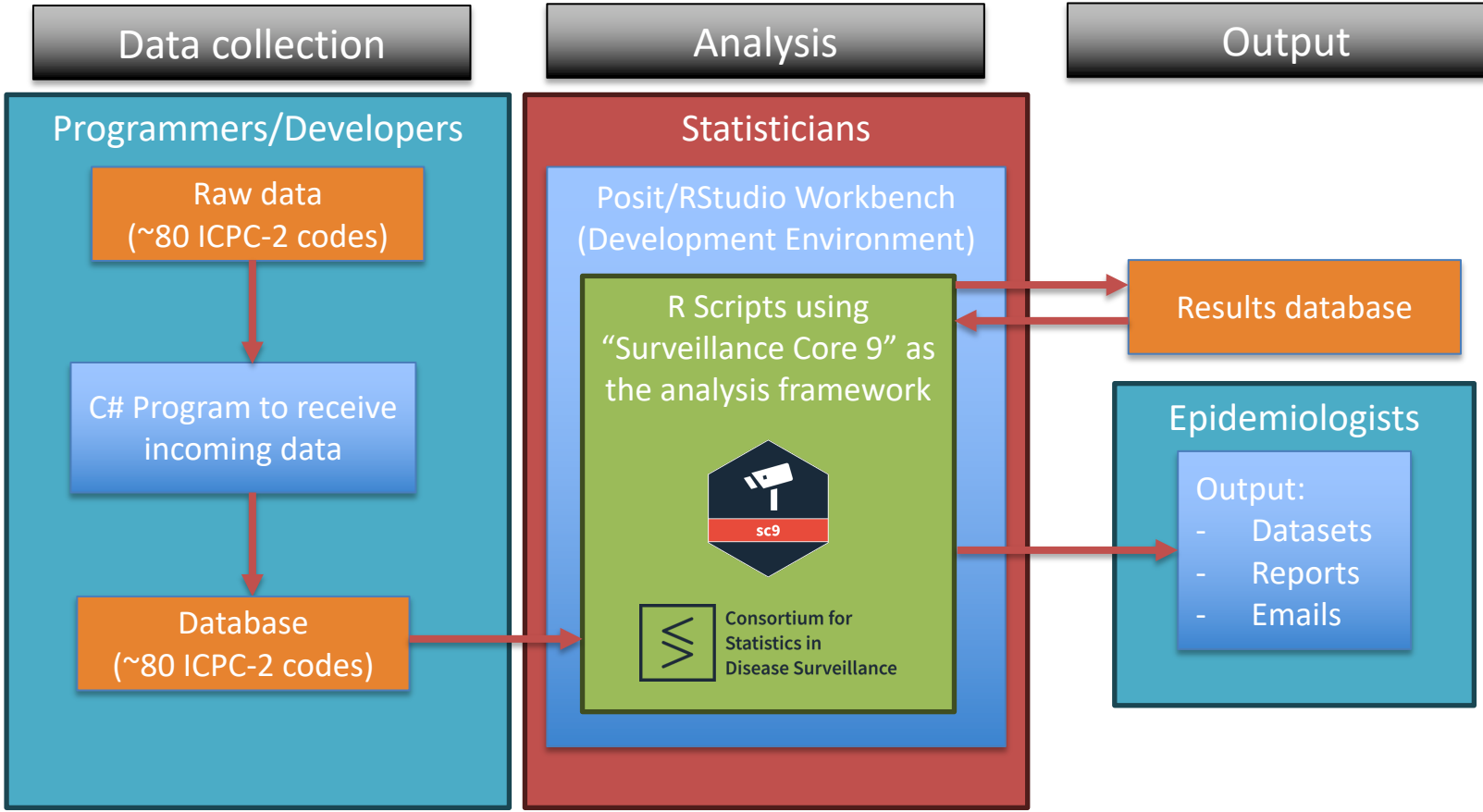
Metric: Number of consultations

Registration delay in NorSySS by isoyear

Days until x% of the consultations are registered

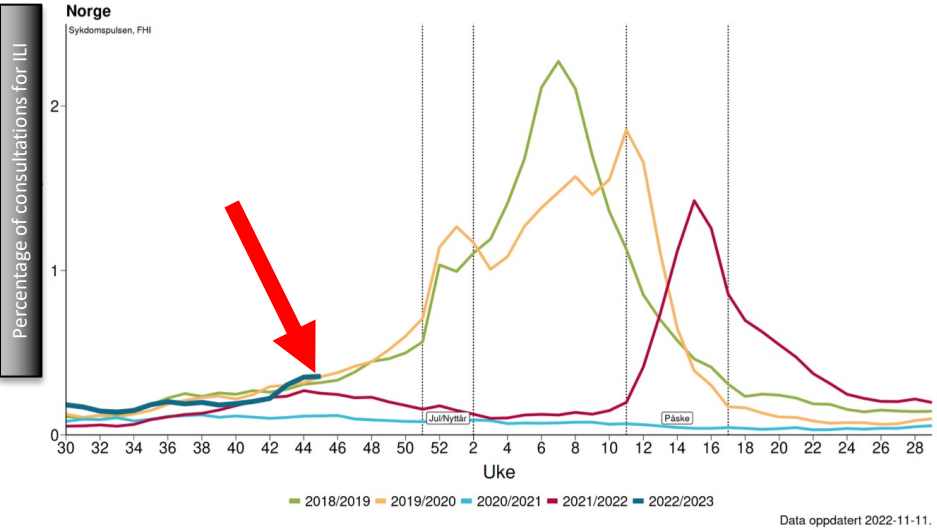
	25%	50%	75%	90%	95%	99%
2006	14	23	33	49	69	144
