



Investigations of foodborne outbreaks in Denmark - an introduction to the work at Statens Serum Institut and examples of recent outbreak investigations

Instituto de Salud Carlos III – 12 February 2026

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Objectives of this talk

- A brief introduction to the organisation of and the work at the national institute of public health in Denmark – Statens Serum Institut
- How do we work on foodborne outbreaks in Denmark
- Some examples of recent outbreak investigations

The History of SSI



- 1902** – Statens Serum Institut was established to ensure the production and supply of antidiphtheria serum to the Danish patients.
- 1910** – The Department of Diagnostics was established – marking the beginning of Denmark’s central and reference laboratory of microbiology.
- 1926** – The Department of Epidemiology was established to monitor infectious diseases and vaccination coverage and to combat epidemics.
- 1951** – The childhood vaccination programme was introduced.
- 1955** – As the first country in the world, Denmark implements nationwide vaccination against polio.
- 2012** – The Danish National Biobank was established.
- 2019** – Together with the University of Copenhagen, Statens Serum Institut assumes responsibility for Denmark’s veterinary emergency preparedness.
- 2020-2022** – Statens Serum Institut undertakes its largest single task to date – Covid-19, through surveillance, expert guidance, vaccine supply, and the operation of TestCenter Denmark.



The Core Functions of SSI

- Surveillance of infectious diseases, congenital disorders, and biological threats.
- Specialized and emergency-supporting diagnostics.
- Ensuring the supply of vaccines and emergency preparedness products.
- Preparedness and response to disease outbreaks, epidemics and pandemics.
- Government research institute – research-based advisory services.



SSI's Organization

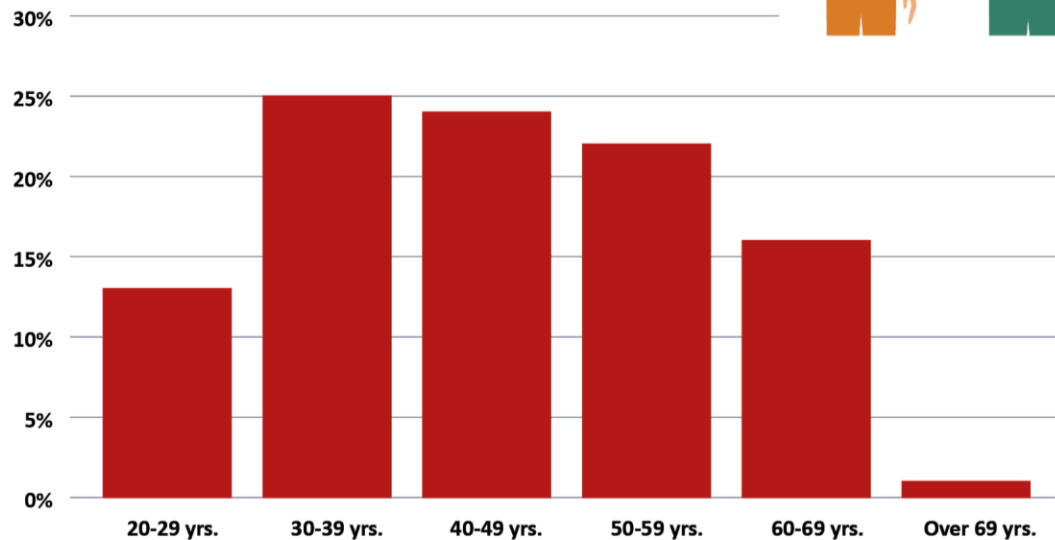
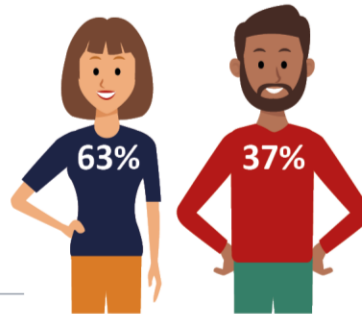


Who are we?

