

Epidemiological investigation of foodborne outbreaks in Denmark

2nd Multidisciplinary training workshop, online, October 23, 2023

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Outline of this presentation



- Overview of foodborne outbreaks in Denmark
- Who is doing what in outbreak investigation in Denmark?
- 10 steps in an outbreak investigation

Example

- *Salmonella* Typhimurium ST36 outbreak in Denmark 2020-2021

Foodborne outbreaks

Denmark links Listeria outbreak to cold meat



Denmark traces suspected source of botulism cases
Food Safety News M

7. APR KL. 08:45

Kinderæg og andet chokolade bliver tilbagekaldt - kan indeholde salmonella



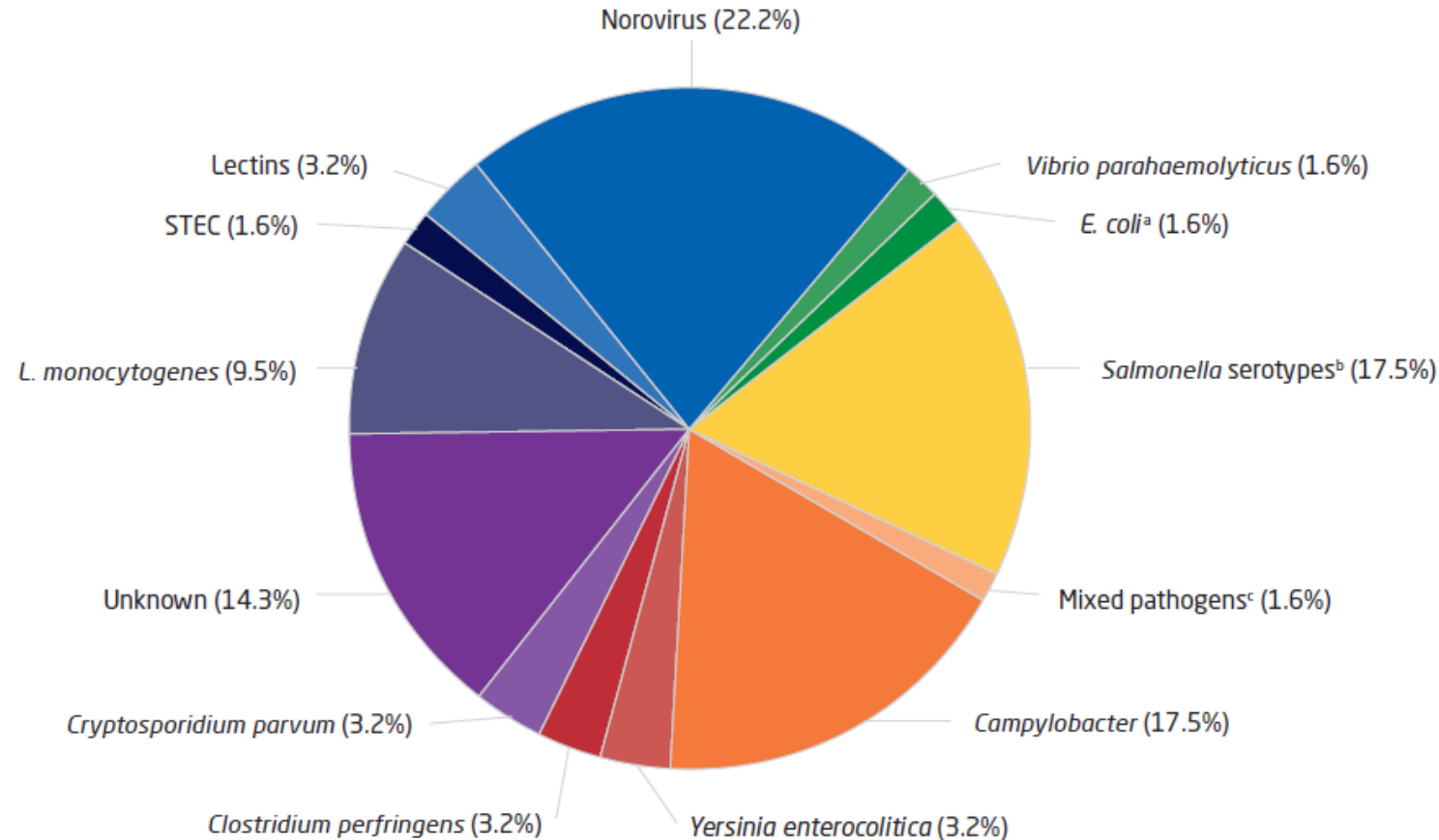
Det er blandt andet partier af Kinder Surprise og Kinder Schokobons, der er blevet tilbagekaldt. (Foto: Daniel DERAJINSKI © Ritzau Scanpix)