2007	14	23	33	49	70	145
2008	14	22	32	48	67	142
2009	13	22	31	47	66	133
2010	6	11	18	29	40	83
2011	5	9	14	22	32	68
2012	5	9	15	24	35	76

NorSySS in 2023 (development version)

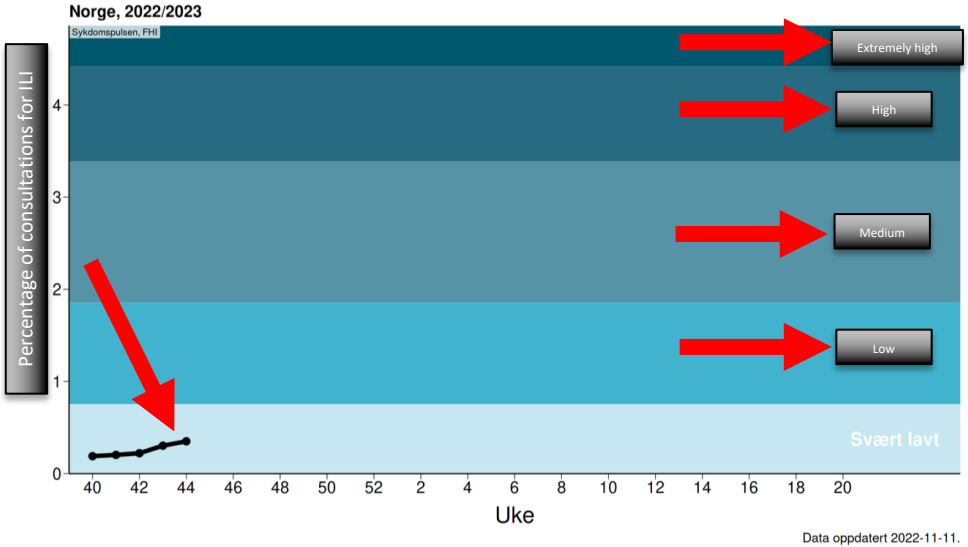


Descriptive statistics (Influenza)