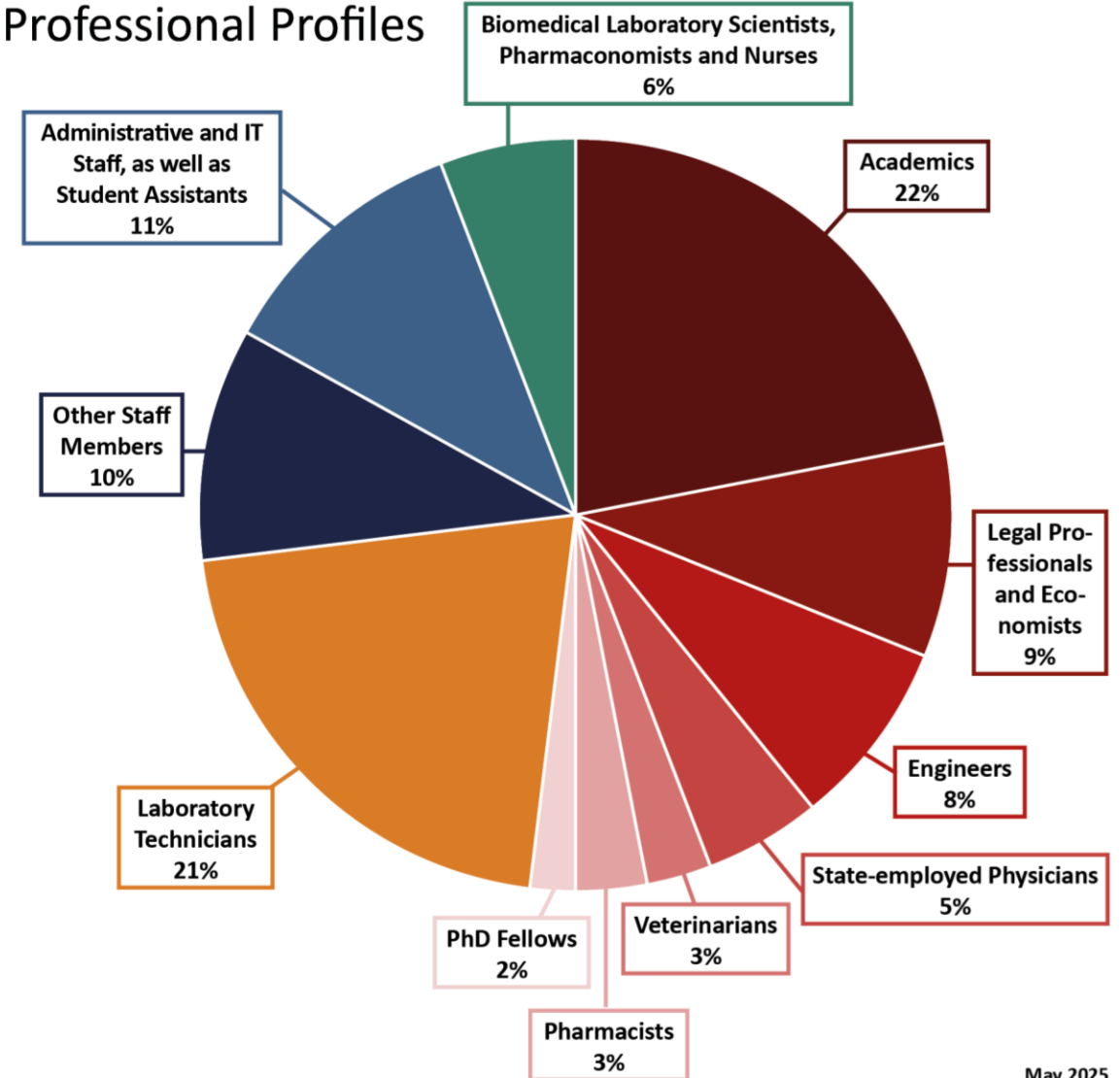
Approximately **850** employees

An average employment duration of **8 ½** years

Age and Gender Distribution



Professional Profiles



SSI's Organization

Chief Executive Officer

Strategy, Management & Organization

Campus Service

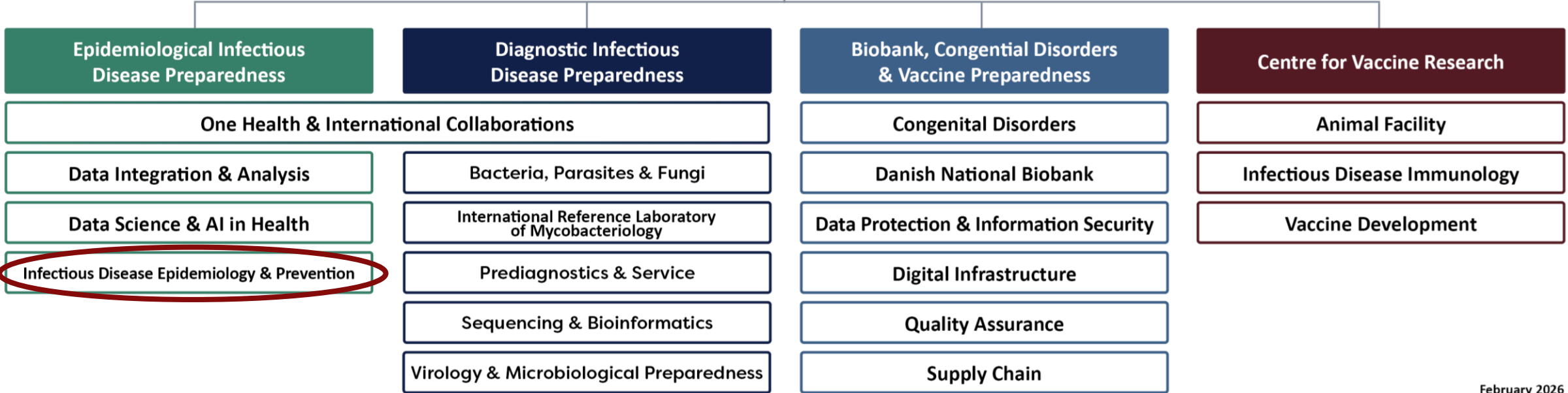
Corporate Affairs

Employees, Job Satisfaction & Development

Finance

Centre for Biosecurity & Biopreparedness

SSI have in total about 850 employees



Department of Infectious Disease Epidemiology & Prevention

- About 60 staff members
- 4 sections:
 - Vaccine preventable infections & Preparedness
 - Healthcare-Associated Infections and AMR → *(support for hospital outbreaks)*
 - Bloodborne and sexually transmitted infections plus digitilisation of surveillance
 - Food- and waterborne disease (Wastewater surveillance, Burden of disease etc)
 - The unit for outbreak response -> currently about 5 people





How we investigate foodborne outbreaks in Denmark

Investigation of foodborne outbreaks in Denmark

Local outbreaks

- E.g. restaurant, private party, drinking water

Responsible institutions

- Regional food safety authorities
- Medical officer
- Local laboratories

The central outbreak
management group

National outbreaks

- Cases in two regions or more
- International aspect

Responsible institutions

- Statens Serum Institut
 - Reference laboratory
 - Department of infectious disease epidemiology
- Veterinary and food administration
- Food Institute at DTU

Signals

- Case level
 - Warning by the Departments of Clinical Microbiology (DCM)
 - Surveillance of the number of positive cases
- Cluster signals
 - Routinely WGS of isolates/samples (SSI have three runs of Nextseq every week)
 - ALL Listeria, STEC, Salmonella, Hepatitis A
 - 15% Campylobacter, sentinel of C.diff
 - Yersinia, shigella on suspicion

Surveillance

Microorganism	Notifications type	Referral of isolates or biological material to SSI	Proportion (%) of cases received as isolates or biological material in 2024 (WGS)
<i>Campylobacter</i>	Laboratory	Voluntary	16.1 (WGS)
<i>Salmonella</i>	Laboratory	Mandatory	83.3 (WGS)
<i>Listeria monocytogenes</i>	Laboratory and clinical notification	Mandatory	98.3 (WGS)
STEC	Laboratory and clinical notification	Voluntary HUS (Mandatory)	27.0 (WGS)
<i>Shigella</i> /EIEC/ (ipaH)	Laboratory and clinical notification	Voluntary	30.5 (WGS when outbreak suspected)
<i>Yersinia enterocolitica</i>	Laboratory	Voluntary	28.2 (WGS when outbreak suspected)

Weekly stand-up outbreak board meetings – Epi & Lab



EPI-LAB MØDER 2026

- NYE SIGNALER
- NYT OM IGANGVÆRENDE UDBRUD
- NYT TIL SSI BEREDSKABSMØDE
- UDBRUD PÅ HJEMMESIDEN
- INTERNATIONALE FORESPØRGESLER
- EVENTUELT

FUD2500 Salm. STRATHCONA ST2559#1
2023-FWD-00090

n=29 18K, 11M 0-87 ÅR
Prøvedato: 3/11-11/12 55% INOLABT

SMP TOMATER FRA ITALIEN, REMANIO

STATUS:

CASE INTERVIEWS ← 24/26 ^{SPILT} TOMATER
CASE-KONTROL 23/25 ^{RENA} 1000
TOMATER 100%, KONTROLLER 69%
INDKØB: 2x CHERRY-GREENYARD FRESH

AFVENTUR FVST SAML. MED ITALIENSKE ISOLAT

PKMU
STNL

FUD2473: S. Muc. Typh. ST834#186
Georbnet

n=13 7K, 6M 19-85 ÅR
1T median=74 ÅR

Prøvedato: 19/Aug 2025 - 12/Jun 2026

Geograf: Sjælland + Hovedstad (10)
Midt (2)
Syd (1)

9 af 13 interviewet

nk - svineked fra slakter? 4/9

STATUS: HYPOTESERAPPORT = sendt til v. DCUG

- FVST check Falevik match KFAK
STNL

FUD2518: Listeria ST29#1

n=2 1K 1M 60-79 ÅR
1T

Prøvedato: 15/11-25 + 20/1-26
Geografi: Esbjerg + KBH

1 interviewet + 2 faste
interview i uge 6

Match til suaberrprou fra Nordsjællands Hospital 10/9-25

- Epi-link?
- optagning på suaberrprou

PKMU

FUD2506: Salm Ent. ST11#262
GENÅBNET

n=13 4K, 9M 2-81 ÅR
median=68 ÅR

Prøvedato: 19/Nov - 14/Jan

Region: Flerc

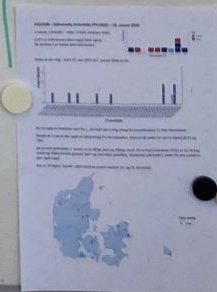
12 af 13 interviewet

Status:

↳ HYPOTESERAPPORT = sendt til DCUG

Match til jäs fra Lidl → ?