Danmark ramt af nyt udbrud

Denmark Salmonella and Listeria outbreaks end with sources still unknown

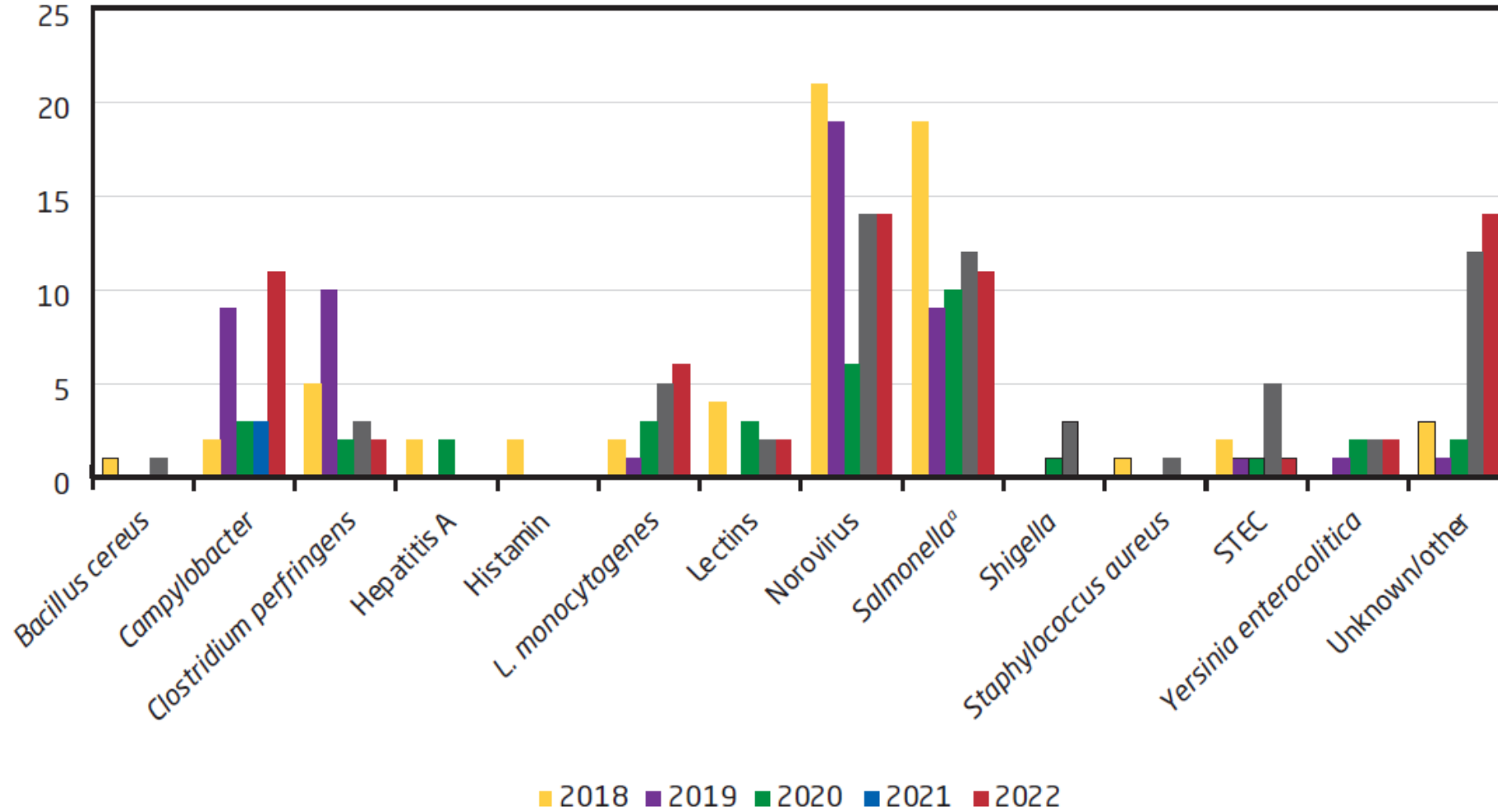
Deadly E. coli O157 outbreak sickens 13 in Denmark