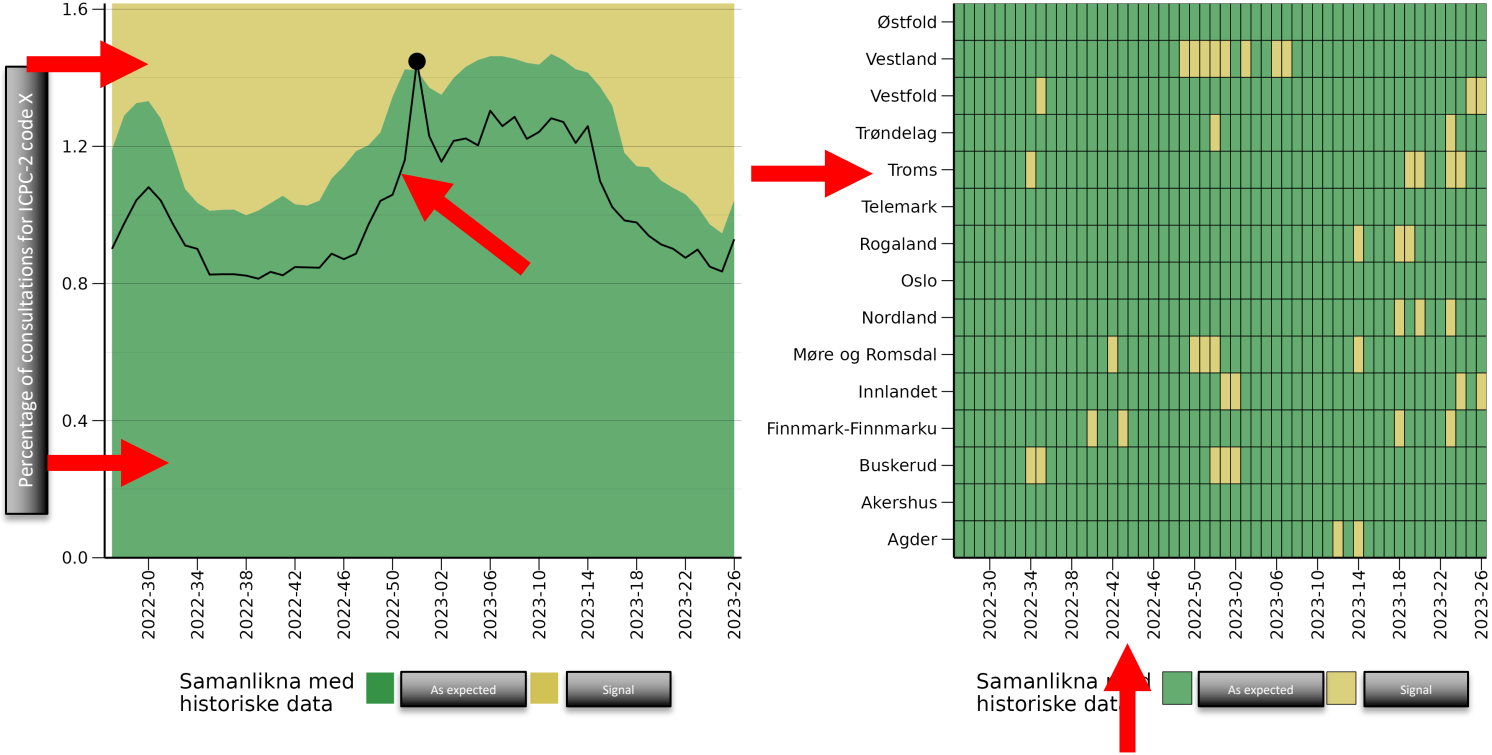
Simple aggregation



With statistics (MEM thresholds)

