



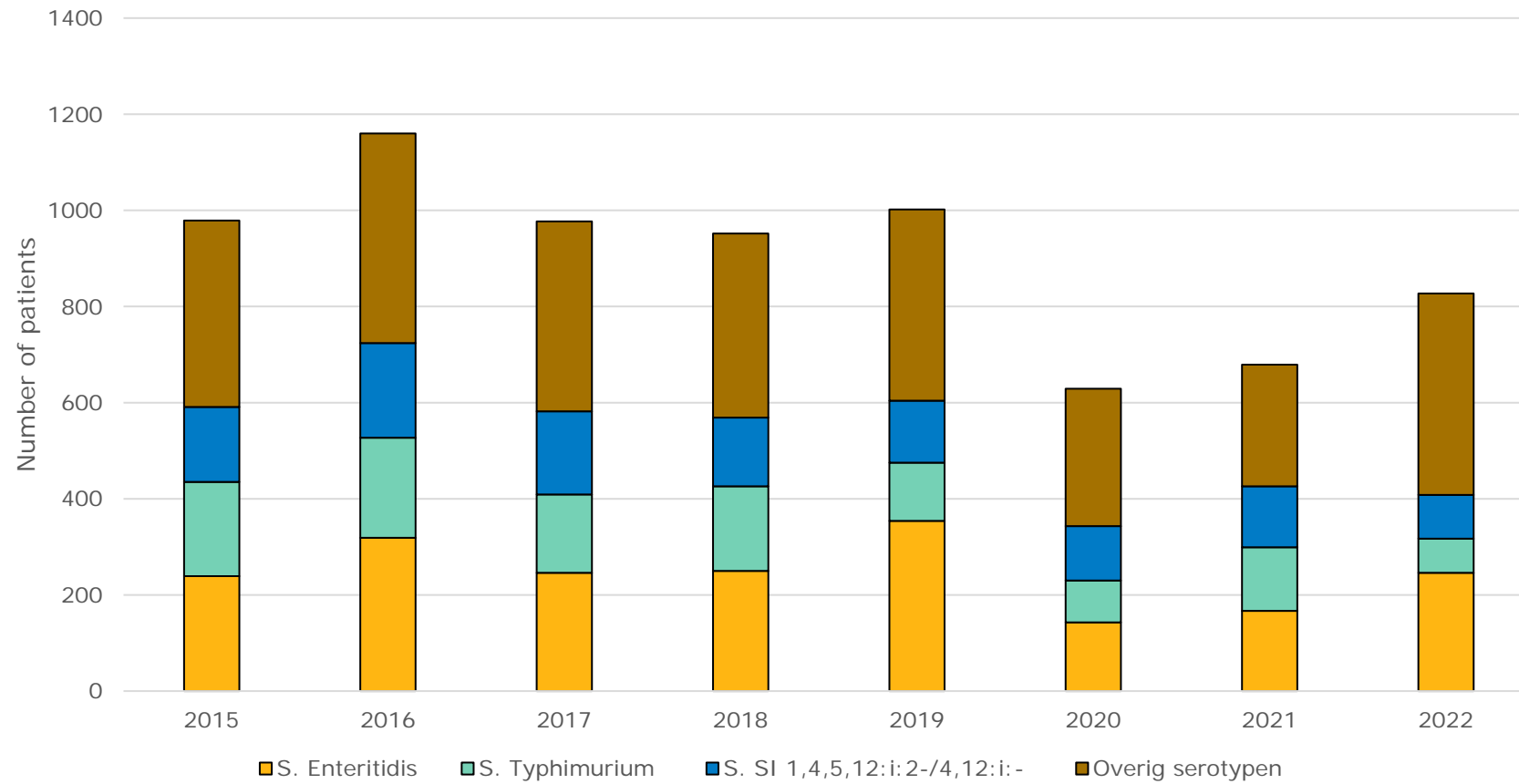
The role of poultry feed in a major *Salmonella* outbreak linked to eggs

- › Dana Adriaansens
- › National Institute for Public Health and the Environment in the Netherlands (RIVM)
- › Enteric, Vectorborne and Zoonotic infections (EVZ-EPI)



