EMERGING RISK IDENTIFICATION SYSTEM

Enhancing Food Safety in New Zealand

New Zealand FOOD SAFETY SCIENCE & RESEARCH CENTRE

ESR Science for Communities He Pūtaiao, He Tāngata

Vertical transmission of *Salmonella* Reading

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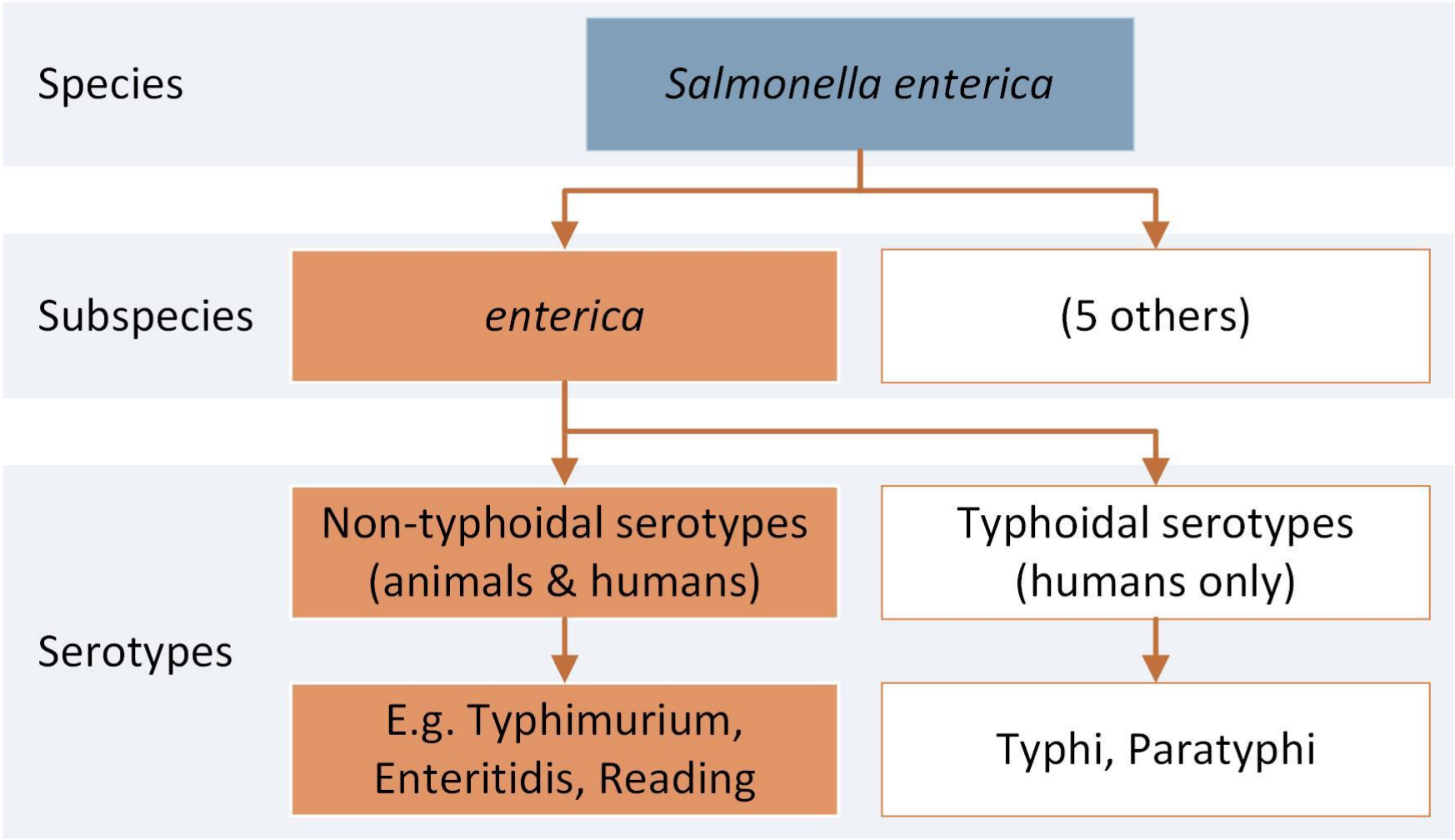
The hazard: *Salmonella* Reading