STNL



Automated outbreak report in R

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
example.analysis2.R example.analysis2.R ebola.siterrep.Rmd Outbreak.Report.Rmd Outbreak.Report.draft.2023.Rmd
Source Visual
1 ---
2 title: "r params$titel"
3 author: "r params$forfatter"
4 date: "r Sys.Date()"
5 output:
6 html_document:
7 df_print: kable
8 toc: yes
9 toc_float:
10 collapsed: false
11 smooth_scroll: false
12 fig_caption: no
13 fig_width: 9
14 fig_height: 5.5
15 matrix: null
16 highlight: kate
17 dev: svg
18 params:
19 title: "Midlertidig titel"
20 initialer: "XX"
21 forfatter: "Navn"
22 case_def: "Midlertidig værdi"
23 ---
24
25 ```{r, echo = FALSE}
26 # Includes SSI logo in report
27 htmltools::img(src = knitr::image_uri("S:/Gastro_team/Udbrud/2_MATERIALE/LineList skabelon/SSI_logo.png"),
28 alt = "Logo",
29 style = 'position: absolute; top: 0; right: 0; padding: 10px;',
30 width = "200px",
31 height = "150")
32
33 SSI_colors <- c("#000000", "#C8513E", "#81412", "#D9933", "#541A23",
34 "#67F68", "#D92FC4", "#2C608B", "#112048")
35
36 ---
37
38 ```{r setup, include=FALSE}
39 knitr::opts_chunk$set(echo = FALSE, message=FALSE)
40
41
42 # -----
43 # Step 1 - Loading R packages needed
44 # -----
45
46 # Install and load required packages
47 if (!require("pacman")) install.packages("pacman")
48 pacman::p_load(
49 tidyverse, janitor, extrafont, here, rio, openxlsx, stringr, lubridate, table1, scales,
50 RODBC, DBI, dbplyr, sf, leaflet, install = TRUE
51 )
52
53 ---
54
55 r params$titel
56
57 Console Terminal Background Jobs
58 R 4.4.0 - S:/Gastro_team/Udbrud/FUD2467 Listeria ST7#4 (Hidligere FUD1970)
59 Type 'q()' to quit R.
60
61 R version 4.4.0 (2024-04-24 ucrt) -- "Puppy Cup"
62 Copyright (C) 2024 The R Foundation for Statistical Computing
63 Platform: x86_64-mingw32/x64
64
65 R is free software and comes with ABSOLUTELY NO WARRANTY.
66 You are welcome to redistribute it under certain conditions.
67 Type 'license()' or 'licence()' for distribution details.
```

Udbrudsrapport: FUD2467 Listeria monocytogenes ST7#4



Pernille Kold Munch
2025-11-12

Case definition

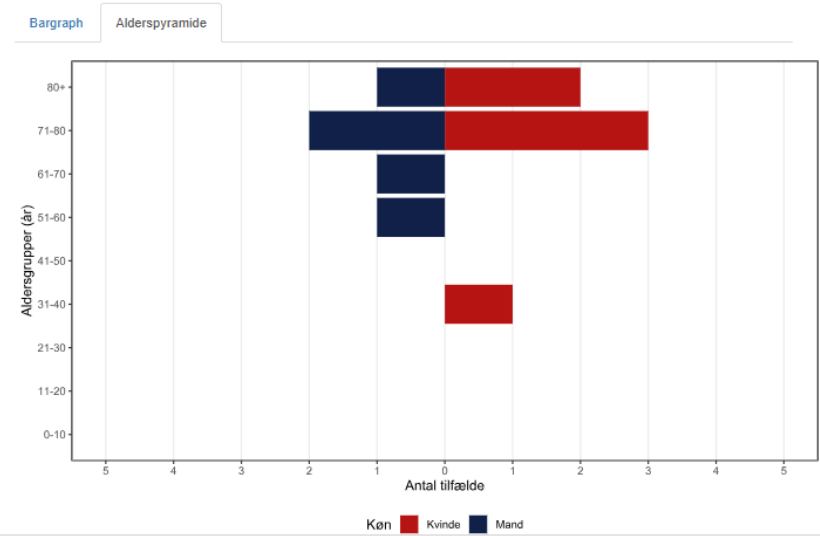
Laboratorie-bekræftede tilfælde af Listeria monocytogenes ST7#4 der matcher på WGS (serotype) med prøvedatoer fra 13. august 2025 og frem, i Danmark.

Alder og kønsfordeling

Table

	Overall (N=11)
sex	
K	6 (54.5%)
M	5 (45.5%)
age	