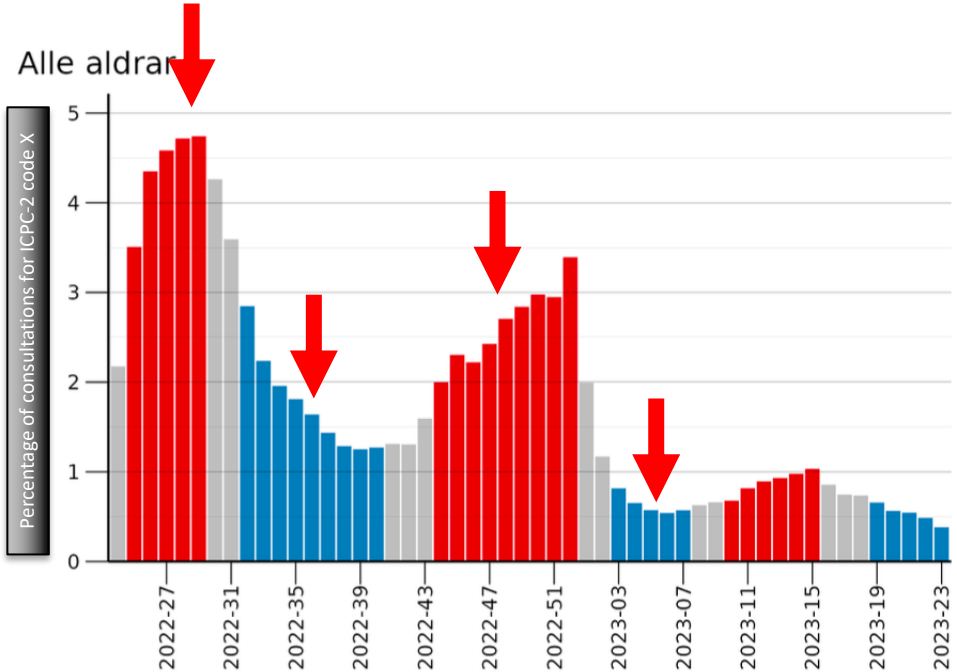


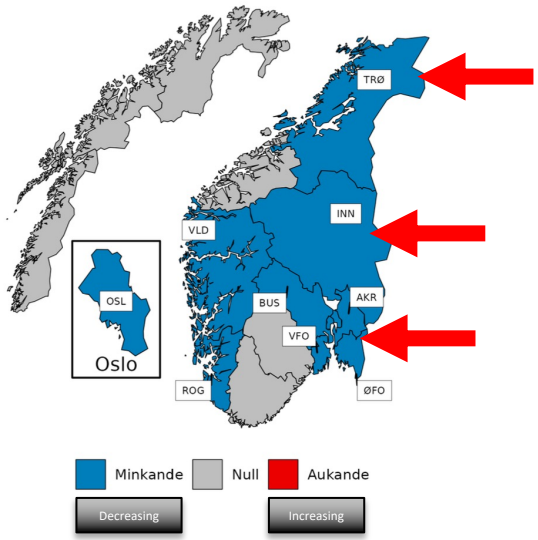
Signal detection



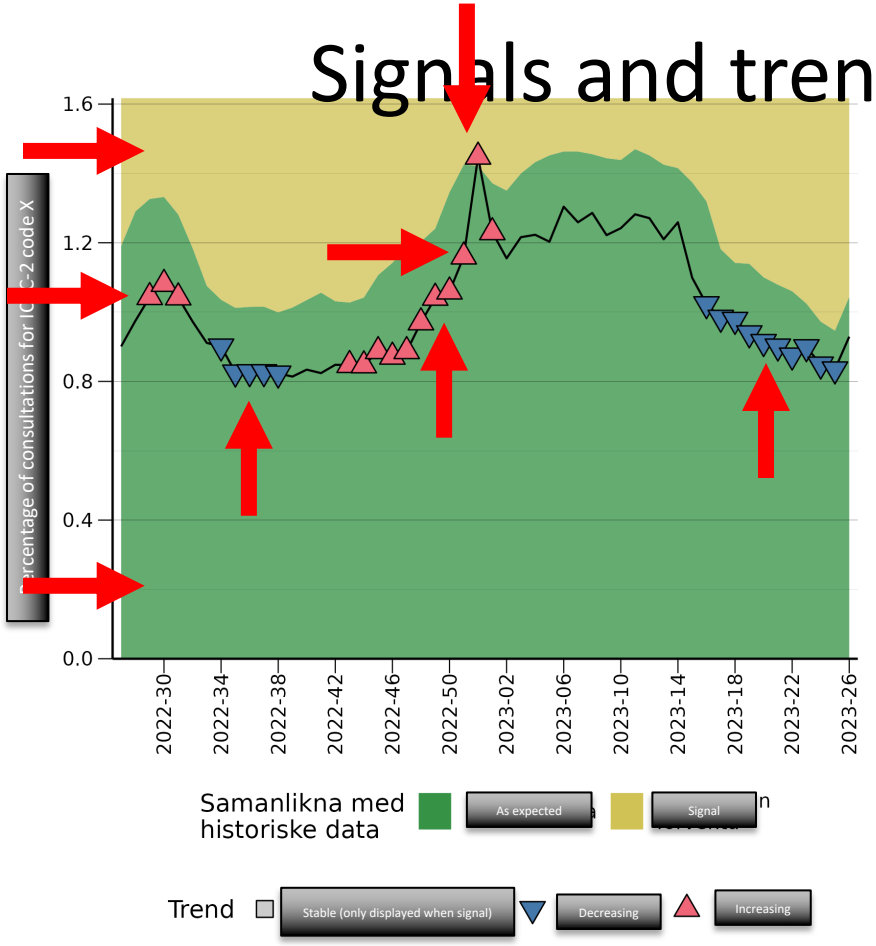
Farrington (1996) method? Noufaily (2012) method? What will come tomorrow?