Salmonella enterica subsp. *enterica* serotype Reading (1,4,[5],12:f,g:[1,2])

<u>Primary source:</u>

- Gastrointestinal tracts of humans and animals

The disease: Salmonellosis

Incubation: 6-72 hours, commonly 12-36 hours

Condition: Salmonellosis (gastroenteritis)

Symptoms: Diarrhoea, abdominal cramping, vomiting, nausea, fever, headache

Duration: Typically 2-7 days (faecal shedding up to 7 weeks)

Long term effects (uncommon): Systemic (invasive) infections (risk factors: HIV, malaria, malnutrition), reactive arthritis

At risk groups: Anyone can be infected; more at risk are young, elderly, immunocompromised, those with underlying disease. Highest incidence among children.

Treatment: Usually supportive, antibiotics when necessary

For more information see https://www.mpi.govt.nz/dmsdocument/1214-Non-Typhoid-Salmonellae

Human salmonellosis (EU 27MS)

https://doi.org/10.2903/j.efsa.2023.8442

Year	Confirmed cases	Rate
2018	82,392	18.2
2019	78,189	18.0
2020	52,690	12.1
2021	60,169	15.3
2022	65,208	15.3

55% Enteritidis

12% Typhimurium

10% Monophasic Typhimurium

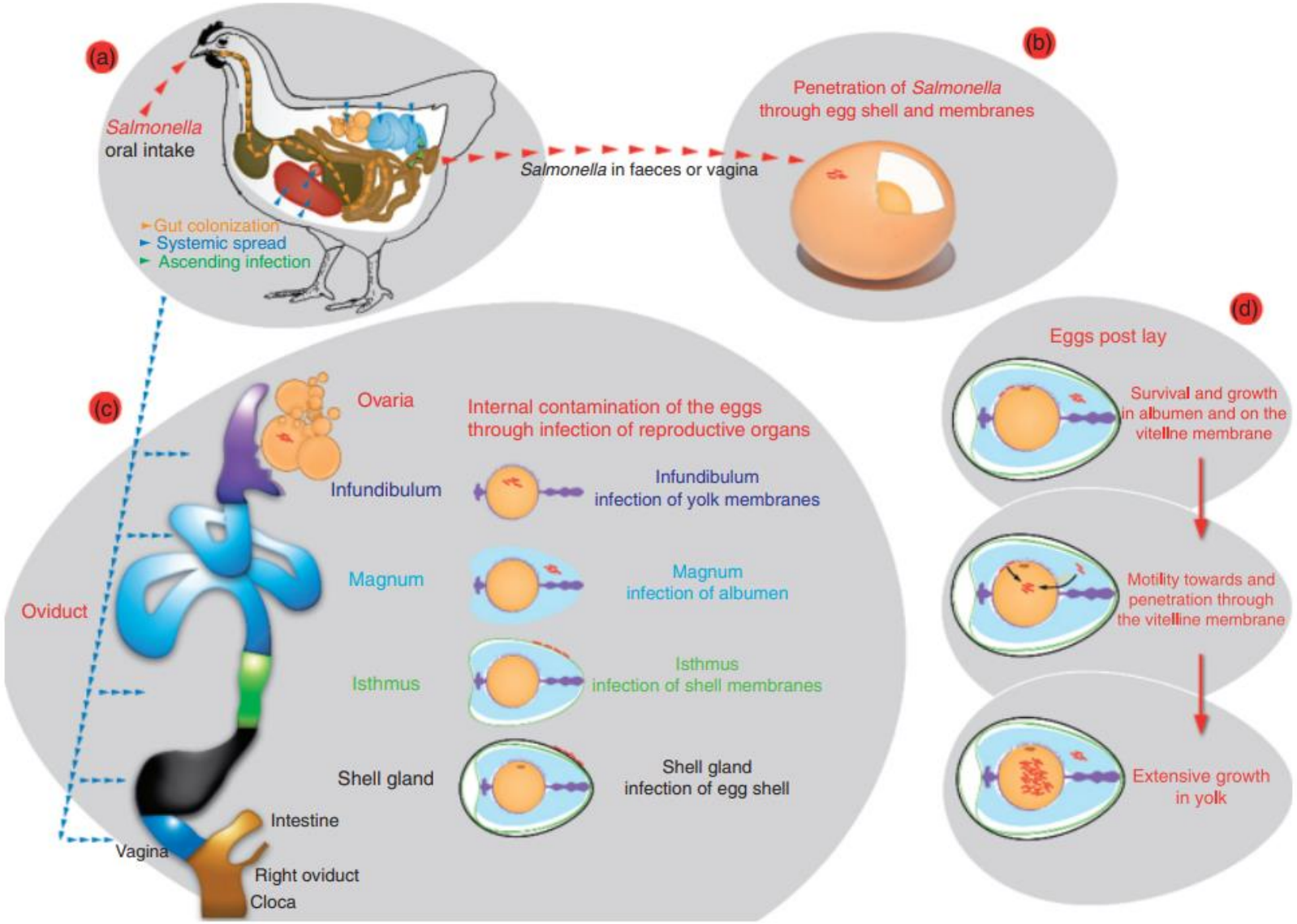
…

11% Other

S. Enteritidis: Transovarian

Image: **Gantois *et al.* (2009)**
https://doi.org/10.1111/j.1574-6976.2008.00161.x

"The colonization of particular regions of hens' reproductive tracts leads to *Salmonella* Enteritidis deposition at different locations in eggs"
Gast *et al.* (2013)
https://doi.org/10.3382/ps.2012-02811



Salmonella Reading outbreaks

Nov 2017-Mar 2019 USA

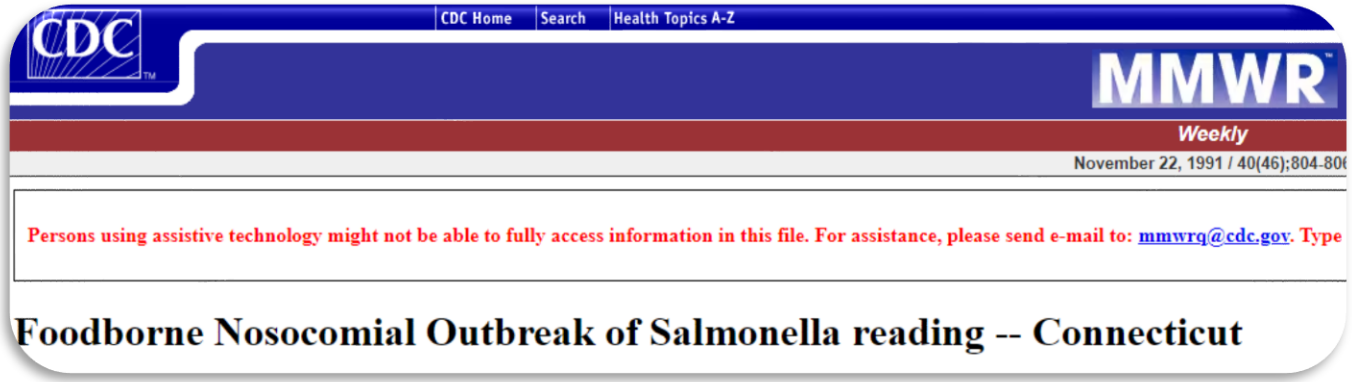
- 356 cases, aged <1 to 101 years
- 132 hospitalised, 1 died
- Case histories: Handling or eating turkey purchased raw (food, pet food), contact with live turkeys
- Outbreak strain isolated from raw turkey (processing, retail), raw turkey pet food, live turkeys; some recalls