Background non-typhoidal *Salmonella*

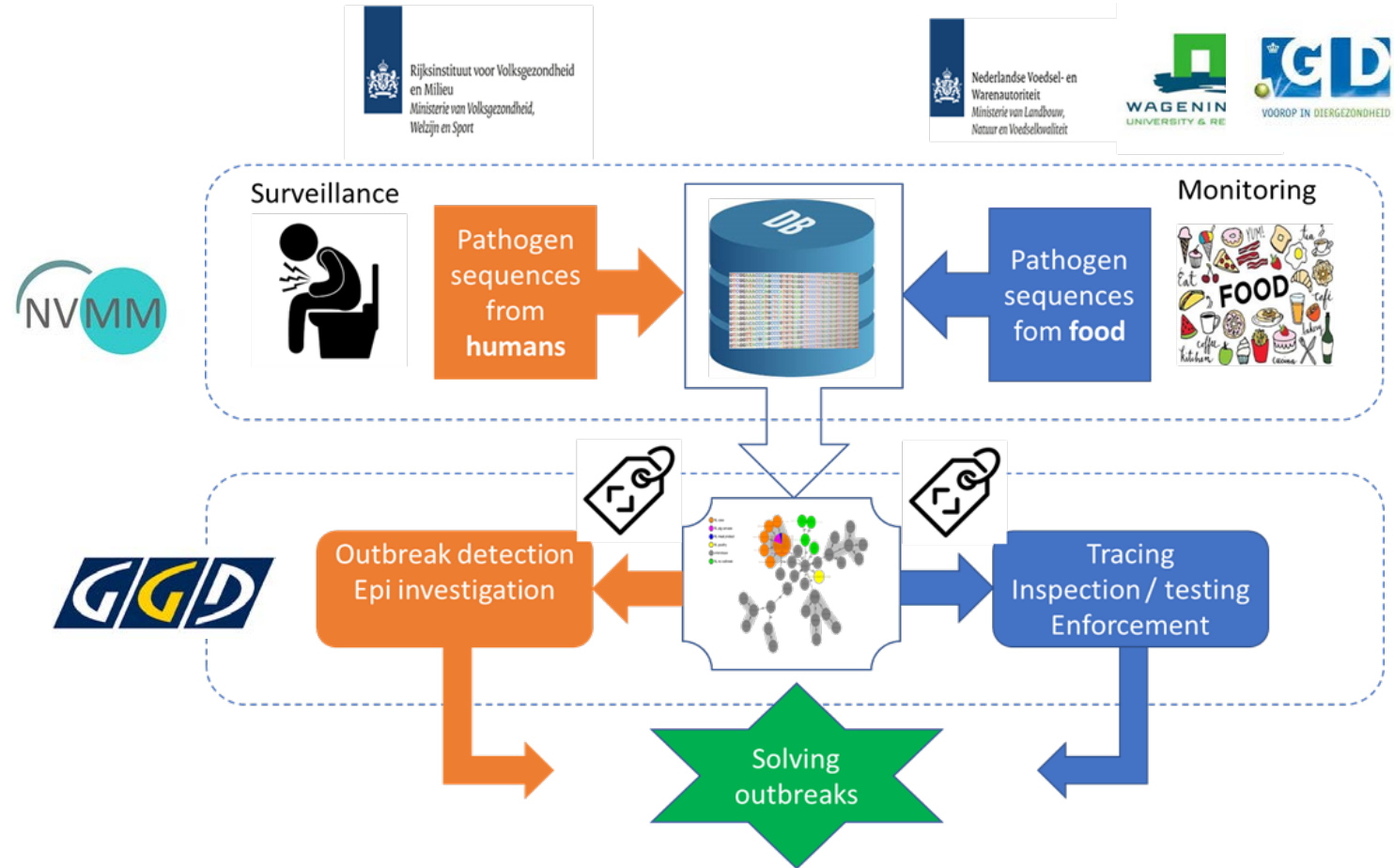
- › One of the major causes of foodborne infections
- › Almost exclusively transmission through food
- › Not notifiable
 - Food infection of two or more epi-related cases **is notifiable**





Surveillance through WGS data-sharing

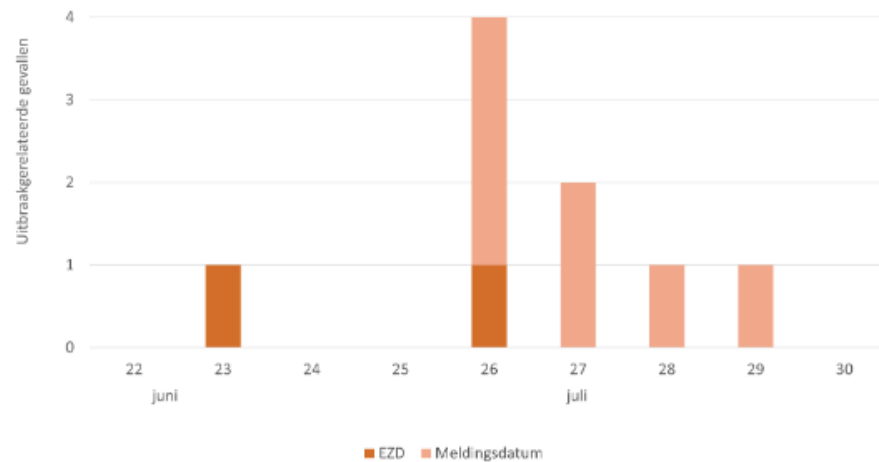
- > Countrywide surveillance network
- > 64% coverage
- > Weekly monitoring
- > cgMLST, 3002 targets
- > Cut-off 5AD





