Swiss TPH
Swiss Tropical and Public Health Institute
Schweizerisches Tropen- und Public Health-Institut
Institut Tropical et de Santé Publique Suisse

Associated Institute of the University of Basel

Epidemiology and Public Health
Household Economics and Health Systems Research
Household Health System Research Group

# Foodborne zoonoses in Switzerland and beyond

PD Dr. Daniel Mäusezahl

**Swiss TPH Winter Symposium, 6–7 December 2018:**

**Zoonoses Control in Humans and Animals – Taking Stock and Future Priorities**

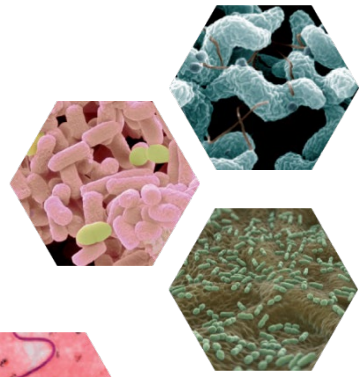
**Comments added for public version**

# Foodborne zoonoses

Swiss TPH

Shiga toxin-producing *E. coli* infection (STEC, VTEC, EHEC)

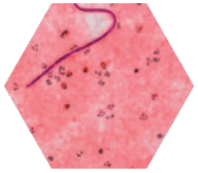
**Campylobacteriosis**



**Salmonellosis**

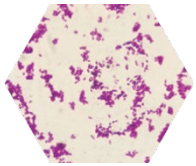
**Listeriosis**

**Trichinellosis**



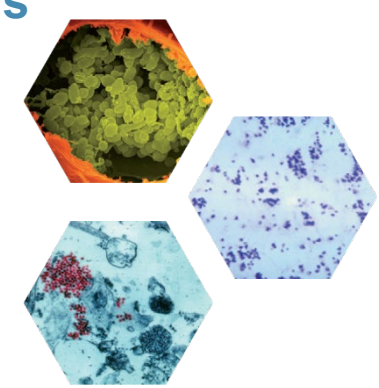