63 foodborne outbreaks in Denmark 2022

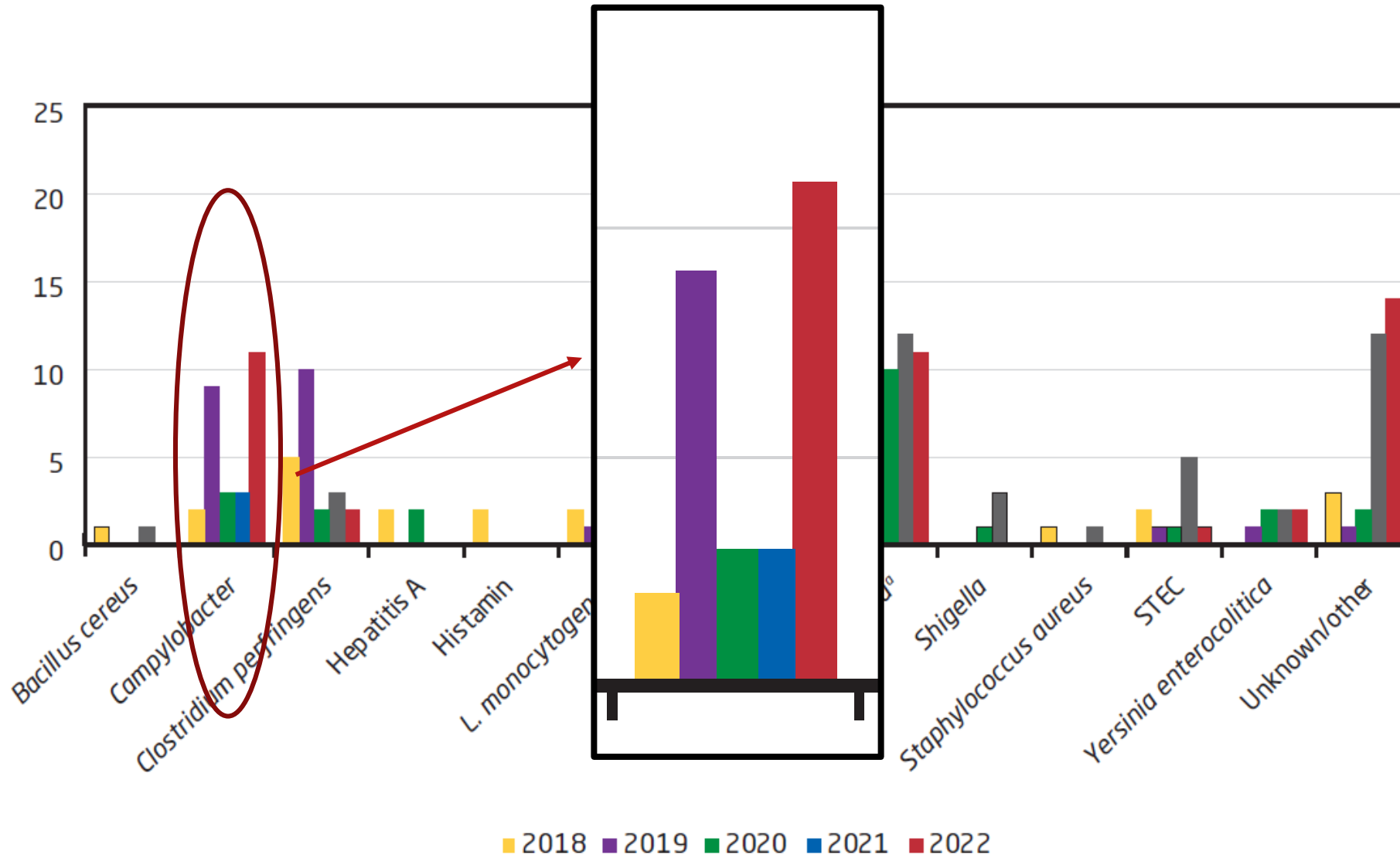


a) One outbreak with *Campylobacter jejuni* and STEC b) Including the monophasic strains S. 1,4,[5],12:i-

Foodborne outbreaks in Denmark per pathogen 2018-2022



Foodborne outbreaks in Denmark per pathogen 2018-2022



Investigation of foodborne outbreaks in Denmark

- **Local outbreaks**
 - E.g. restaurant, private party, drinking water
- Responsible institutions
 - Regional food offices
 - Medical officer
 - Local laboratories
- **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

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**The Central Outbreak
Management Group**

- **National outbreaks**

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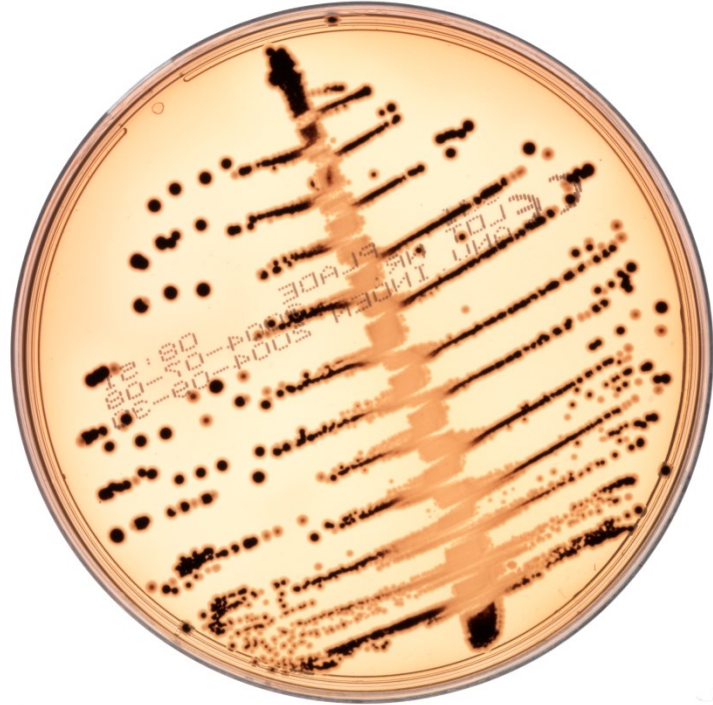
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10 Steps of an outbreak investigation

1. Establish the existence of a “real” outbreak
2. Confirm the diagnosis
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9. Communicate finding
10. Execute control and prevention measures