Signal 27 juli 2023

- › 9 S. Enteritidis patients in June/July
- › 3 males, 6 females
- › Median age 23 years (range: 2 – 57 years)
- › 2 related isolates of boot swabs (laying hen farms)





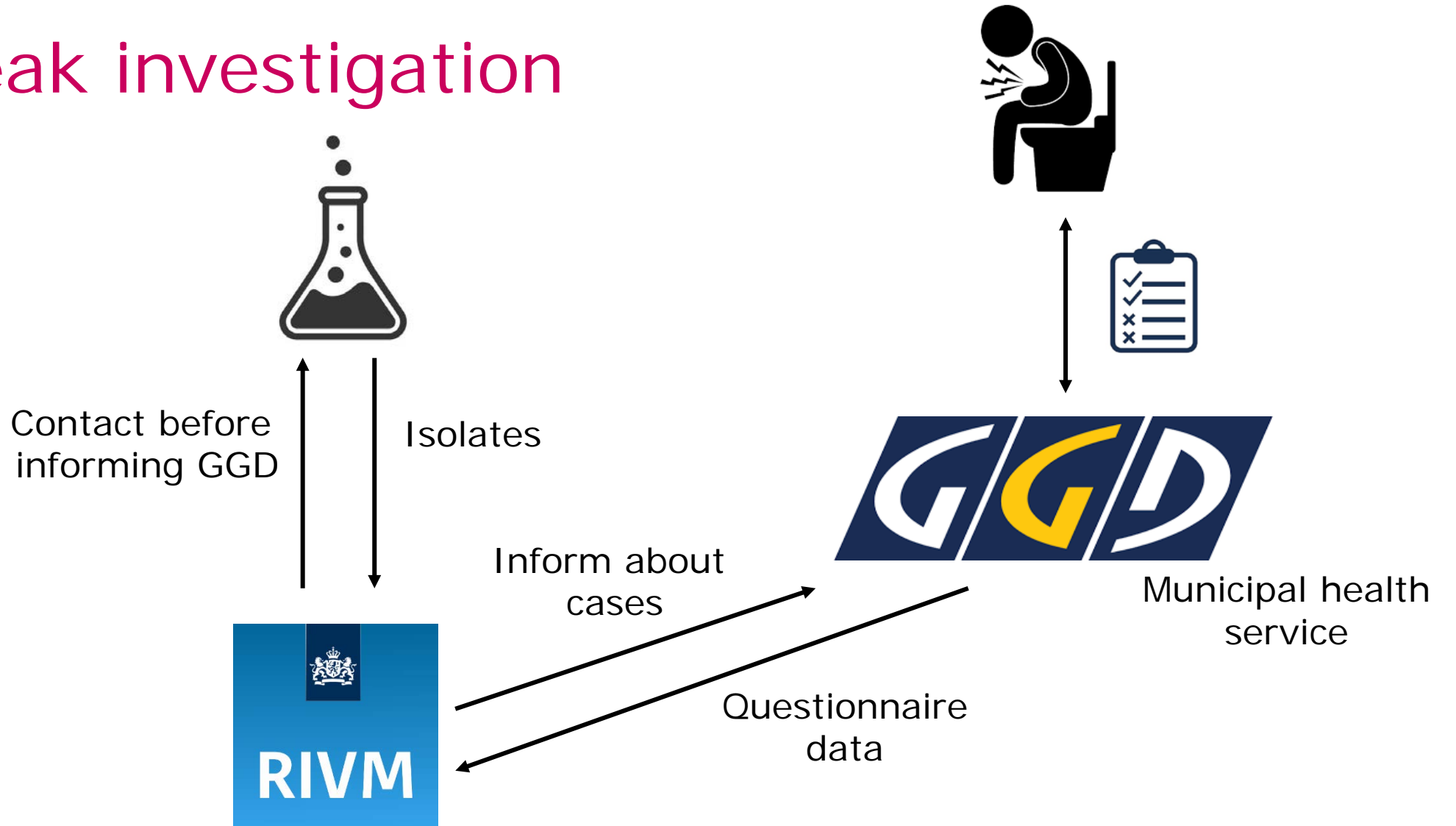
Outbreak investigation

Case definition: Patients of which isolates belong to the outbreak cluster using single-linkage clustering based on cgMLST (3,002 targets) using a cut-off of 5 alleles