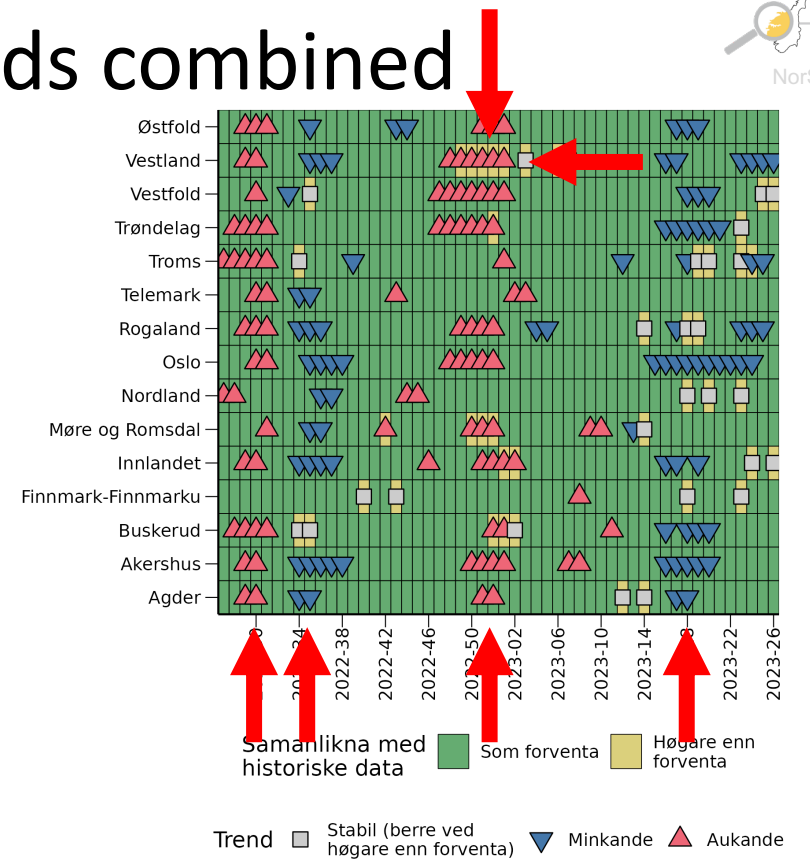
Detection of trends



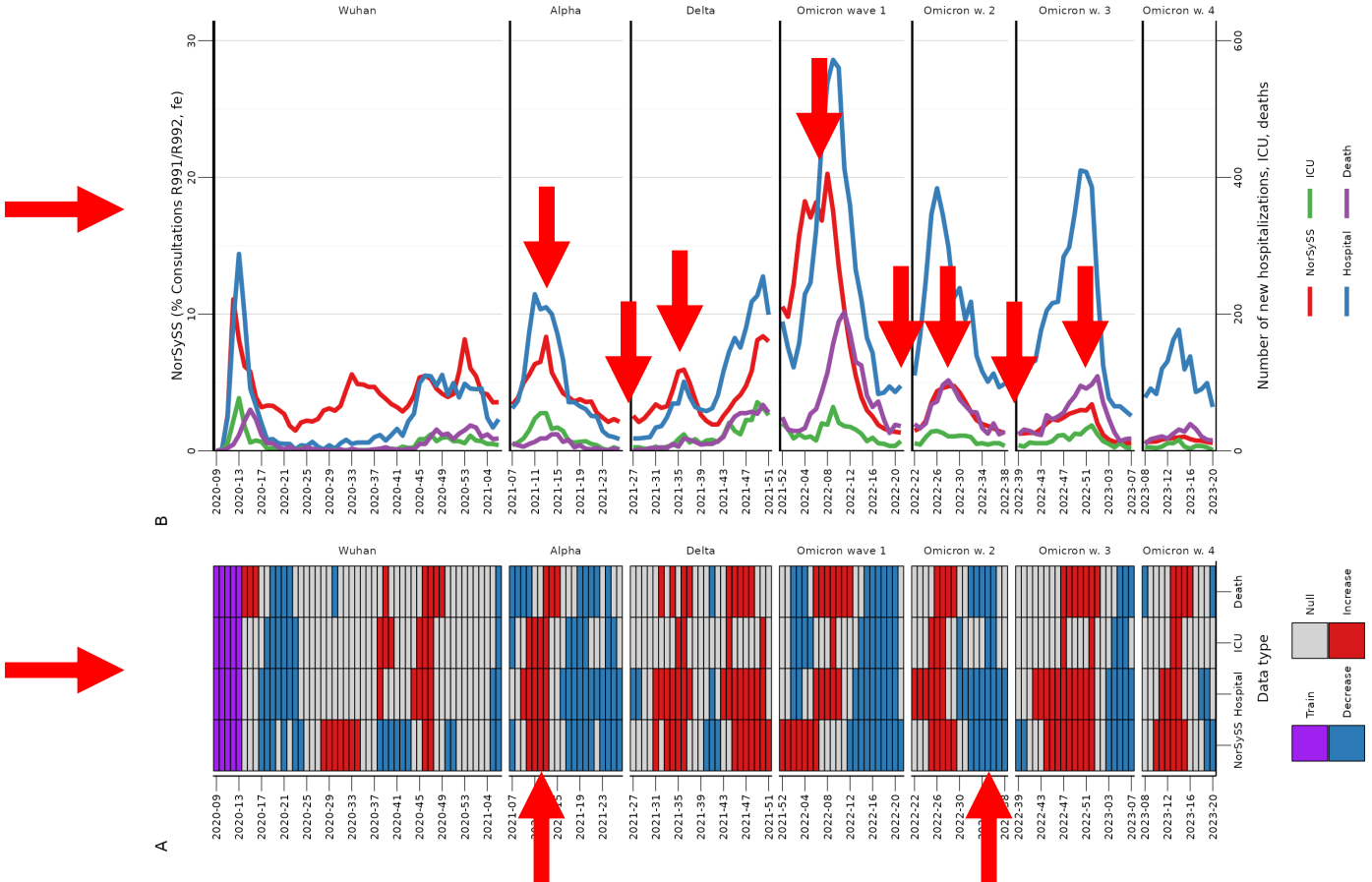


Signals and trends combined

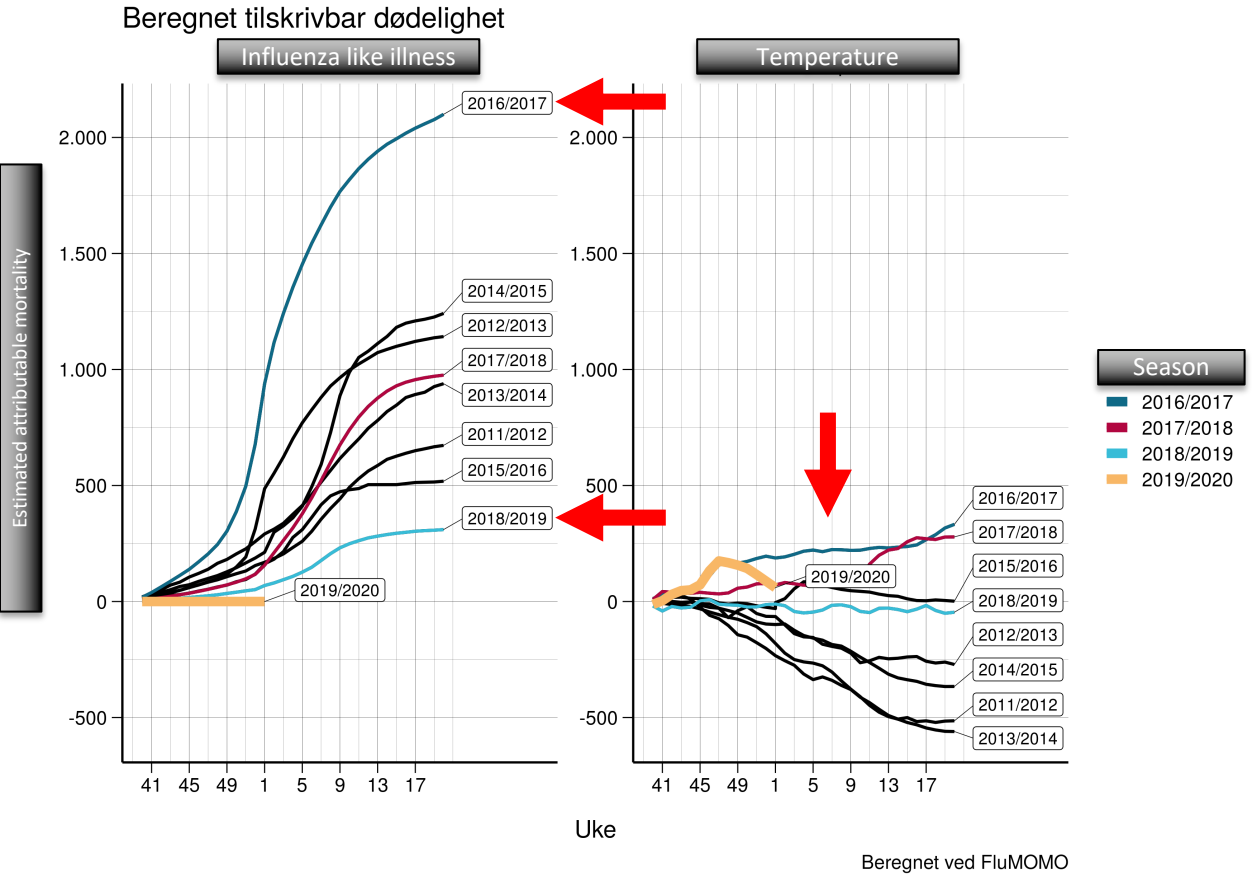




Validation against hard endpoints