Hassan *et al.* (2019) http://dx.doi.org/10.15585/mmwr.mm6846a1

Apr 2017-Jan 2020 Canada

- 130 cases, aged <1 to 96 years
- 39 hospitalised, 1 died
- Case histories: Exposure to raw turkey and chicken products
- USA recalled products not imported into Canada

https://www.canada.ca/en/public-health/services/public-health-notices/2018/outbreak-salmonella-illnesses-raw-turkey-raw-chicken.html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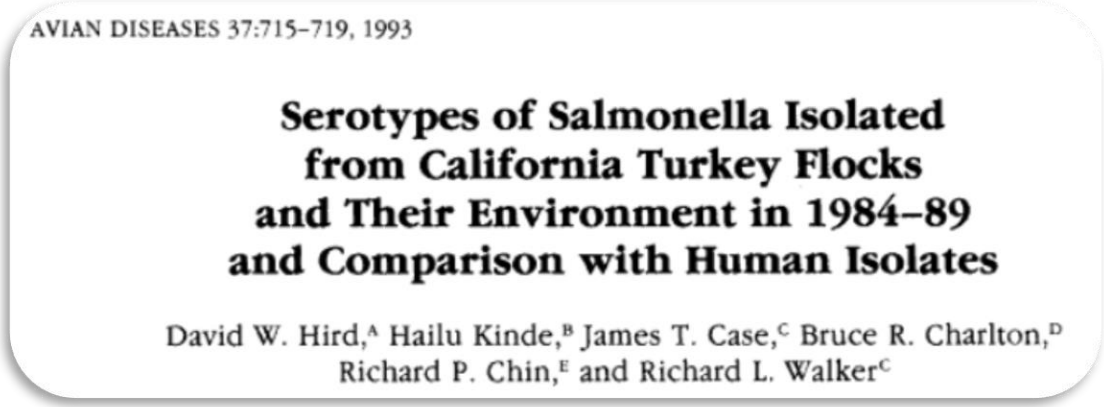
MMWR Weekly

November 22, 1991 / 40(46);804-80

Persons using assistive technology might not be able to fully access information in this file. For assistance, please send e-mail to: mmwrq@cdc.gov. Type

Foodborne Nosocomial Outbreak of Salmonella reading -- Connecticut


AVIAN DISEASES 37:715–719, 1993

Serotypes of Salmonella Isolated from California Turkey Flocks and Their Environment in 1984–89 and Comparison with Human Isolates

David W. Hird,[A] Hailu Kinde,[B] James T. Case,[C] Bruce R. Charlton,[D] Richard P. Chin,[E] and Richard L. Walker[C]