Case questionnaires: focus on egg consumption



Outbreak investigation





Results

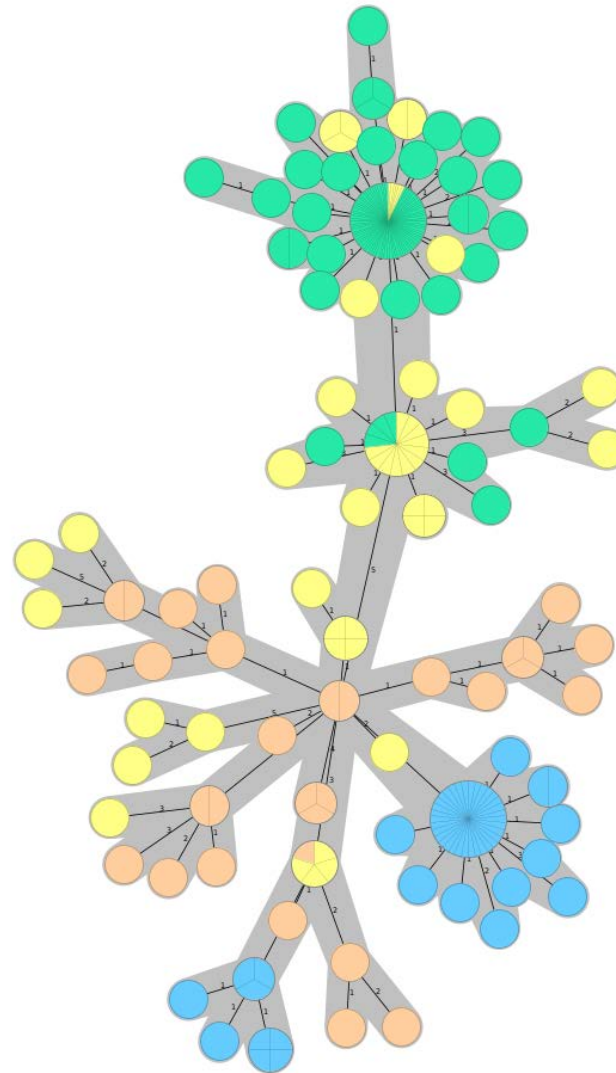
- › 156 patients (~x25 higher)
- › 140 feces, 11 blood, 5 other materials
- › Median age 41,5 years (range 1-98)
- › 76 male, 80 female



156 patients

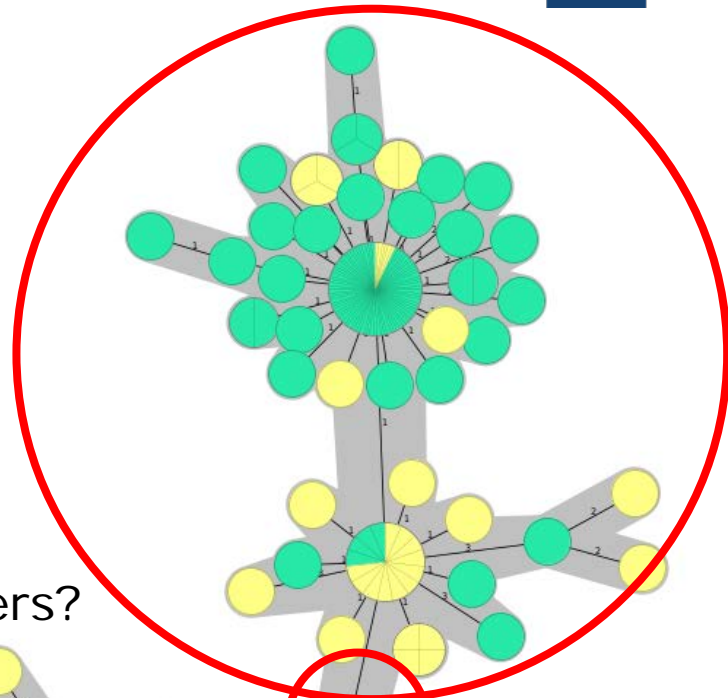
Isolates from:

- 14 laying hen farms
- 3 egg processing companies
- 1 animal feed producer
- 1 egg packing station



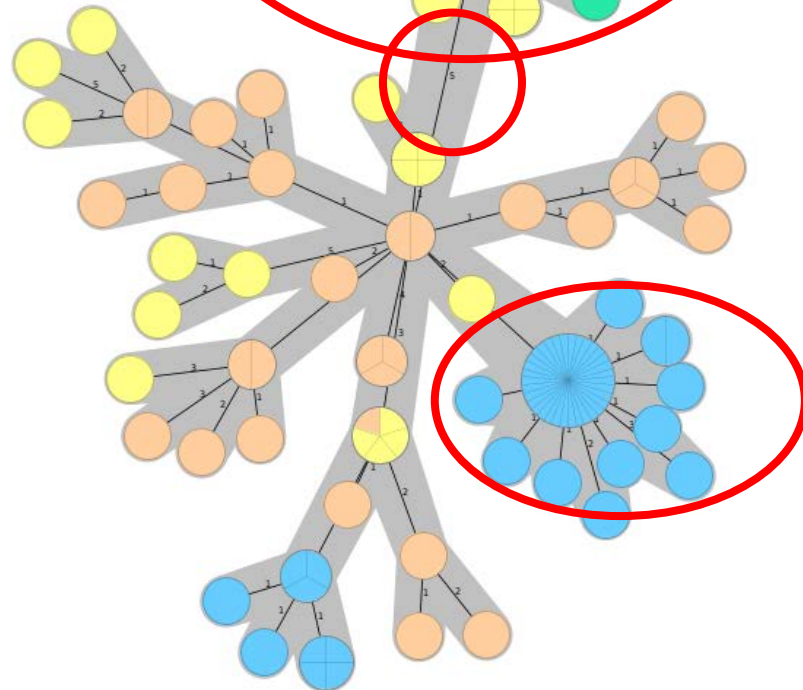
- Cluster 1 human isolates
- Cluster 2 human isolates
- Non-human isolates
- Older human isolates (before June 2023)