**Echinococcosis**

**Brucellosis**



**Bovine tuberculosis**

**Q-fever**



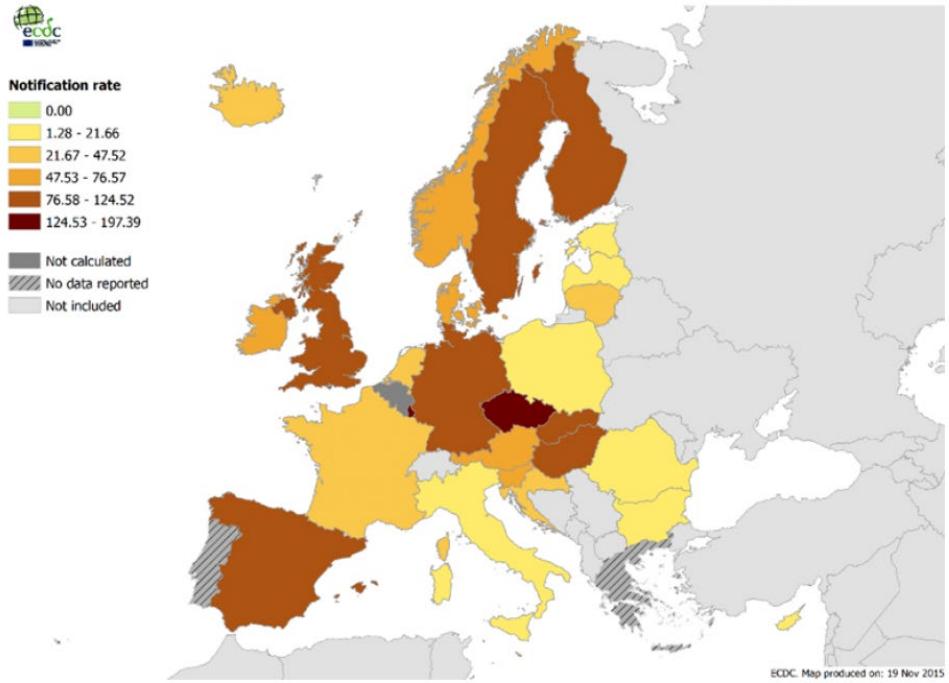
**Tularaemia**

**West Nile Fever**

# Surveillance / human case numbers in Europe

## Campylobacteriosis

Figure 2. Reported confirmed campylobacteriosis cases: rates per 100 000, EU/EEA, 2014



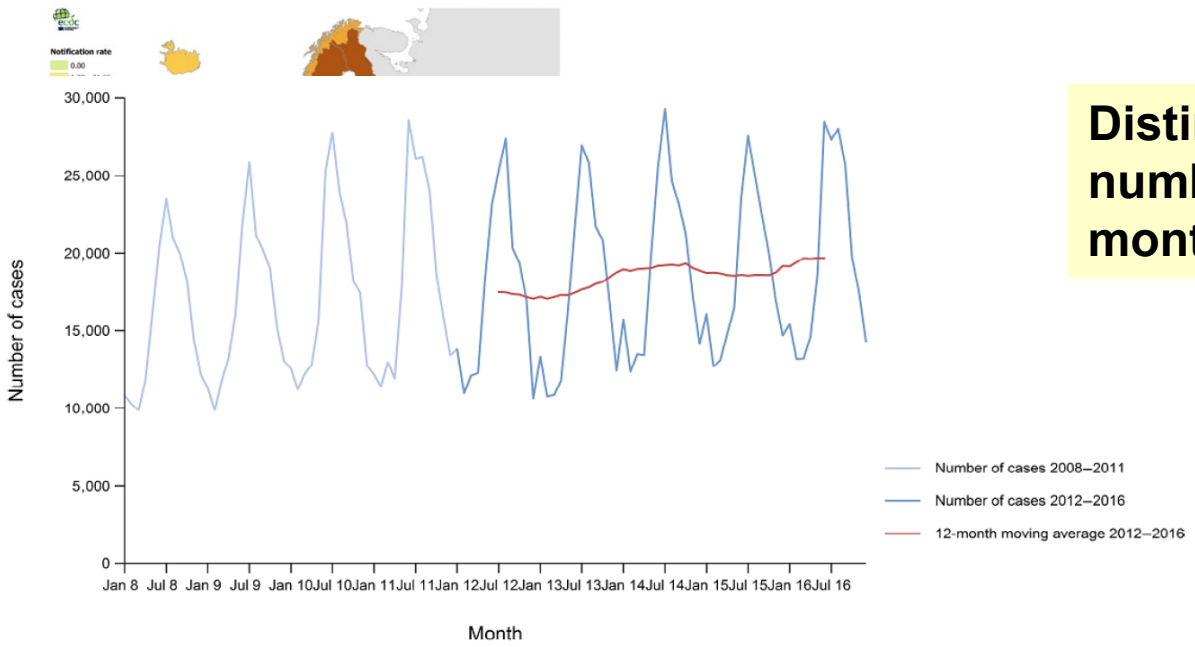

Source: Country reports from Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, the United Kingdom.

**Variable notification rates across Europe – No data provided by CH to ECDC**

# Surveillance / human case numbers in Europe

Campylobacteriosis

Figure 2. Reported confirmed campylobacteriosis cases: rates per 100 000, EU/EEA, 2014




Source(s): Austria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. Belgium, Bulgaria, Croatia and Portugal did not report data at the level of detail required for the analysis. In Greece, campylobacteriosis is not under surveillance.