***Salmonella* Typhimurium ST36#7 outbreak
November 2020 to July 2021**

The first signal

- January 21: National laboratory reports a cluster of 5 *Salmonella* Typhimurium ST36 cases identical on WGS



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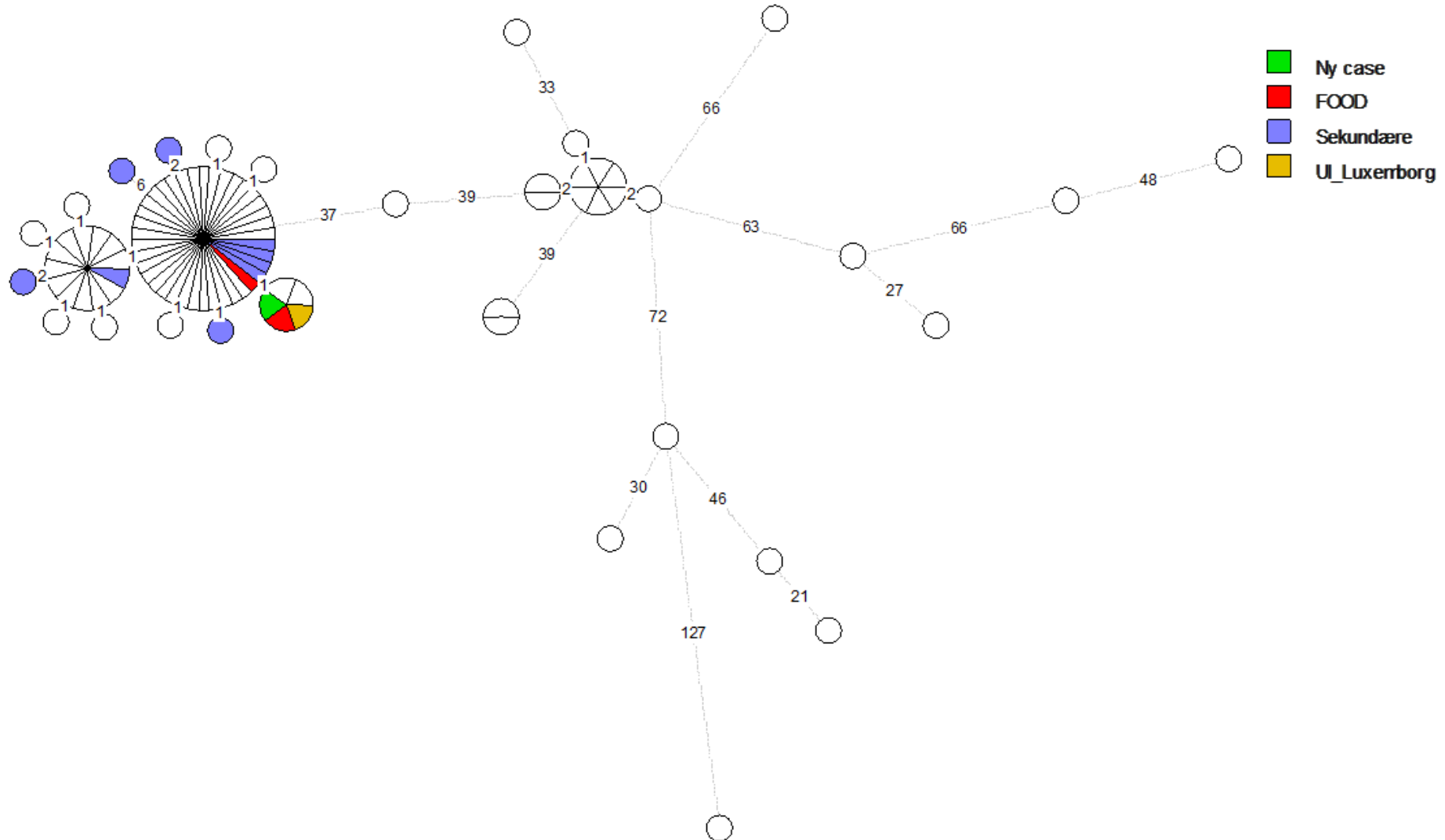
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Phylogenetic tree (cgMLST analyses) *Salmonella* Typhimurium 2021



Case definition

- A person with laboratory-confirmed *Salmonella* Typhimurium in Denmark clustering by whole-genome sequencing (ST36#7) from November 2020 and onwards

Case definition

Person

Place

- A person with laboratory-confirmed *Salmonella Typhimurium* in Denmark clustering by whole-genome sequencing (ST36#7) from November 2020 and onwards

Time

- How sensitive?
- How far back in time?
- What about cases who travelled?
- Exclusion criteria?