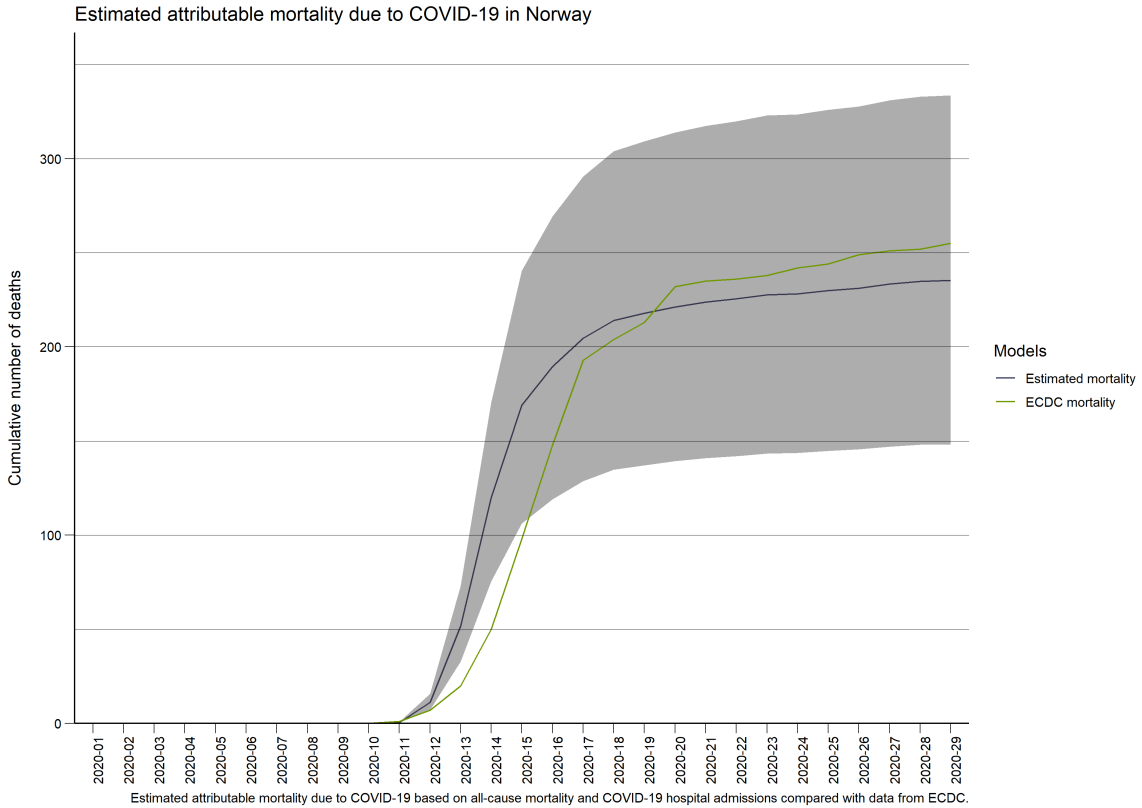


Attributable mortality



- Outcome:
  - All cause mortality
- Exposures:
  - Influenza like illness (NorSySS)
  - Temperature (MET)

Attributable mortality validating recorded mortality



- Outcome:
  - All cause mortality
- Exposures:
  - Percentage of consultations that were COVID-19 (NorSySS)
- Can run in real-time to predict deaths in 1-2 weeks.