Mean (SD)	73.3 (16.6)
Median [Min, Max]	75.0 [34.0, 92.0]

Graphs



Epicurves

First and last sample dates

first_sampledate	last_sampledate	length_day	length_week
2025-08-13	2025-10-24	72	10.28571

Epicurve by day Epicurve by sampling week Epicurve by sampling week and second variable

Epicurve by week and symptom onset Epicurve by month Epicurve by year

Geographical distribution

Table

Baseret på KMA/lab

region	n	percent	valid_percent
NA	11	100%	-

Baseret på nuværende adresse (CPR register)

Region	n	percent
Hovedstaden	6	55%
Sjælland	5	45%
Syddanmark	2	18%
Midtjylland	1	9%
Nordjylland	3	27%

Maps


Interactive Map

Interview center

- 5 students in public health, medicine, pharmacy, veterinary medicine or the like
- Trained in interviews and the pathogens we work with
- Work evenings and weekends
- Advantages
 - Reach patients when they are home (reduces after-hour work)
 - Time saving
 - Less influenced by hypotheses
 - High flexibility
- Disadvantages
 - Loss of “feeling” with the patient/interview
 - Missing information (not asked?)
 - Not so flexible during exam periods



Disease-specific questionnaires

STATENS SERUM INSTITUT  Patientnummer _____

Salmonella XXX FUD
Hypotesegenererende interviews (version: sep 2024)

Interview foretaget af _____ Dato for interview ____ / ____ / ____

Hvem interviewes? Patienten selv En anden hvem _____

1. PATIENT INFORMATION

1.1 Fornavn: _____
1.2 Efternavn: _____
1.3 Telefonnummer: _____
1.4 Køn: Kvinde Mand
1.5 Alder: ____ år 1.6 Prøvedato: ____ / ____ / ____

Goddag mit navn er [for- og efternavn], taler jeg med [for- og efternavn]? Jeg ringer fra Statens Serum Institut. Jeg ringe barn har haft en infektion med Salmonella. Det viser sig, at der er flere, der har været syge med den samme type af salmonellose, at i er blevet smittet af den samme fødevarer. Jeg vil derfor høre dig, om jeg må stille nogle spørgsmål angående barnes sygdom og hvad du/(han/hun) har spist i tiden op til du/(han/hun) blev syg?
Tak. Det kan være en hjælp, hvis du har en kalender ved hånden – på den måde kan du måske bedre huske hvad der er sket i tiden sygdommen begyndte.
(Hvis spørgeskemaet gælder et barn spørges 'dit barn' eller barnets navn i stedet for du/dig under hele interviewet)

2. SYGDOMSHISTORIE

2.1 Hvilken dato fik du de første symptomer på sygdom? ____ / ____ / ____ dd/mm/åå


2.2 Er du stadig syg? Ja Nej Usikker