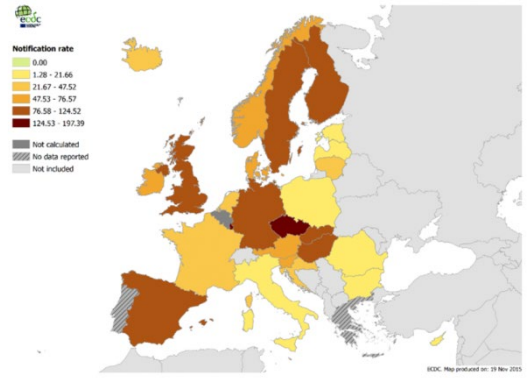
**Figure 2:** Trend in reported confirmed human cases of campylobacteriosis in the EU/EEA, by month, 2012–2016

**Distinct seasonality – high case numbers during summer months**

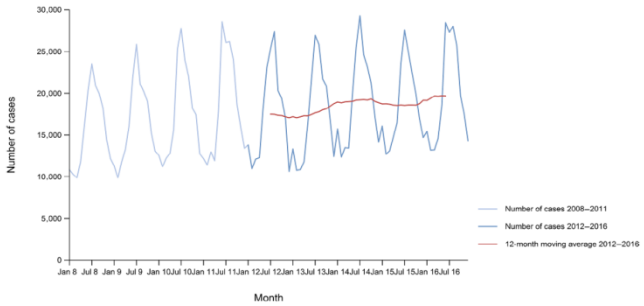
# Surveillance / human case numbers in Europe

Campylobacteriosis

Figure 2. Reported confirmed campylobacteriosis cases: rates per 100 000, EU/EEA, 2014




Source: Country reports from Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, the United Kingdom.