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ECDC EpiPulse platform: Salmonellosis

Item details

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ID: 2021-FWD-00013 Type: Event Title: EPIS FWD: Outbreak of Salmonella Typhimurium ST36 in Denmark - (UI-709)
Diseases: Salmonellosis Pathogens: Salmonella Typhimurium Participating domain: FWD

[+ Key information](#)

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Item created on: 2021-03-17 09:29

Item last updated on: 2021-04-22 22:39

Number of reply comments: 10


NCC: Number of confirmed cases: 38

NNC: Number of non-confirmed cases: unknown

NCD: Number of confirmed deaths: 0

Show 10 rows

[View comment](#)

<input type="checkbox"/>	Domain	Country / Organisation	Sector	NCC	NNC	NCD	Epidemiological information	Microbiological information	Additional information	Modified time	
<input type="checkbox"/>	FWD	Denmark	Public Health	37			Since November 2020, we have seen 13 cases, 8 female and 5 male aged 17-85 years. Interviews have not yet revealed a hypotheses of the source. Update: 09-04-2021 The outbreak has increased to 25 cases, 12F, 13M, 0-89 years. The interviews disclosed 110%	The outbreak consist of ST36 isolates and the 12 isolates are between 0-2 AD in the Enterobase scheme calculated in		2021-04-20 10:49	

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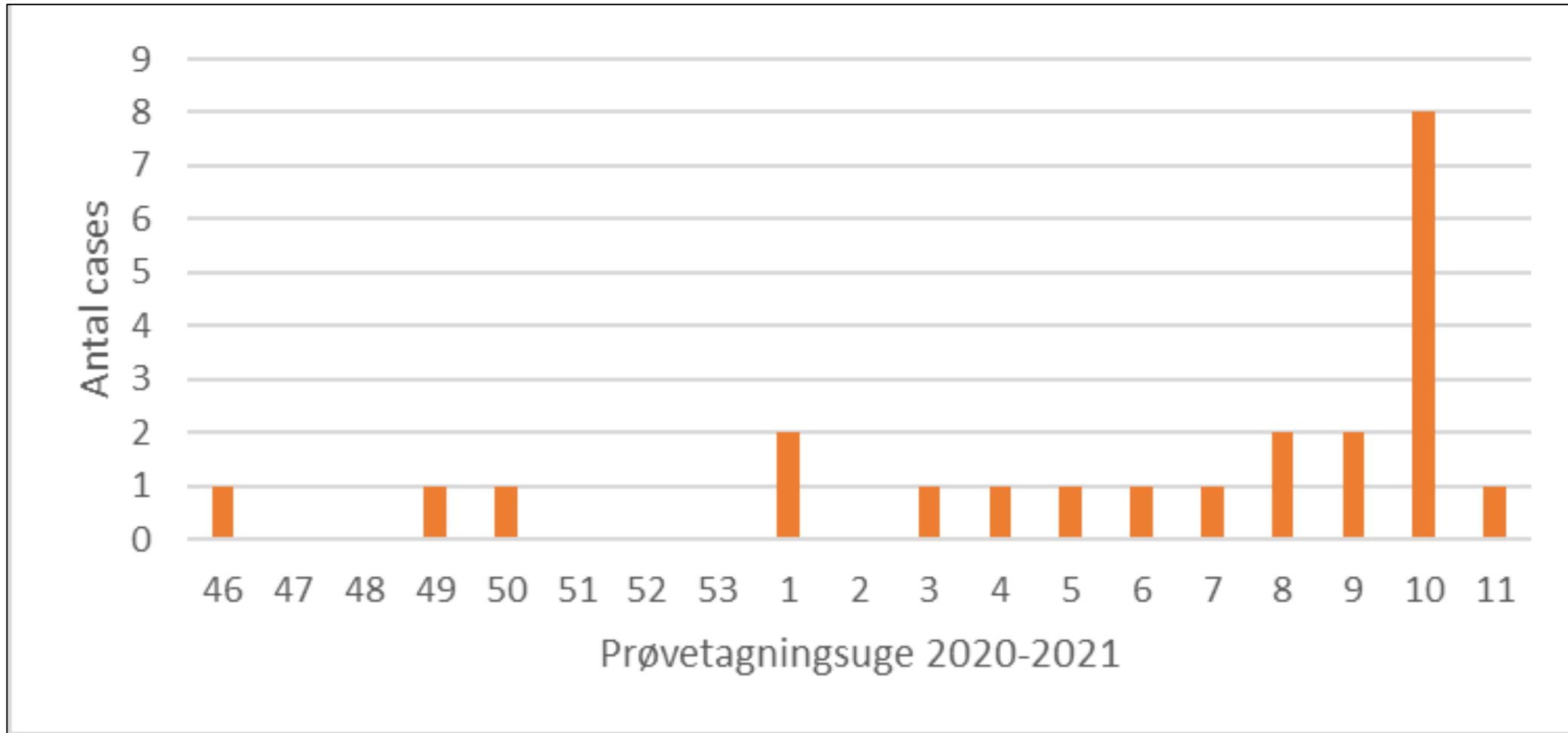
- March: No other countries reported cases