2.2.1 Hvis nej, hvor mange dage var du syg i alt? _____ dage

2.3 Har du haft nogle af følgende symptomer?

Symptom	Ja	Nej	Usikker
Diarré	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blodig diarré	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mavesmerter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kvalme	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Opkast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feber	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ledsmerter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hovedpine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tæthed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Andet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.3.1 Andet symptom, beskriv _____

2.4 Var du indlagt pga din sygdom? Ja Nej
2.4.1 Dato for indlæggelse ____ / ____ / ____ 2.4.2 Dato for udskrivelse ____ / ____ / ____ eller fortsat indlagt

Vurdering af interview (sæt ring):
  
 Bemærkninger:

10.1 Har du spist nogle af følgende grøntsager i de 7 dage før du blev syg? Har du spist...

Grøntsager	Hejt sikkert ja	Sandsynlig -vis ja	Sandsynlig -vis nej	Hejt sikkert nej	Hvis ja eller sandsynligt: Hvilket produkt var det? Købt eller hjemmedyrket? (økologisk, løs vægt, pose, bakke, "far-til-at-spise", dansk)	Hvor var det købt?
Tomat						
Ågurk						
Rå gulerødder						
Andre rå rodfrugter						
Peberfrugt						
Rå løg (fx i salat eller på pålæg)						
Rå forårsløg						
Spirer fx bønnespirer eller karse						
Grøn salat						
Rucola salat						
Salatmix						
Spinatblade						
Færdigpakket, klar-til-at-spise salat eller andet grønt						
Kål						
Andre grøntsager						

10.1 Hvis andre grøntsager, hvad _____

The Central Outbreak Management Group

- Institutions
 - Statens Serum Institut
 - Veterinary and food administration
 - Food Institute at DTU
- Weekly outbreak meetings – every Thursday
- Coordinates investigation of national food-borne outbreak in Denmark
- Published Annual Report on Zoonoses in Denmark
- Inform about regional outbreaks
- Food- and waterborne outbreak database (FUD)



Annual Report on Zoonoses in Denmark 2024



STATENS
SERUM
INSTITUT



Ministeriet for Fødevarer,
Landbrug og Fiskeri
Fødevarestyrelsen



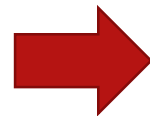
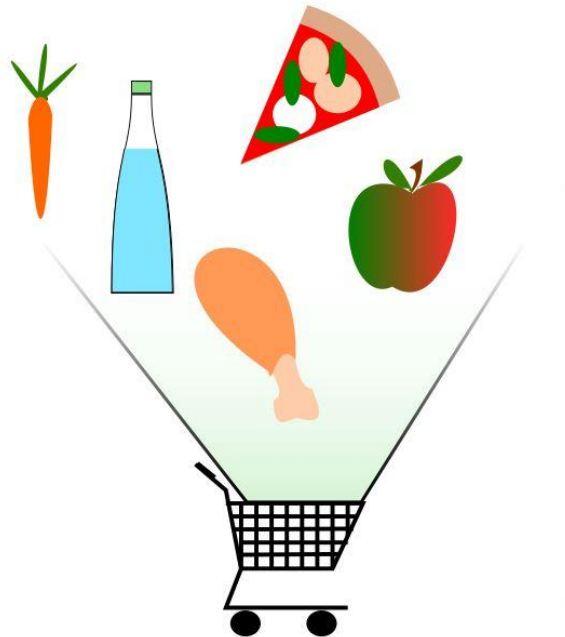
DTU Fødevareinstituttet