Positive farms → heat treatment of eggs

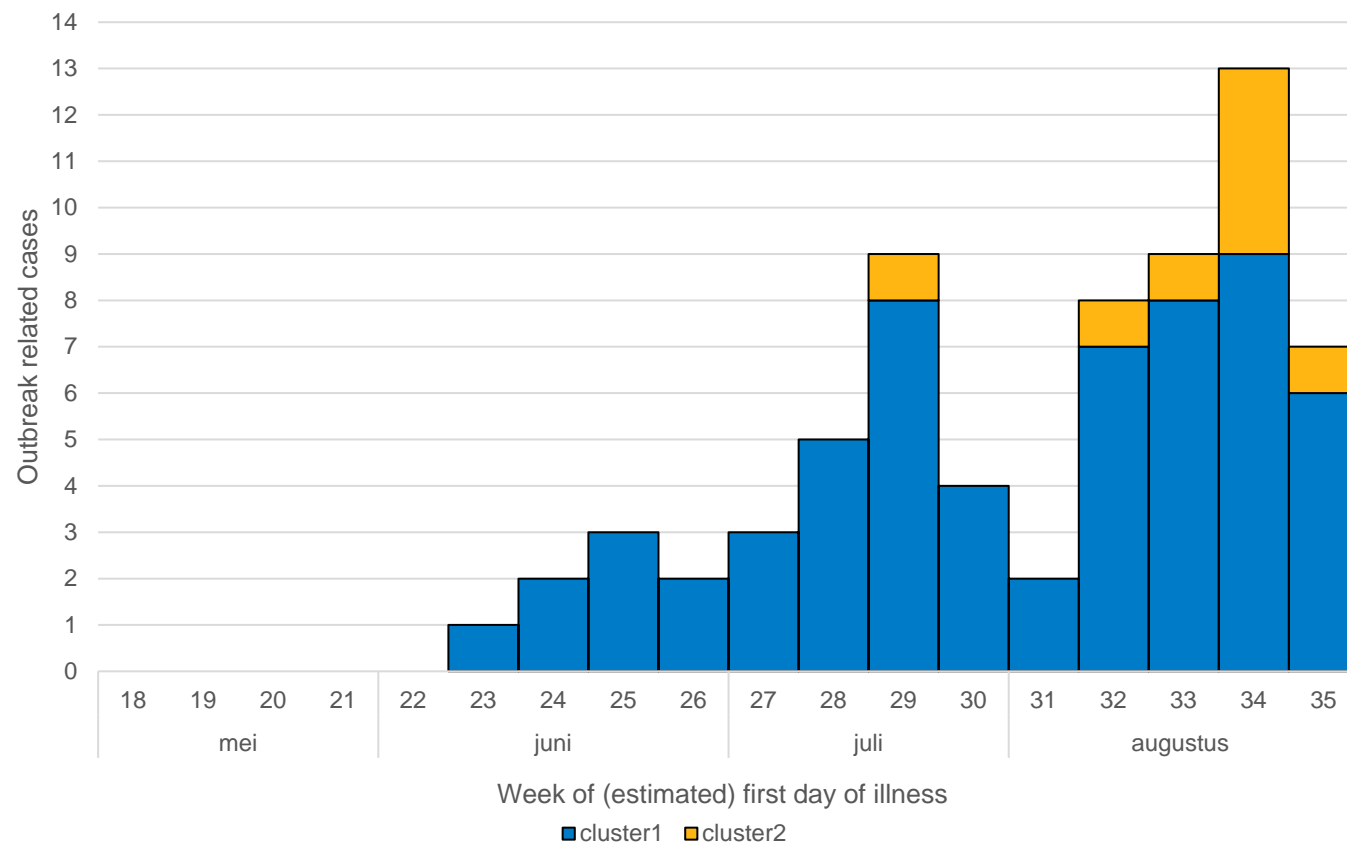


Cluster 1

5 alleles – two clusters?