10 Steps of an outbreak investigation

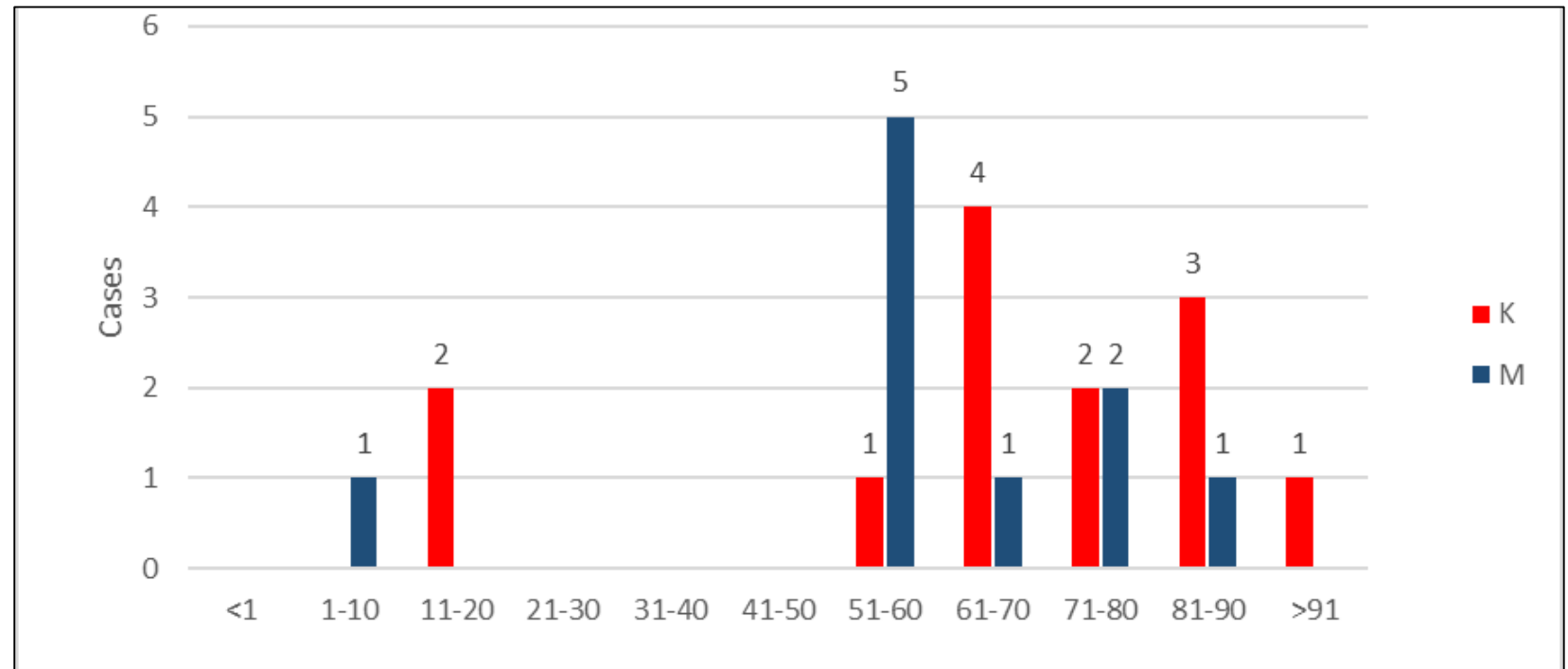
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Salmonella Typhimurium ST36#7 by week of sample, n=23



Salmonella Typhimurium ST36#7 by sex and age, n=23

- 13 female, 10 male
- 2-92 years
- 6/22 elderly home



Salmonella Typhimurium ST36#7 by place of residence, n=23



March 31, 2021

Trawling questionnaire



Salmonella XXX FUD Hypotesegenererende interviews (version: August 2023)

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

Hvem interviewes? Patient 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: ____/____/____

Bemærkninger:

Goddag mit navn er [for- og efternavn], taler jeg med [for- og efternavn]? Jeg ringer fra Statens Serum Institut. Jeg ringer fordi du/dit barn har haft en infektion med Salmonella. Det viser sig, at der er flere, der har været syge med den samme type af salmonella og vi mistænker, at I er blevet smittet af den samme fødevarer. Jeg vil derfor høre dig, om jeg må stille nogle spørgsmål angående din/(dit barns) sygdom og hvad du/(han/hun) spiser?

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 op til 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	Varighed
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"/>	
Træthed	<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



Results of the first interviews

- Hypothesis-generating interviews
 - Difficult patient group (mental illness, live in nursing homes, dead)
 - No common events, super market chains, food items
 - Common catering in the institutions?
- New hypothesis
 - Medicine or dietary supplements?
- New round of interviews...