A turkey-adapted clade

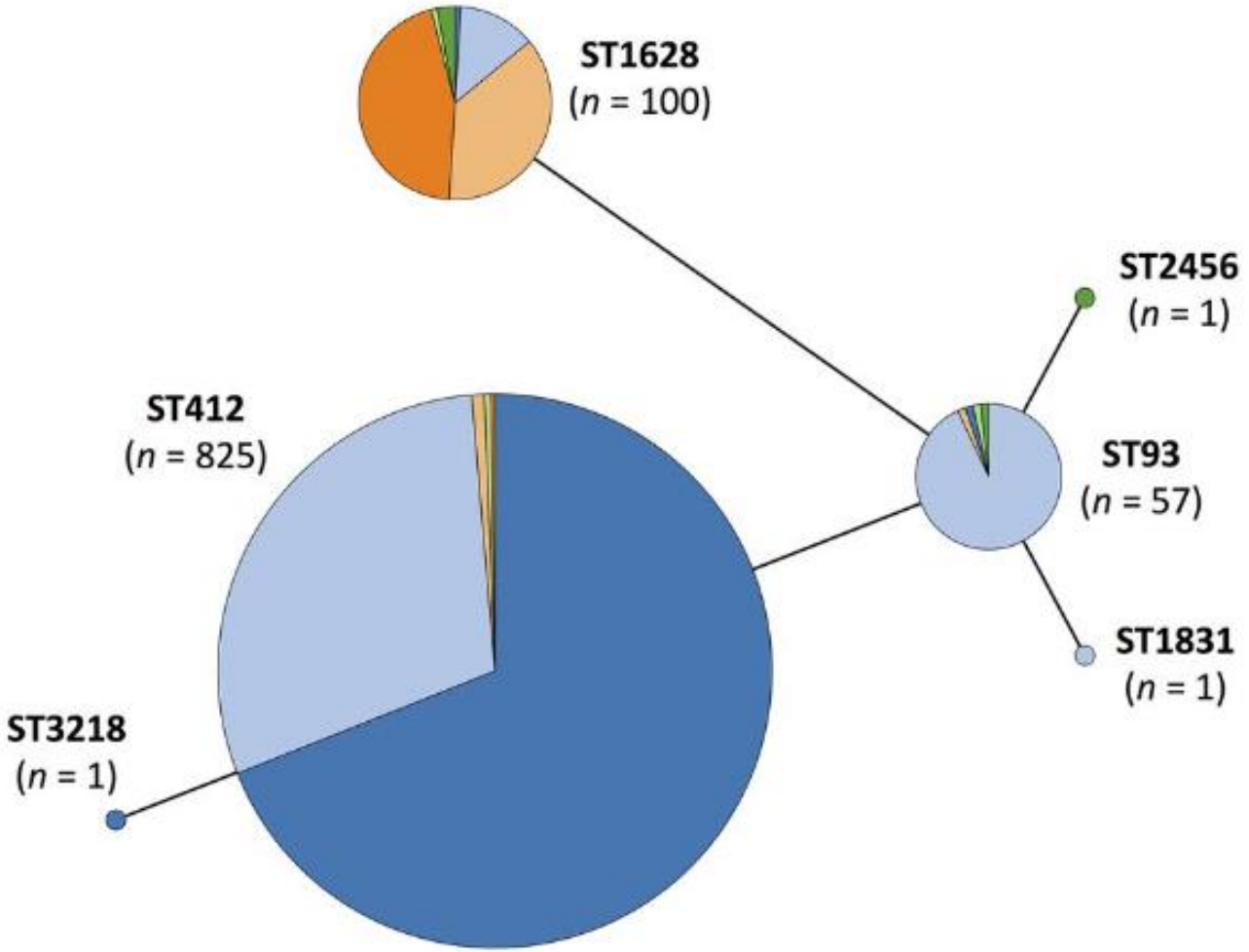
988 *S.* Reading isolates

(human cases, meat products, live animals, environmental samples)

Animal host clustering shown by genomics:

- 7-gene MLST (ST412 = turkey + human)
- WGS SNP (clade 1 = turkey + human)