Cluster 2





Cluster 1 = blue

Cluster 2 = orange



	cluster 1 (n=64)		cluster 2 (n=26)	
Boodschappen	n/N	%	n/N	%
Lidl	38	59%	14	54%
Jumbo	28	44%	13	50%
AH	23	36%	15	58%
Aldi	17	27%	4	15%
Plus	8	12%	3	12%
toko	1	2%	2	8%
Aankooplocatie ei				
Supermarkt	60	94%	21	81%
Markt	1	2%	4	15%
Boer	3	5%	0	0%
Eiconsumptie	55	92%	24	92%
Type ei				
Scharrel	31	82%	3	14%
Vrije uitloop	7	18%	6	29%
Biologisch	2	5%	19	90%
Ongestempeld	0	3%	2	10%



Case-control study

- > **Cases:** outbreak-related cases
- > **Controls:** persons randomly selected through population registries, matched on age, gender and municipality of residence

(Lab)Infact: *Salmonella* Enteritidis (1)

19-09-23

- Binnenland

In dit bericht:

- Uitbraak van *Salmonella* Enteritidis gerelateerd aan eieren en/of ei producten
- Verzoek aan microbiologische laboratoria om isolaten in te sturen



	Cluster 1				Cluster 2			
	Cases (%) (n=64)	Controls (%) (n=72)	OR (95% CI)	Interpretation	Cases (%) (n=26)	Controls (%) (n=22)	OR (95% CI)	Interpretation
Supermarket								
Lidl	38 (59%)	24 (33%)	2.9 (1.5-5.9)	Shops more at Lidl	14 (54%)	8 (36%)	2.0 (0.6-6.5)	
Albert Heijn	23 (36%)	44 (61%)	0.4 (0.2-0.7)	Shops less at AH	15 (58%)	15 (68%)	0.6 (0.2-2.1)	
Type of egg								
Barn egg	31 (82%)	21 (43%)	5.9 (2.2-16.0)	More barn egg consumption	3 (14%)	11 (73%)	0.1 (0.0-0.3)	Less barn egg consumption
Organic egg	2 (5%)	12 (24%)	0.2 (0.0-0.8)	Less organic egg consumption	19 (90%)	3 (20%)	38.0 (5.5-261.7)	More organic egg consumption
Soft-boiled eggs	34 (57%)	28 (40%)	2.0 (0.97-3.9)		16 (64%)	7 (32%)	3.8 (1.1-12.8)	More soft-boiled eggs



Saturation epi-data



Food product known

Farm/barn →

Country →

Kind of egg →
0 = biological
1 = free range
2 = barn eggs
3 = enriched cage/colony housing

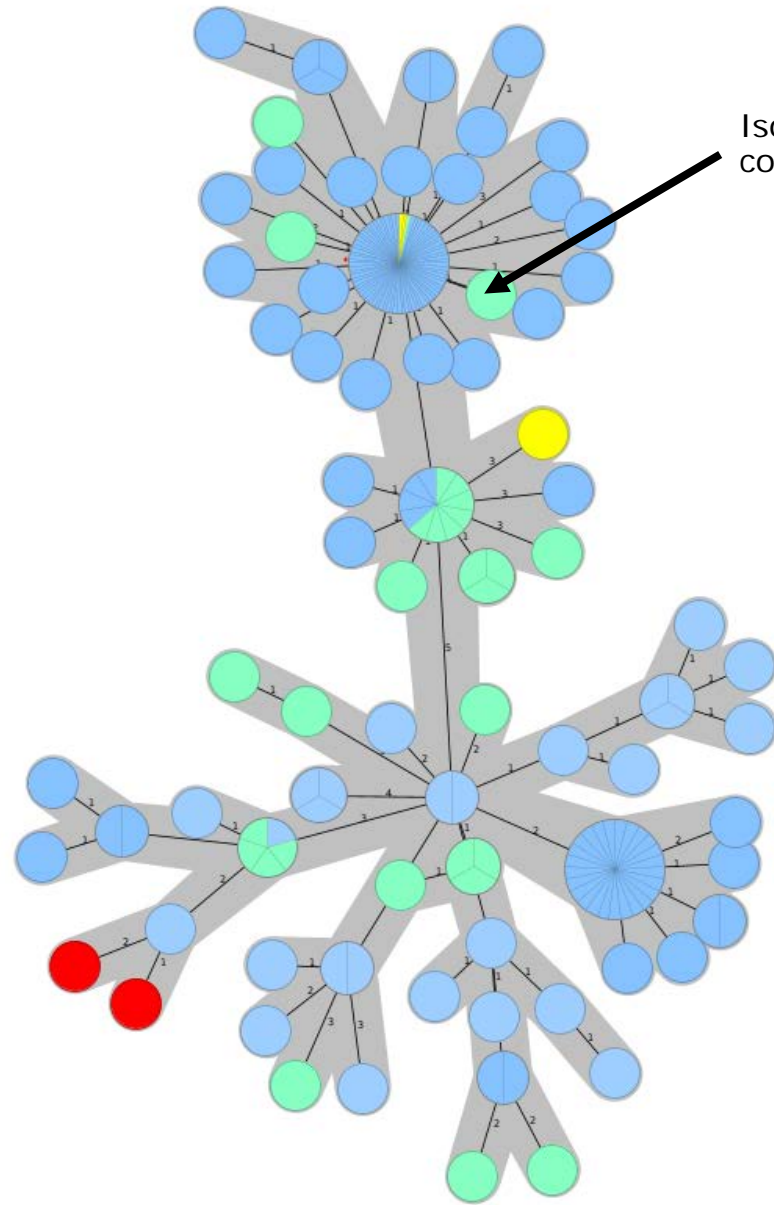


Trace-back very complex



We need egg codes!