Break-through in the investigation

- March 30: Case count: 23
- 13 interviewed about herbal medicine and dietary supplements
- 11/13 consumed HUSK herbal medicine psyllium seed husks
 - 6 persons in-depth interviews:
 - All in capsules
 - Package with green logo
 - Bought in pharmacies and different supermarkets
 - 4 still had the product at home
 - Same expiry date: Sept 2023
 - Two lot numbers
 - Photos from three



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Case-control study

- Method
 - 15 cases
 - 45 control persons from Danish Civil Registration system
 - matched on sex, age and municipality
- Results
 - HUSK consumed by 87% of cases and 7% of controls
 - Matched-OR=**26**; 95%CI: 3.8-175



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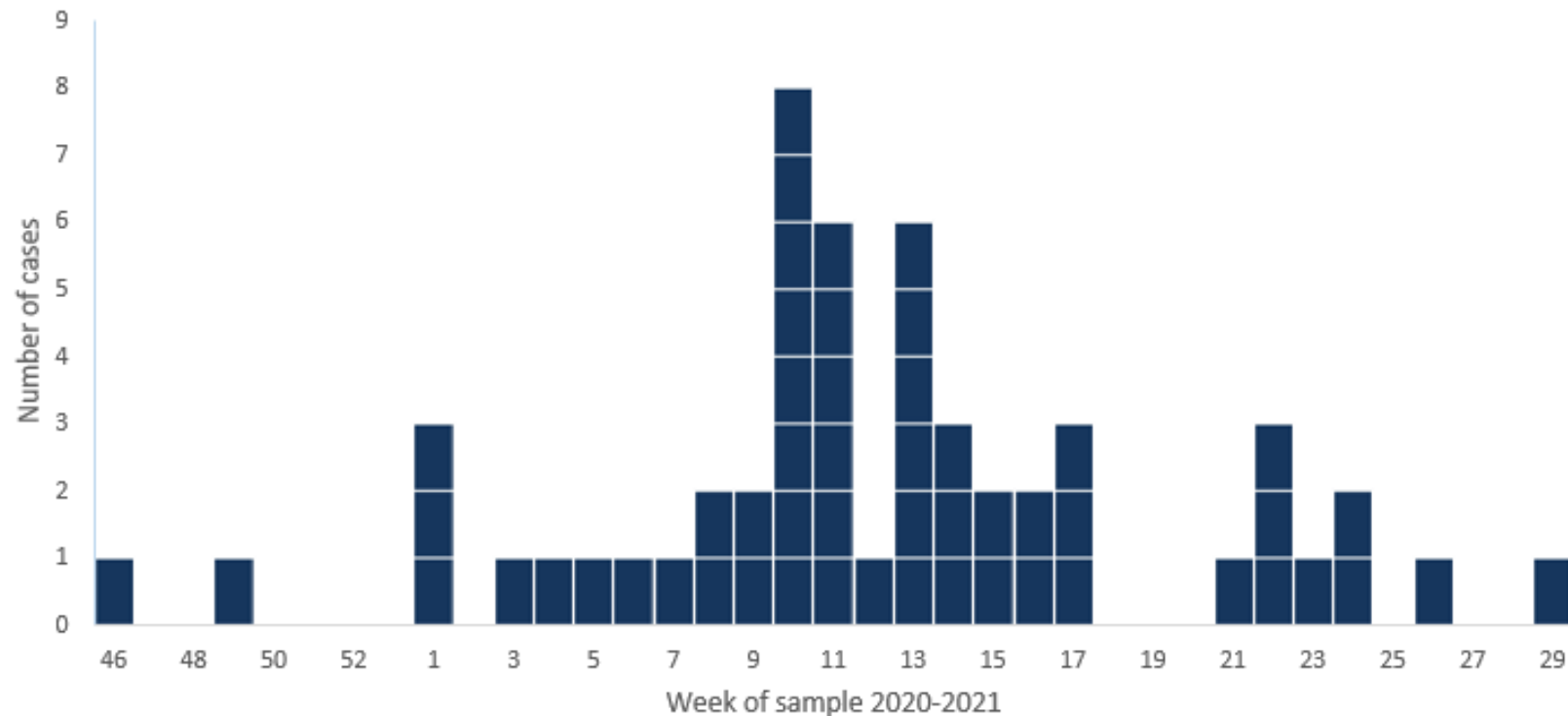
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Product investigation