Using consumer purchase data in outbreak investigations

Consumer purchase data for outbreak investigation

- Looking in the receipts of the food bought by patients prior to disease onset
- Data retrieved from supermarket databases
- Using membership/loyalty card or credit/debit card
- Search for specific transactions
- Compare purchase data from different patients





Limitations of consumer purchase data

- Consumer purchase data is not equal to consumption
- Will not capture food eaten outside home
- Not suitable for all patients (i.e. those shopping with cash)
- Sensitive data for patients
- Time consuming to collect data
- Multiple members of household might be buying food using several cards
- Retailers not always able to identify purchases – i.e. for fresh products like salad it can be hard to identify batch / product
- Retailers might not want to share data

Comments on consumer purchase data

- Highly added value to outbreak investigation
- Can fulfil a gap – when patients do not recall food history
- Can be used at different stages of the investigation
- Dependent on good collaboration between public health, food authorities and retailers
- Future:
 - Access to more digitalised data
 - More routinely implemented
 - Invoices collected from institutions i.e. elderly homes
 - Use for analytical approach i.e. case control studies
 - Direct comparison with overall sales data



Examples of recent outbreak investigations



Recurring multi-country outbreaks of *Salmonella* Strathcona linked to tomatoes

Salmonella Strathcona



JOINT ECDC-EFSA RAPID OUTBREAK ASSESSMENT

Prolonged multi-country outbreak of *Salmonella* Strathcona ST2559 linked to consumption of tomatoes in the European Union/European Economic Area – first update

23 October 2025

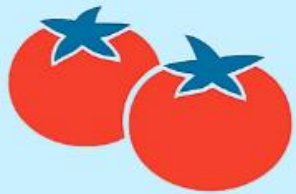
Salmonella Strathcona

 Eurosurveillance

Recurring multi-country outbreaks of *Salmonella* Strathcona linked to tomatoes, Europe, 2011–2024



643 cases
across 17 countries

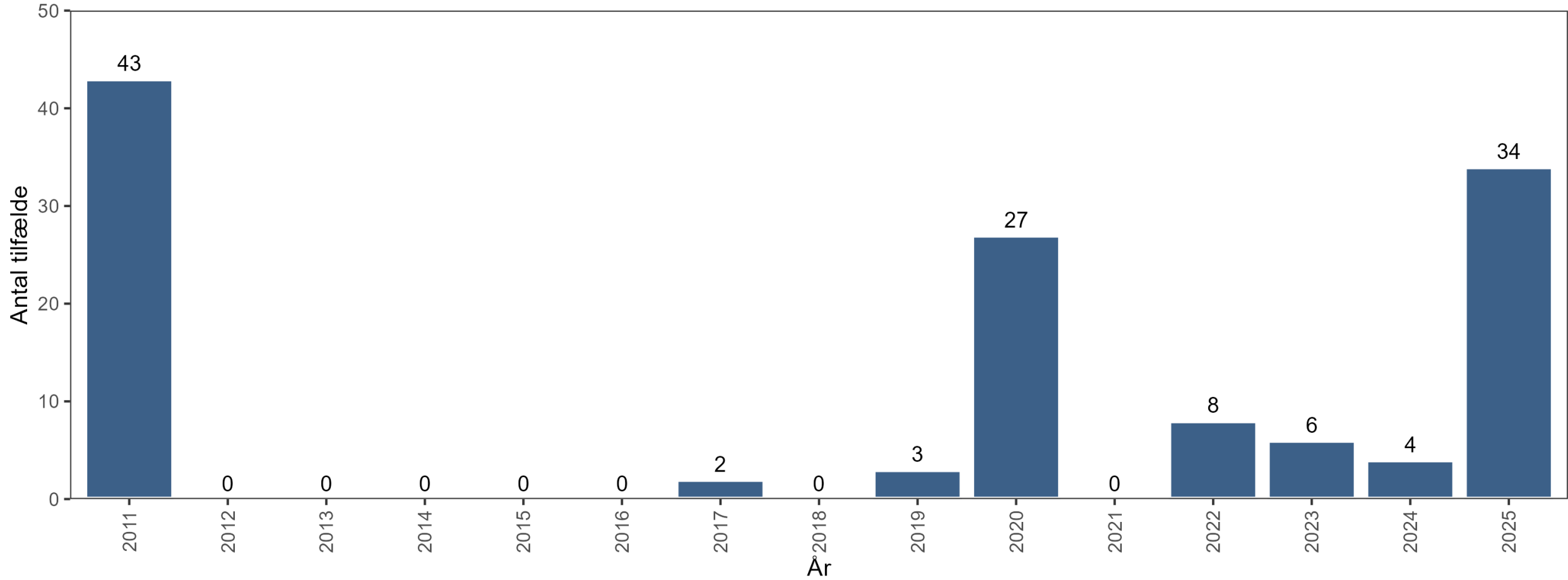


Small tomatoes
identified as the
likely vehicle



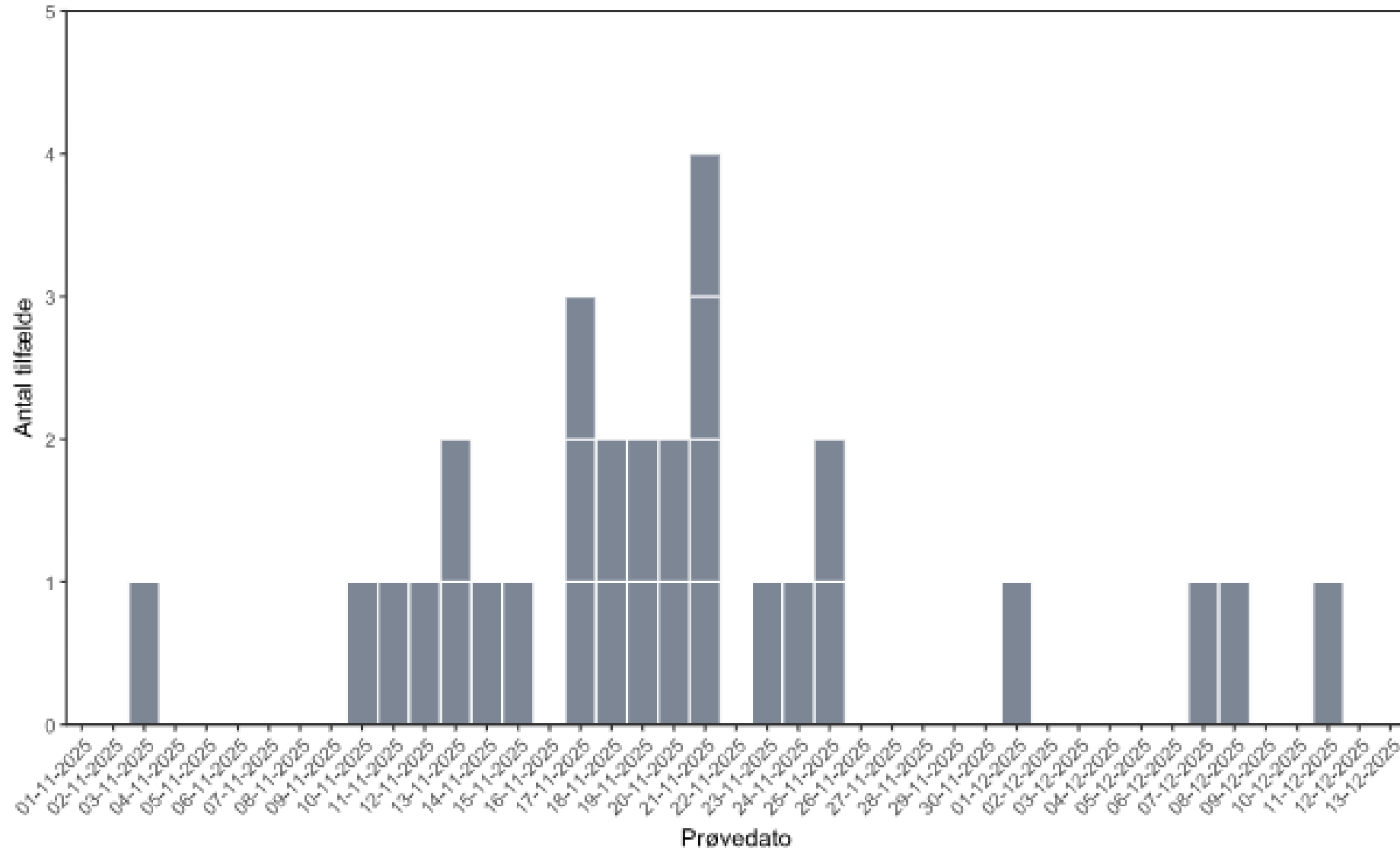
Seasonal pattern
of recurrence

Salmonella Strathcona cases in Denmark by year, 2011-2025



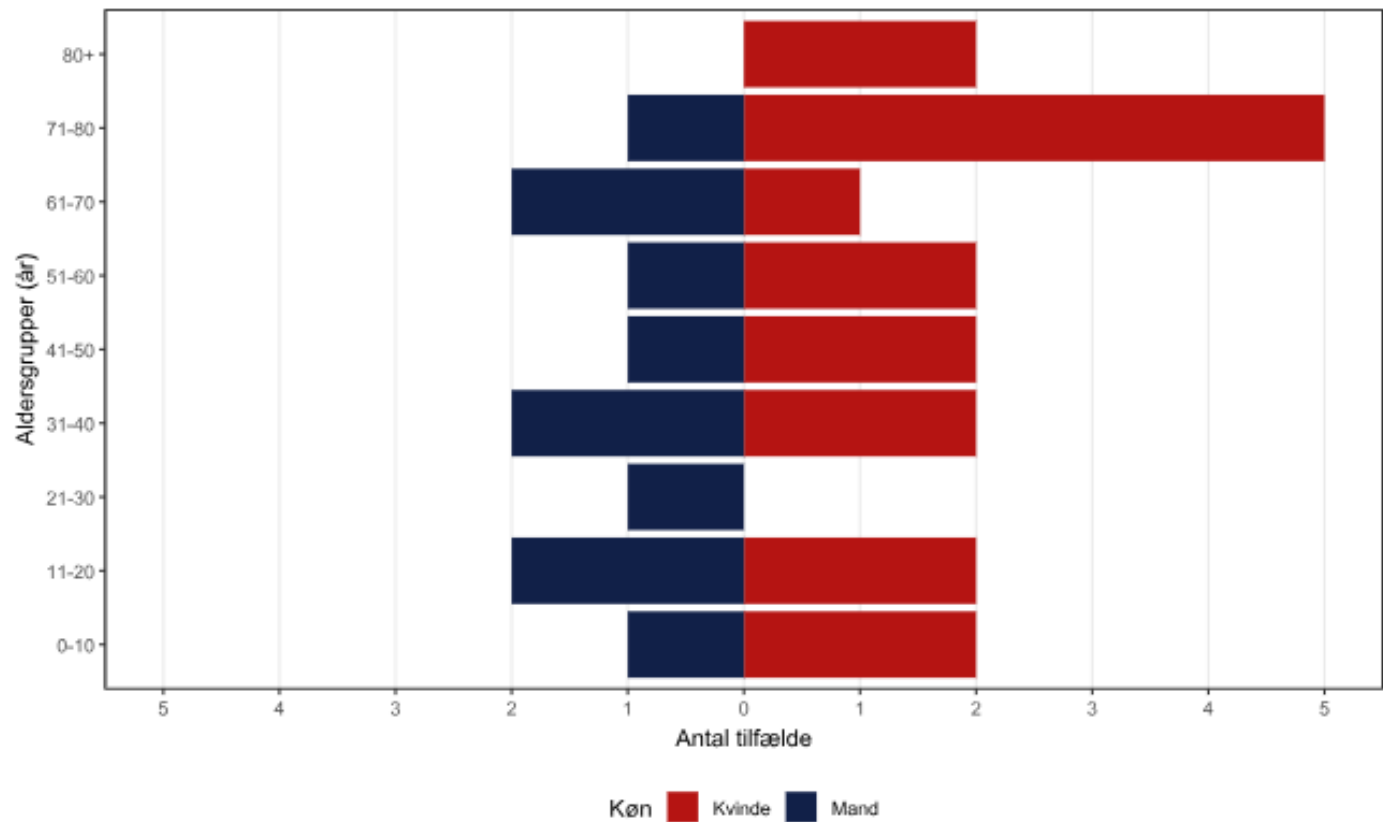
Salmonella Strathcona cases in Denmark by sample date

3. nov – 11. dec 2025, n=29



Salmonella Strathcona in Denmark, 2025