However – eggs already consumed



Isolates dried egg shell from egg grinding company **after treatment**



Blue = Human

Green/yellow = Non-human

Red = Belgium

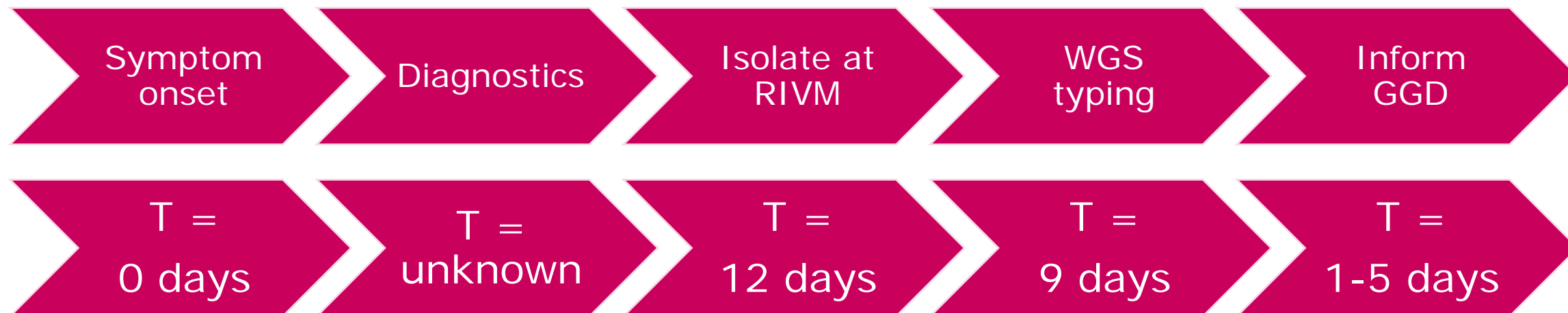


Control measures

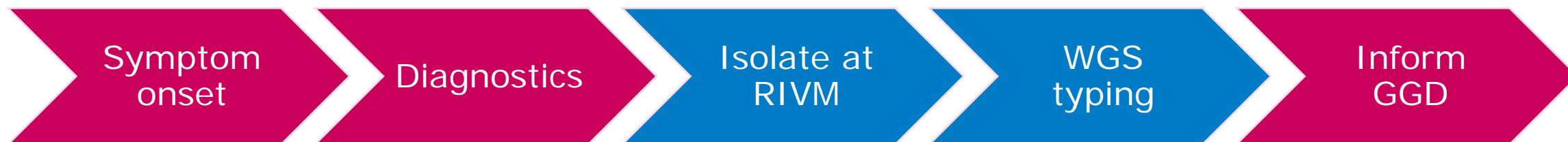
- › Laying hen farms → Heat treatment of eggs (standard procedure)
- › Egg grinding company → improve treatment of shells
- › However – farms can still be positive



The hunt for egg codes



- > Aim: find direct link between patients and laying hen farm



(Lab)Infact: *Salmonella* Enteritidis (2)