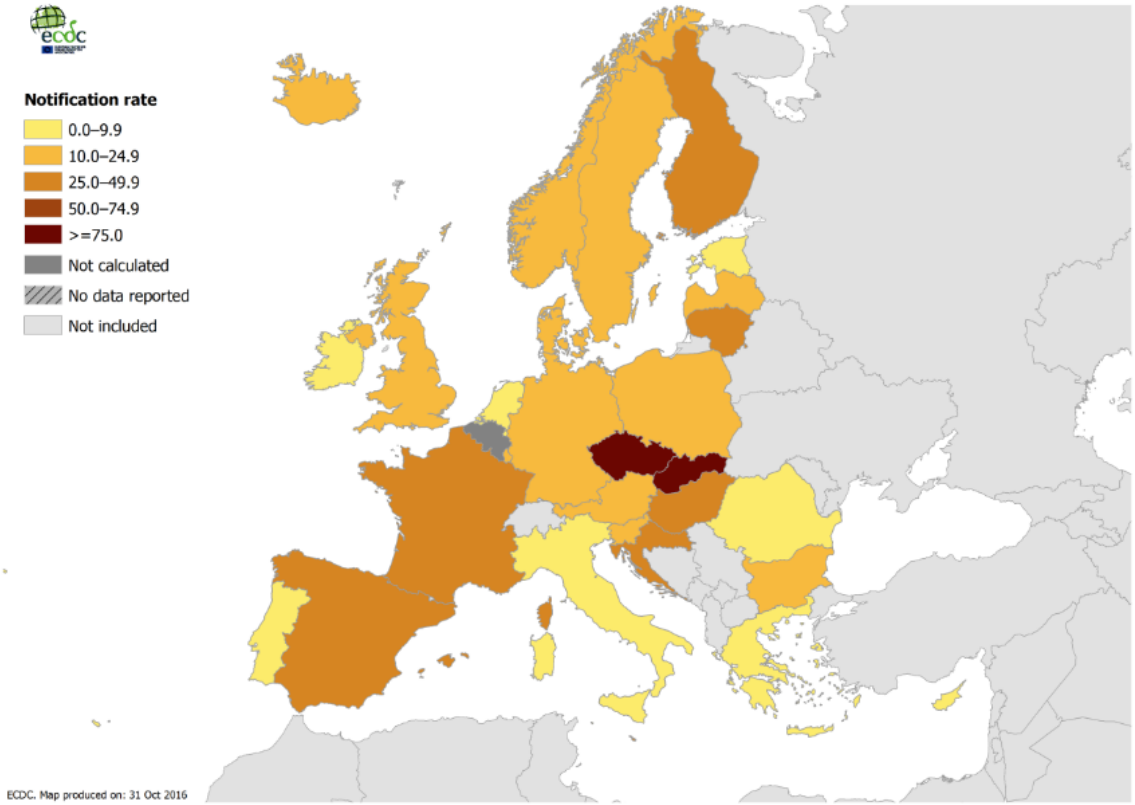

Source(s): Austria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. Belgium, Bulgaria, Croatia and Portugal did not report data at the level of detail required for the analysis. In Greece, campylobacteriosis is not under surveillance.

**Figure 2:** Trend in reported confirmed human cases of campylobacteriosis in the EU/EEA, by month, 2012–2016

Salmonellosis

SURVEILLANCE REPORT — Annual epidemiological report for 2015

**Figure 1. Distribution of confirmed cases of non-typhoidal salmonellosis per 100 000 population, EU/EEA, 2015**

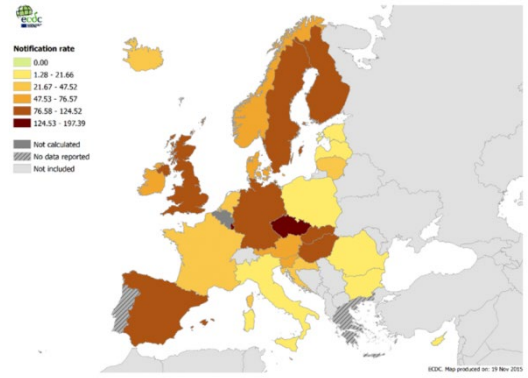



**Similar variable pattern for salmonellosis**

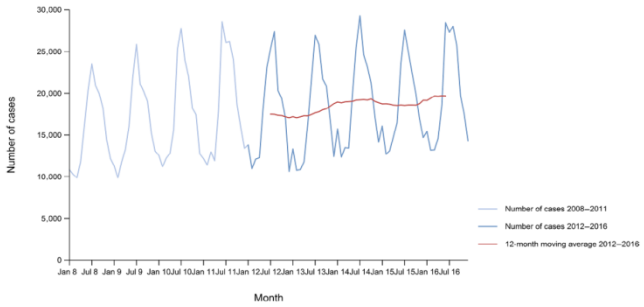
# Surveillance / human case numbers in Europe

Campylobacteriosis

Figure 2. Reported confirmed campylobacteriosis cases: rates per 100 000, EU/EEA, 2014