Miller *et al.* (2020) https://doi.org/10.1128/msphere.00056-20



A turkey-adapted clade

Clade 1:

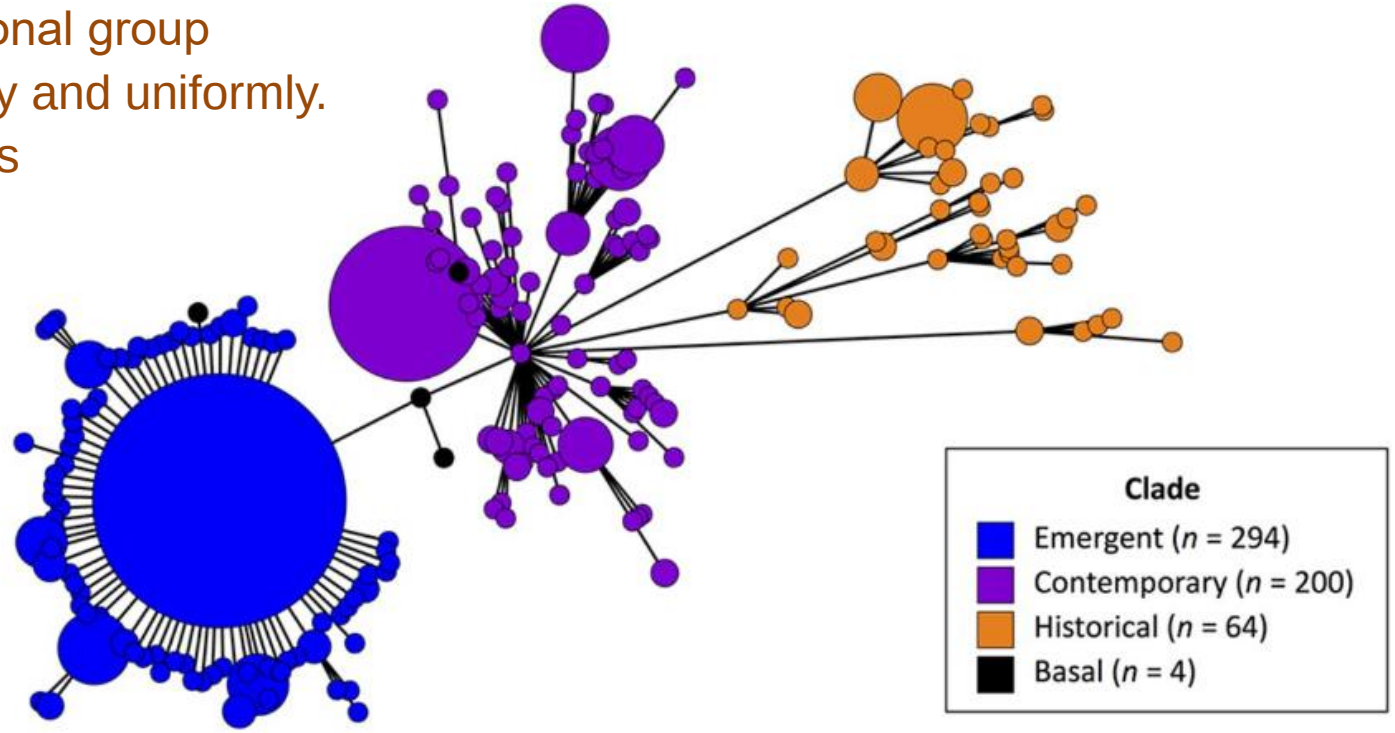
- Highly adapted to turkeys (subclades separated by time)
- Human case isolates from outbreaks clustered with contemporary and emergent subclades
- Highly clonal outbreak strain emerged ~2015