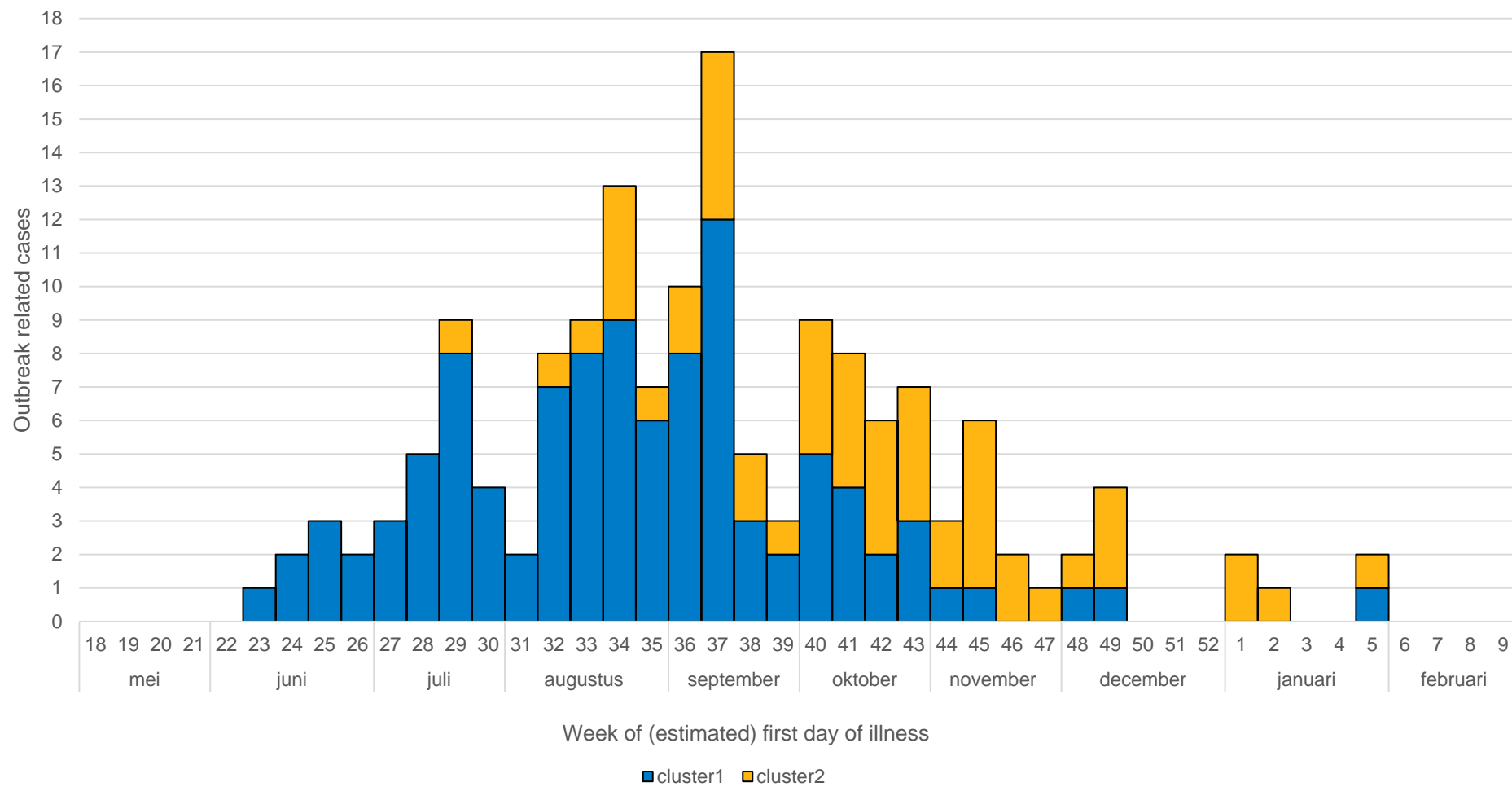
01-12-23

- Binnenland

In dit bericht:

- Stand van zaken uitbraak van *Salmonella* Enteritidis gerelateerd aan eieren en/of eiproducten
- Verzoek aan laboratoria om GGD'en reeds te informeren bij vaststellen *Salmonella* serogroep D of *S. Enteritidis*
- Verzoek aan GGD'en om ingekorte vragenlijsten af te nemen

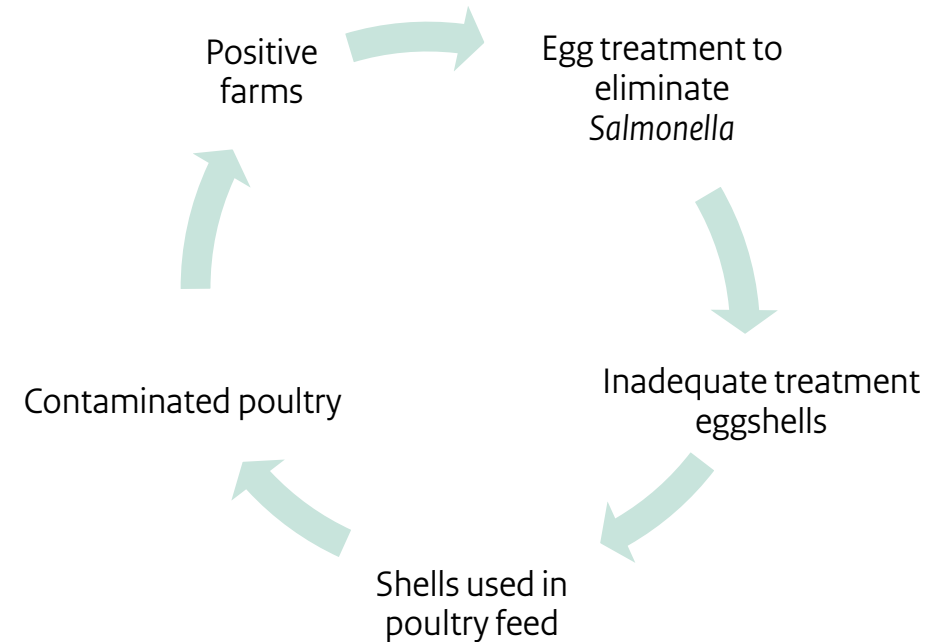






Conclusion

- > Spread of *S. Enteritidis* to laying hen farms via poultry feed
- > Outbreak under control
- > Other factors may have also played a role
 - Avian influenza
 - Vaccin efficacy?
 - ...





Thank you!