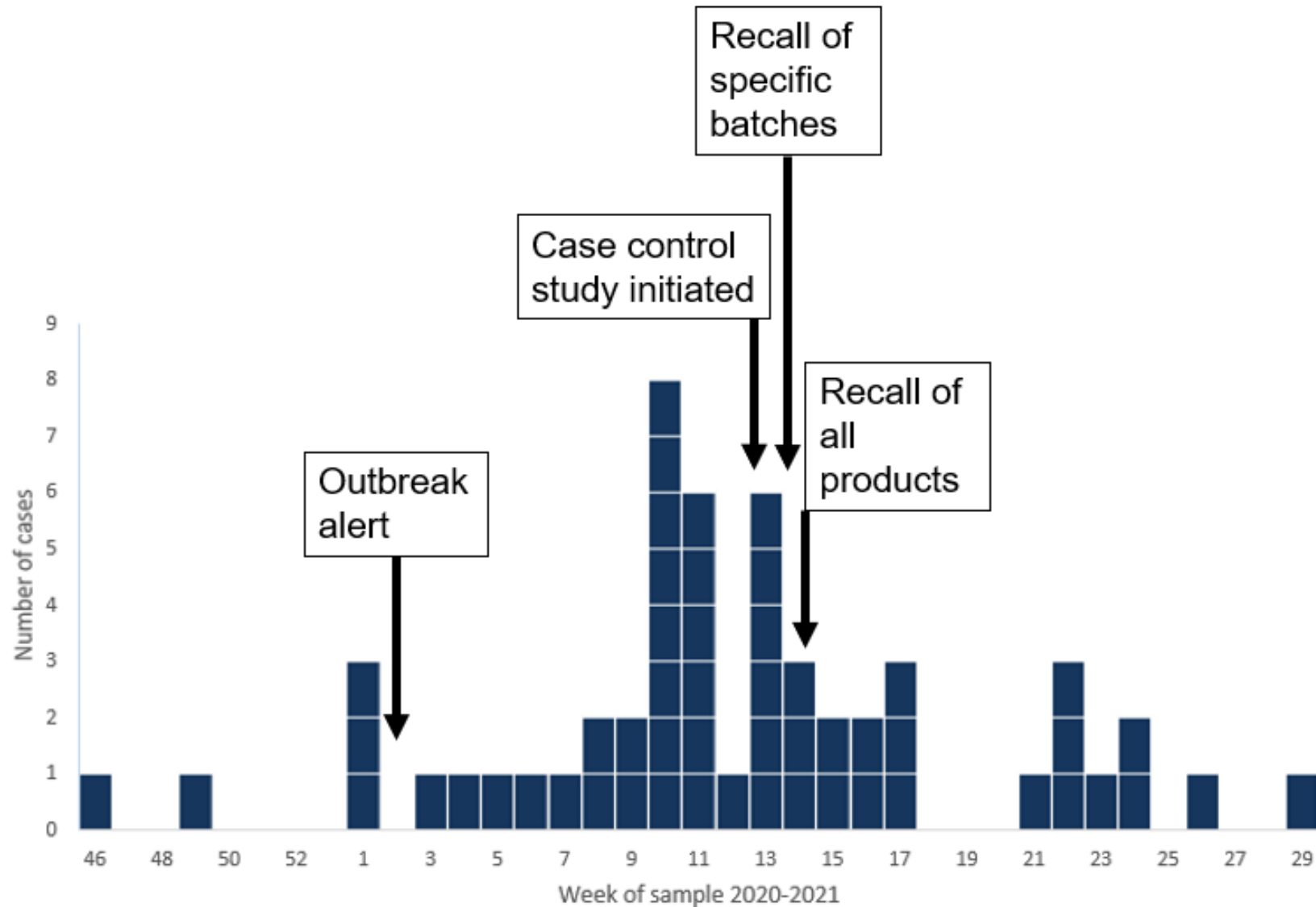
- Product samples
 - HUSK collected from patient homes
 - Salmonella outbreak strain found in one package
 - *Salmonella* Senftenberg in one package
 - Reference sample at producer: outbreak strain
- Trace-back
 - Raw seed husks from India
 - Sold both as herbal medicine and dietary supplements
 - Hand-over to new authority!!

Salmonella Typhimurium ST36#7 outbreak

- In total 54 cases
- 33 female (61%) median age 65 years range 2-92 years
- 32 cases hospitalized (59%), 3 cases died
- One case reported April 2, from Luxembourg (Dane bought product in DK)



Timeline of outbreak investigation



What is consumer purchase data?

- 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





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Control of the outbreak

DR INDLAND

Tre døde efter at have spist naturlægemiddel: Tjek, om du har farligt produkt derhjemme

Kapsler med frøskaller tilbagekaldes efter udbrud med salmonella.





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October 21, 2021 – product back – now heat treated!



Conclusion

- First outbreak of salmonella in herbal medicine in Denmark
- Critical risk group
- Severe disease
- Capsules perfect for effect in the intestines
- Rapid action complicated by new authorities involved
- Long shelf life of product
- Active control measure follow-up on the human side
- Most likely prevented cases
- Intervention: the husks are heat-treated



Summary and challenges

- Microbiology and epidemiology goes hand in hand in outbreak investigation
- Outbreak investigation dependent on collaboration in a One health approach
 - Established outbreak group in “peacetime”
 - Common tools (FUD, comparison of isolates...)
- WGS has advanced the surveillance of zoonoses considerably
 - Clusters not necessarily defined in time and place
- WGS can not stand alone!
 - Timely interviews of patients is needed to compare WGS results with the epidemiology
 - Trace-back investigation
- Use standard procedures – but be prepared for the unexpected

If you want to know more...



STATENS
SERUM
INSTITUT



Ministry of Food, Agriculture
and Fisheries of Denmark
Danish Veterinary and
Food Administration

Annual Report on Zoonoses in Denmark 2022



DTU Food
National Food Institute

- Statens Serum Institut: www.ssi.dk
 - Surveillance data
 - Epi-Nyt (Epi-News)
- Annual report on Zoonoses in Denmark 2022
- Danish Veterinary and Food Administration
- DTU – Food Institute
- European Centre for Disease Prevention and Control
 - www.ecdc.europe.eu
 - Communicable disease threats report (weekly)
 - Eurosurveillance (Rapid communications)

• lum@ssi.dk



Thank you

Questions?



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