Miller *et al.* (2020) https://doi.org/10.1128/msphere.00056-20

"…it is quite likely that the introduction of this clonal group occurred in commercial turkey production rapidly and uniformly. The most parsimonious explanation is that it was introduced vertically from a common source, likely through supply birds at the top of the genetic breeding pyramid."

2015: HPAI outbreak among turkeys leading to depopulation

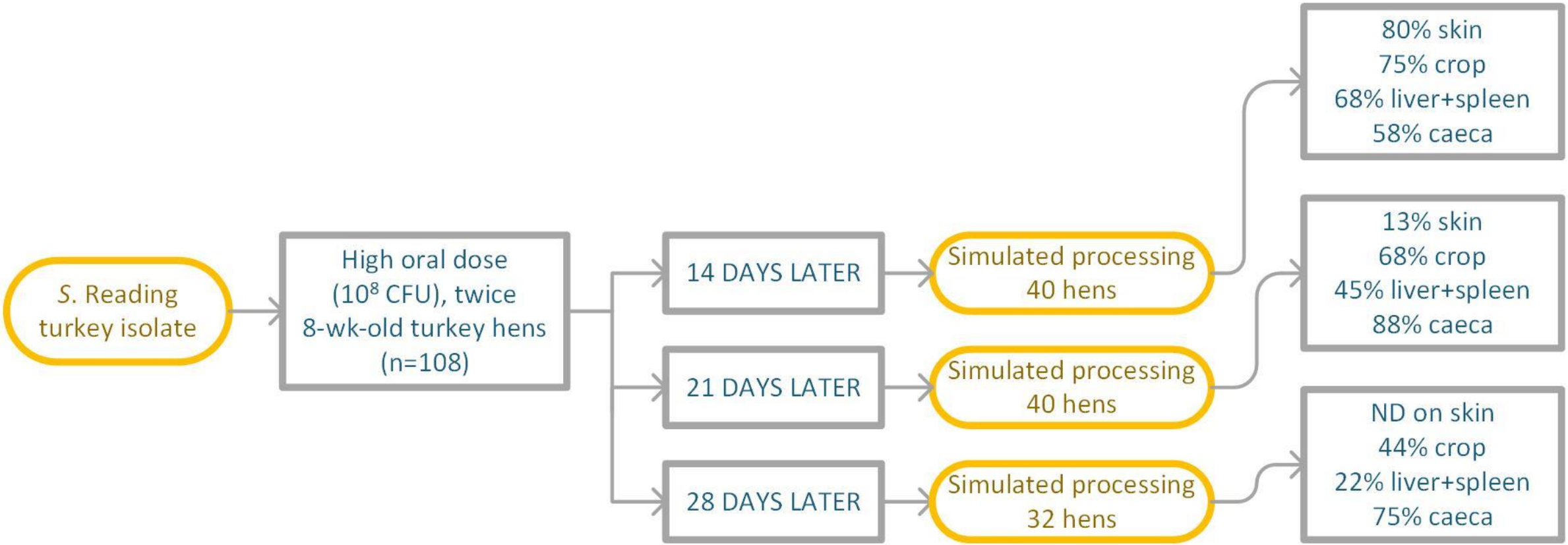
Introduction through rapid repopulation?