- 29 cases in November/December 2025
- 18 women, 11 men, 0-87 years
- Mostly cases live in Jutland (western part of Denmark)
- 55% admitted to hospital



Salmonella Strathcona investigation, 2025

- Interviews
 - 24/25 report eating tomatoes
 - 22/25 shop in the same supermarket chain (Rema1000)

- Consumer purchase data:
 - Two patients: bought cherry tomatoes from Greenyard Fresh (according to receipts from REMA1000)

- Case control study
 - 15 cases and 100 healthy controls – matched by age, sex and area of residence
 - Controls recruited via “digital post”
 - Tomater: cases 100%, controls 69%
 - Cherry tomatoes: cases 82%, controls 59%

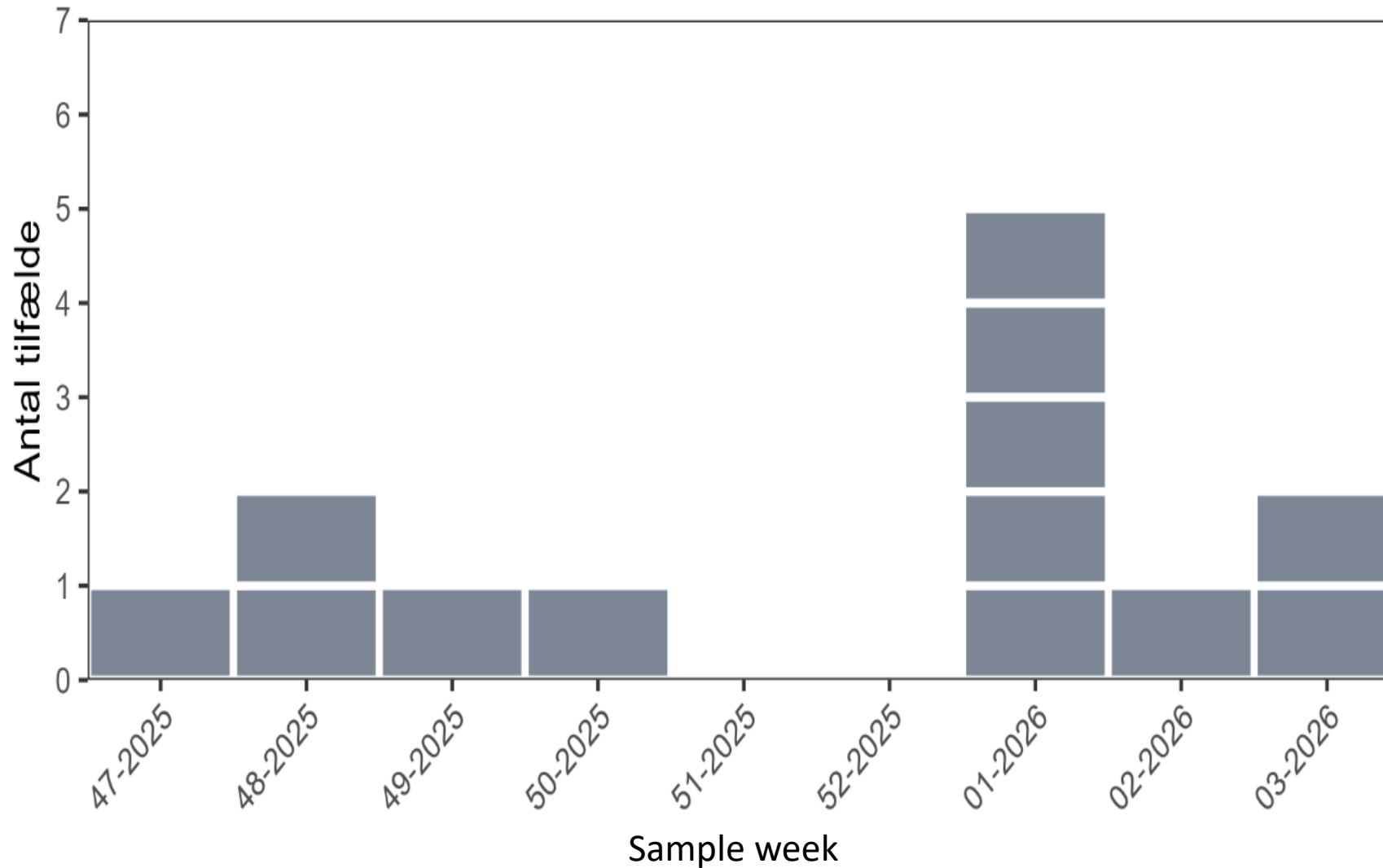
- January 2026: Meeting with supermarket chain -> presenting results from investigations



Salmonella Enteritidis ST11#262

***Salmonella* Enteritidis ST11#262 by sample week**

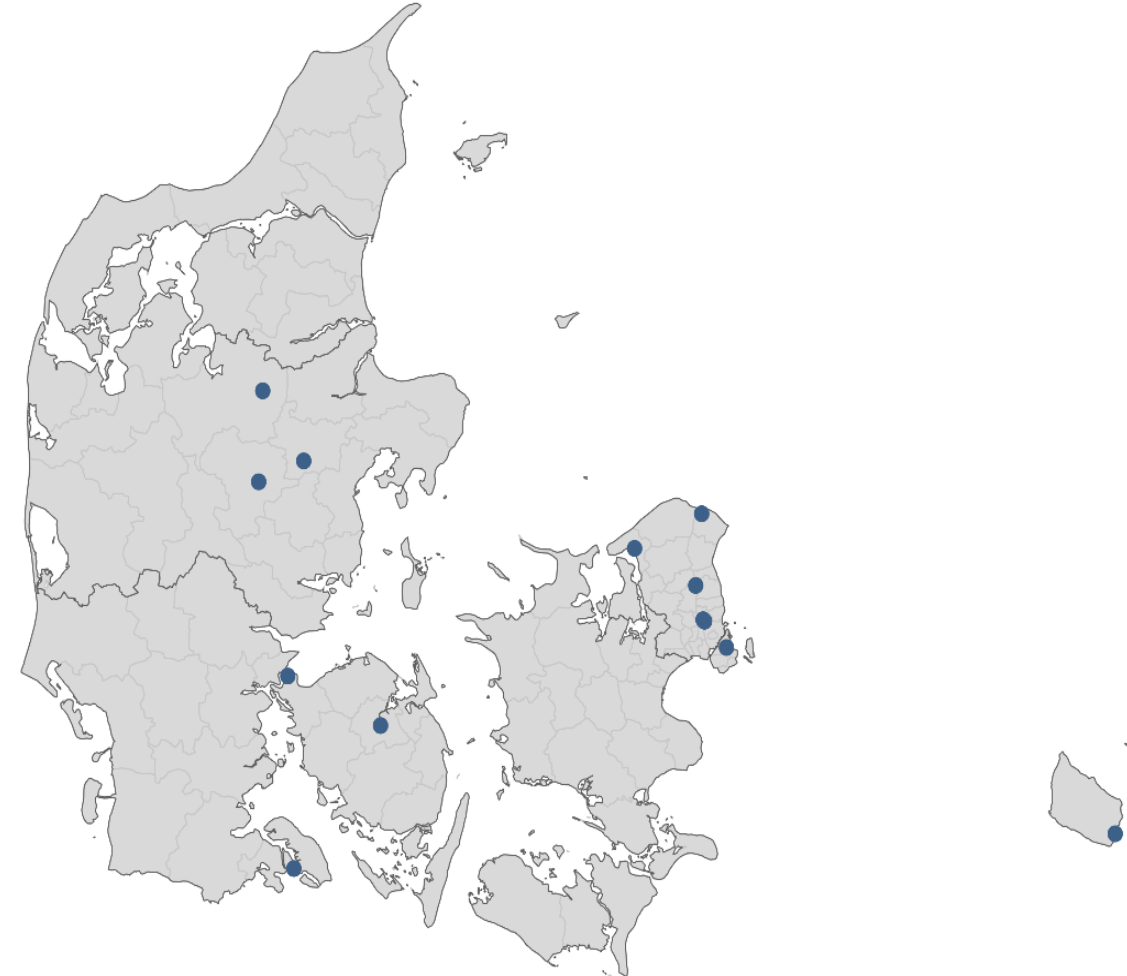
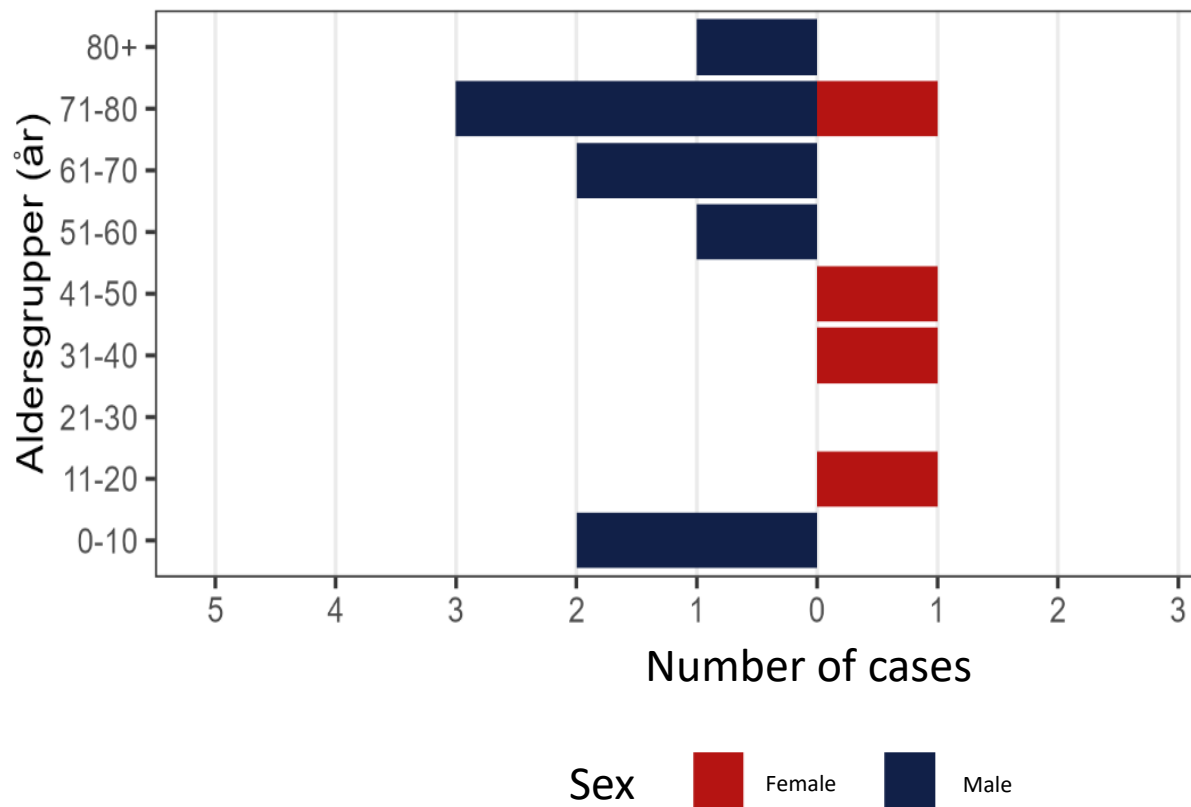
November 2025 – January 2026, n=13



Salmonella Enteritidis ST11#262 by sample week

November 2025 – January 2026, n=13

- 13 cases
- 4 women, 9 men, 2-81 years (median age: 68)
- 6 of 13 cases live in north of Zealand
- 4 of 13 admitted to hospital



***Salmonella* Enteritidis ST11#262 by sample week**

November 2025 – January 2026, n=13

- 12 of 13 cases interviewed
 - 5 of 12 interviewed not very useful (i.e. did not remember well)
- No travel reported
- 6 of 12 only ate at home in the week prior to symptom onset
 - -> the source is most likely a product eaten at home
- 10 of 12 shop at the same supermarket chain
- They often buy the cheapest products
- They eat quite a lot of meat – mostly pork
- It seems unlikely that the source is a vegetable or a fruit

- Latest case has sample date 14 January. If no new cases, we plan to close this outbreak next week. Source = unknown.



Wrap up

Examples of other recent outbreak investigations

- Multi-drug resistant *Shigella Sonnei* ST152 among men who have sex with men – n=16 cases in Sept-Dec 2025 (EpiPulse 2026-STI-00002)
 - 33 cases reported by 7 countries on EpiPulse (0 in Spain)
- *Listeria monocytogenes* ST7 outbreak linked to ready-to-eat fish patties – n=11 cases in August-October 2025
- *Cryptosporidium parvum* subtype family Ilzeta A12 – n=11 cases in June-July 2025. Linked to flat-leaf parsley from Italy

Last slide