Predict risk of outbreaks

NorSySS

RESEARCH

A One Health real-time surveillance system for nowcasting *Campylobacter* gastrointestinal illness outbreaks, Norway, week 30 2010 to week 11 2022

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Background: ***Campylobacter*** **is a leading cause of food and waterborne illness. Monitoring and modelling** ***Campylobacter*** **at chicken broiler farms, combined with weather pattern surveillance, can aid nowcasting of human gastrointestinal (GI) illness outbreaks. Near real-time sharing of data and model results with health authorities can help increase potential outbreak responsiveness. Aims: To leverage data on weather and** ***Campylobacter*** **on broiler farms to build a risk model for possible human** ***Campylobacter*** **outbreaks and to communicate risk assessments with health authorities. Methods: We developed a spatio-temporal random effects model for weekly GI illness consultations in Norwegian municipalities with** ***Campylobacter*** **monitoring and weather data from week 30 2010 to 11 2022 to give 1-week nowcasts of GI illness outbreaks. The approach combined a municipality random effects**

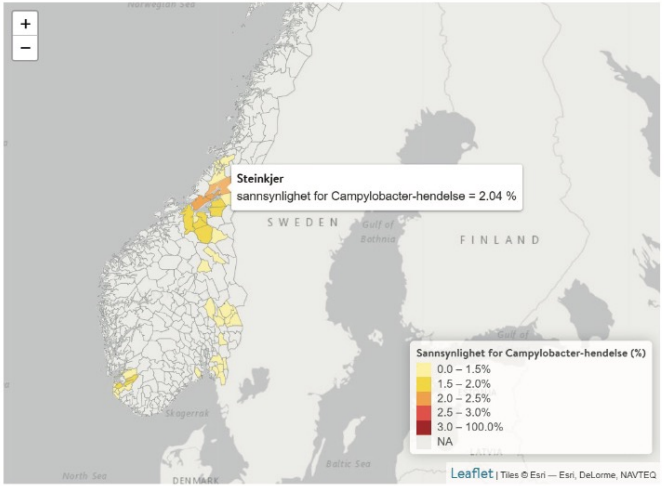
Introduction

In syndromic and data-driven infectious disease surveillance, health indicators are used to facilitate early detection of outbreaks [1]. Syndromic surveillance is based on non-laboratory confirmed information, and so using several data sources and models for outbreak detection is often desired since both the sensitivity and specificity of one data source can be suboptimal [2,3]. A One Health perspective is increasingly acknowledged as important for surveillance and preparedness, given that approximately 75% of emerging pathogens affecting humans are regarded as zoonotic [4]. Thus, combining available data from animal and human health with environmental sectors in a risk model is an important aspect of improved surveillance.

One well-established source of food- and waterborne gastrointestinal (GI) illness in humans

FIGURE 2

Interactive map, as presented on the Sykdomspulsen One Health website for selected municipalities, Norway, week 45 2021 (n = 38 municipalities)



The map shows the probability of an outbreak event (Norwegian: Sannsynlighet for *Campylobacter*-hendelse) happening in the current week. When hovering over a municipality, the name of the municipality and the probability of an event are displayed. For sensitivity reasons, only the municipalities with three or more farms are displayed, which yields a total number of 38.

Statisticians-first viewpoint

- Statisticians must be able to easily test and implement new methods.
  - Otherwise, you'll be stuck in the 1990s.
  - Statisticians must be able to use tools/languages/packages they are used to. I.e., R or Python.
- **Don't let the statisticians do whatever they want!**
  - Must follow a framework (e.g., Surveillance Core 9).
  - Don't implement custom analyses. Try to be as "large scale" as possible (e.g., only analyses from csalert package).
- Automated weekly data deliveries to epidemiologists in Excel format.
- Allow for emergency ad-hoc analyses.