S. Reading: Hen colonisation

Source: **Ashcraft *et al.* (2021)** https://doi.org/10.1016/j.psj.2021.101114

Can *S.* Reading colonise turkeys?

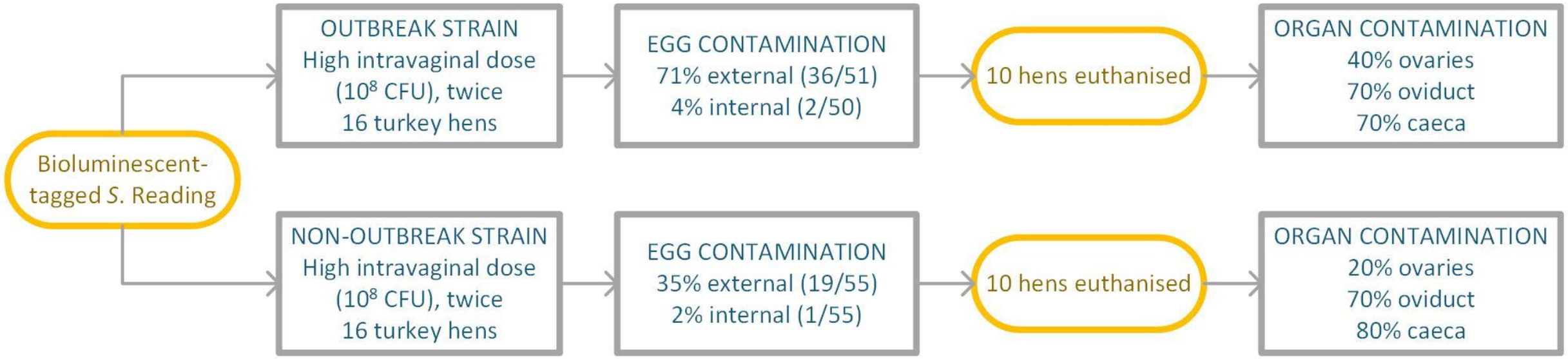


S. Reading: Transovarian?

Source: **Isah *et al.* (2024) Evaluating the vertical transmission potential of *Salmonella* Reading outbreak and non-outbreak strains.** Poster (P216) presented at the International Poultry Scientific Forum, Atlanta GA, January 29-30, 2024
https://www.ippexpo.org/education-programs/IPSF/docs/2024-IPSF-Abstracts.pdf

Funded by US Poultry & Egg Association and the USPOULTRY Foundation
https://www.uspoultry.org/programs/research/search-abstracts/repository/PROJ_729.html

Can *S.* Reading colonise reproductive tissues and contaminate the eggs of hens?



Summary

- *Salmonella* known hazard for poultry (risk management in place)
- Transovarian transmission known for *S.* Enteritidis
- Turkey-adapted strains of *S.* Reading caused outbreaks (breeder flock origin?)
- *S.* Reading can colonise turkey hen organs after oral inoculation
- *S.* Reading can colonise turkey hen reproductive organs after intravaginal inoculation

Is this an emerging risk?

- Confirmation of transovarian transmission under real-world conditions needed
- Are there genetic factors linked to transovarian transmission?
- Continued monitoring of serotype data important (human cases, poultry industry surveillance)
- Current risk management for Enteritidis