- I'm interested to hear how you work in Spain to investigate foodborne outbreaks
- And I'm happy to take questions and comments 😊



**Thank you for
your attention**



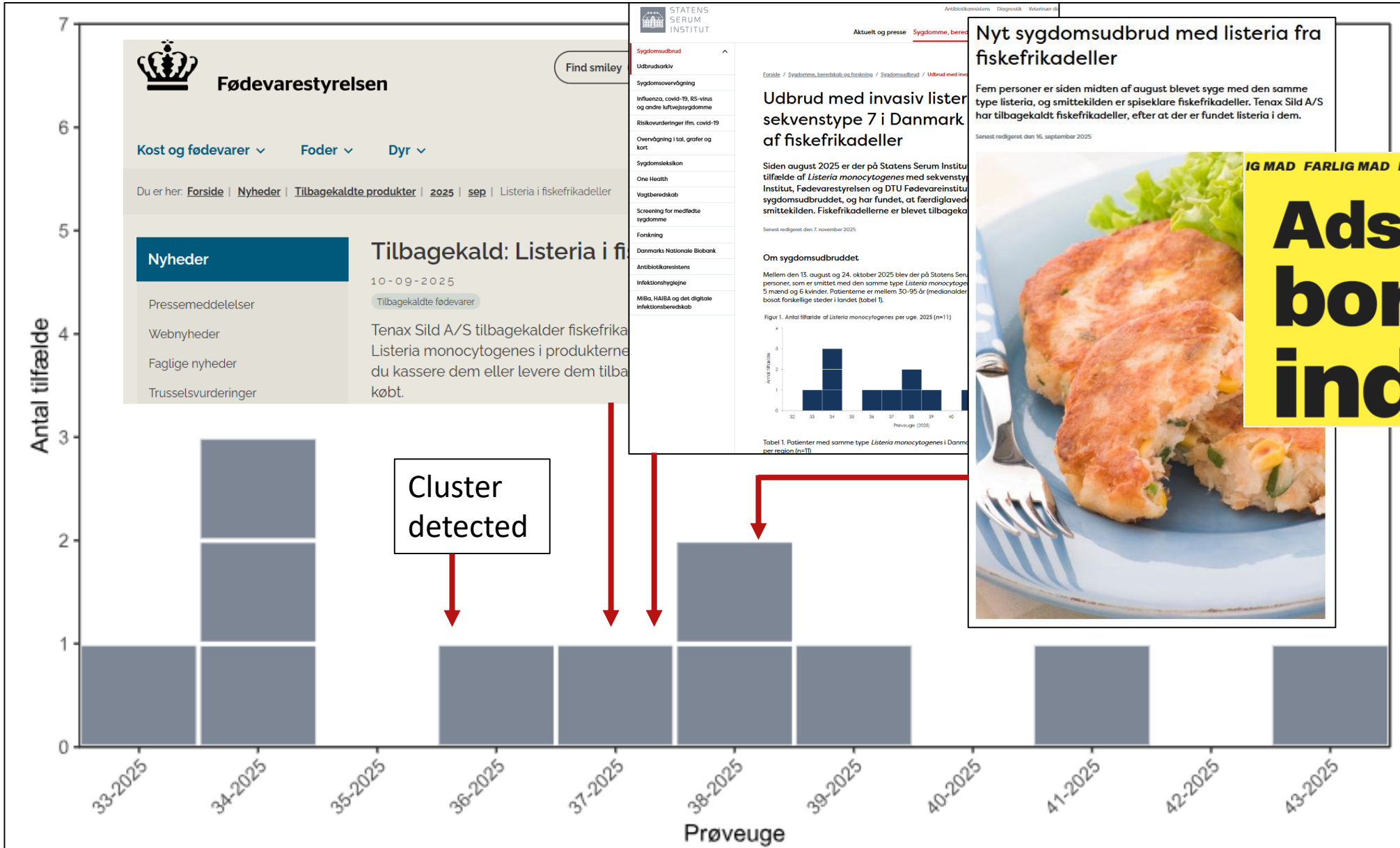
Stine Nielsen – STNL@ssi.dk



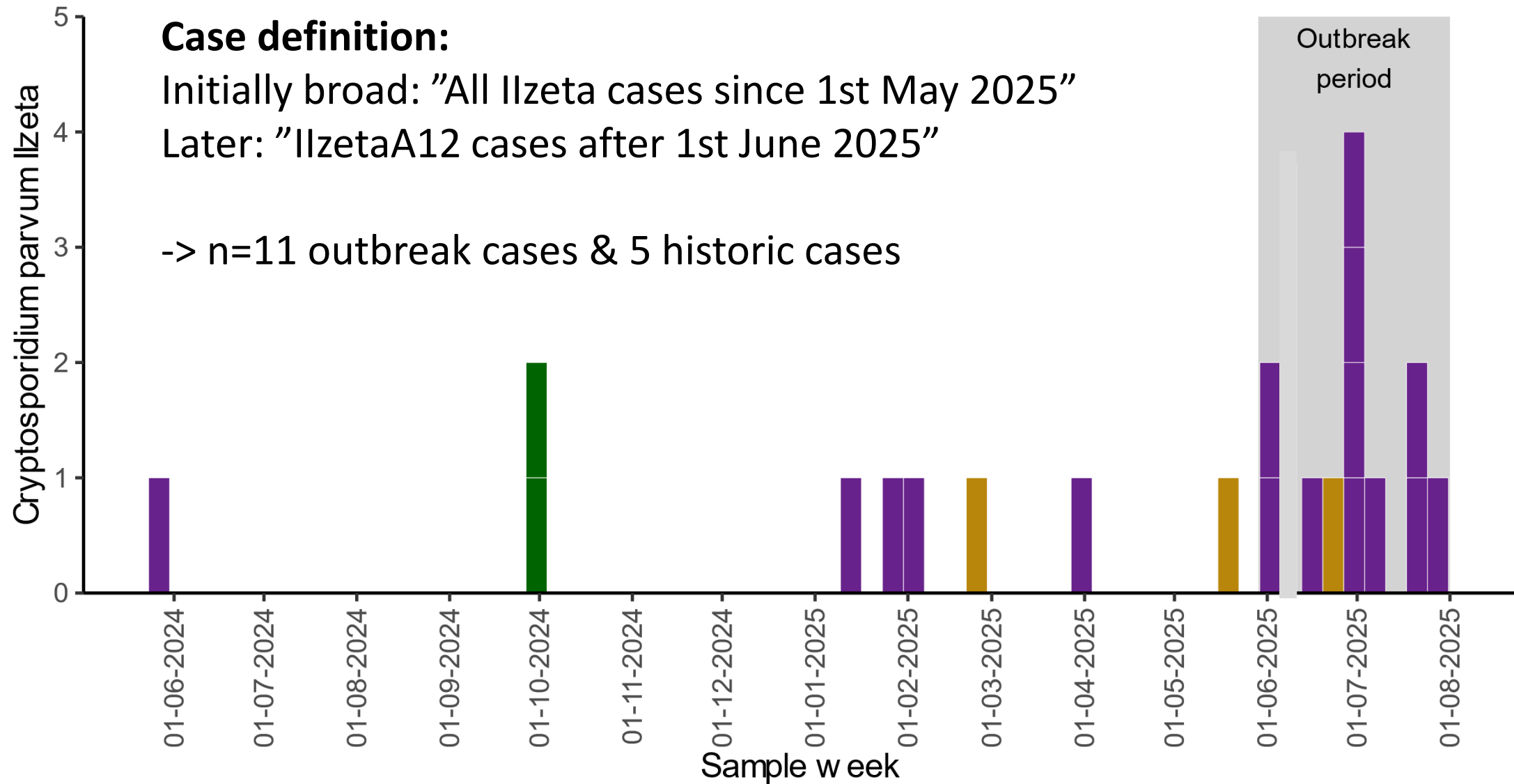


Extra slides

Communication: *Listeria monocytogenes* ST7#4



Epicurve



Subtype  IlzetaA11a  IlzetaA11b  IlzetaA12

Food- and waterborne outbreak database (FUD)

Basisoplysninger

FUD nr: 2345 (sagen afsluttet) Sagen sidst rettet af: stnl@ssi.dk, 21-02-25 [Vis alle](#)

Titel på udbrud: **Salmonella Umbilo**

Anmeldt af: **International kilde** Startdato: **15-07-2024** Udbrudsår: **2024** ▼

Status på udbruddet: **Bekræftet fødevarer- eller vandbåret udb** Status på udbrudsarbejdet: **Undersøgelsen afsluttet**

Status på udbrud, fritekst: _____ Udbrudstype: **Internationalt** ▼

Findes udbrudsrapport: **Ja** ▼ [Filer \(1\)](#) Slutdato: **10-09-2024** [Genåbn](#)

Patientinformation

Antal syge etc.

Antal syge	Antal eksponerede	Antal lab bekræftet	Antal indlagte	Antal døde
22		22		

Fordeling på køn

Kvinder/piger	Mænd/drenge	Ukendt køn
7	15	

Aldersfordeling

0-4 år	5-14 år	15-44 år	45-64 år	65+ år	Alder uoplyst
1	1	8	6	6	

Symptomer og varighed ▼

Lokation ▼

Kilde ▼

Agens ▼

Konklusion ▼

Why investigate outbreaks?

- Prevention of infectious diseases
 - Find the route of infection
 - Find the source
 - Prevent more cases/ outbreaks
 - Describe and document investigations and findings as knowhow and a tool to prevent repeat exposures



Challenges in outbreak investigation

- Work against time
- Political/media pressure
- Don't have full information when you start (react on small signals)
- Interviews can be difficult, e.g. stigmatized disease, language barrier, etc..
- Exposure history hard to remember
- Selective memory
- Very ill/dead people
- In-depth epidemiological analyses often not possible (quick and dirty)
- Can be difficult to find pathogen
- Hidden ingredients(in food e.g.)
- Multiple sources
- We don't always find the source

Take-home messages

- Outbreak investigation is team work
- Interviews and statistical tools are important components of epidemiological methods
- Outbreak investigation is an continuous process
 - Hypotheses generating
 - Control measures
 - Maybe additional investigations
- Dissemination

Outbreak investigations are fun, informative and never predictable