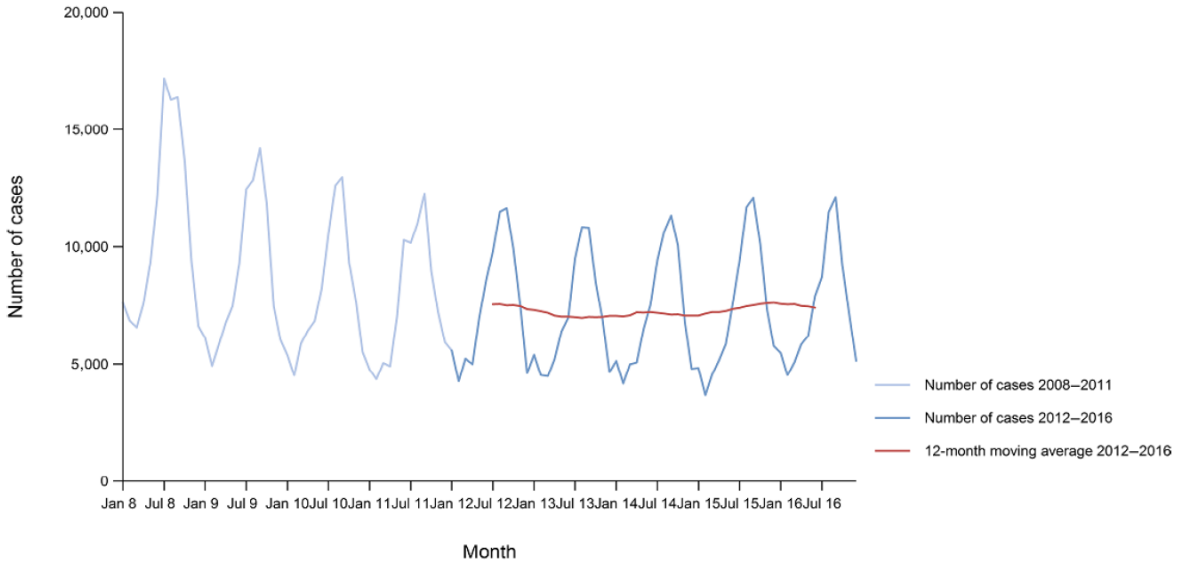

Source: Country reports from Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, the United Kingdom.




Source(s): Austria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. Belgium, Bulgaria, Croatia and Portugal did not report data at the level of detail required for the analysis. In Greece, campylobacteriosis is not under surveillance.

**Figure 2:** Trend in reported confirmed human cases of campylobacteriosis in the EU/EEA, by month, 2012–2016

Salmonellosis


Source(s): Austria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. Belgium, Bulgaria and Croatia did not report data to the level of detail required for the analysis.

**Figure 3:** Trend in reported confirmed human cases of non-typhoidal salmonellosis in the EU/EEA, by month, 2012–2016

**Comparable seasonality (summer peaks)**

# Media reports / Outbreaks

Watson.ch (16.03.2018)

## Bundesamt warnt vor Salmonellen in Bio-Amaranth von Lidl

Im Produkt «Golden Sun Bio Organic Amaranth», verkauft bei Lidl, wurden Salmonellen nachgewiesen. Eine Gesundheitsgefährdung kann nicht ausgeschlossen werden, teilt Bundesamt für Lebensmittelsicherheit und Veterinärwesen (BLV) am Frei-


(09.11.2018)

## Fears of salmonella outbreak at uMhlanga eatery

NEWS / 9 NOVEMBER 2018, 07:15AM / KAILENE PILLAY

*Old Town Italy restaurant in uMhlanga. Picture: Sibonelo Ngcobo/African News Agency (ANA)*

Durban - At least 20 people have been hospitalised with suspected salmonella food poisoning after eating at the popular Old Town Italy restaurant in uMhlanga at the weekend.

Blick am Abend (04.07.2014)

## Das Poulet versaut uns die Feier

**MYSTERIÖS** ⇢ Über die Weihnachtstage erkranken jedes Jahr Tausende Schweizer. Jetzt ist das Rätsel gelöst. Schuld ist der Feiertagsschmaus.

Es ist der Feiertags-Klassiker schlechthin, das Fondue Chinoise. Zu Hunderttausenden sitzen Herr und Frau Schweizer über die Weihnachtstage mit Freunden und Familie gemütlich am festlich gedeckten Tisch. Und schlemmen. Nicht selten endet der fröhliche Abend aber unschön: Mit üblen Bauchkrämpfen auf dem Topf.

**Jahr für Jahr erkranken in den Weihnachtsferien 7000 bis 8000 Schweizer an einer Campylobacter-Infektion.** Diese auffällige Häufung brachte Experten und Ärzte ins Grübeln.

Nun hat das Schweizerische Tropen- und Public Health-Institut aus Basel das Rätsel gelöst. Und den Übeltäter entlarvt: Es ist das Fondue Chinoise. Genauer: Das rohe Poulet.

Die Forscher befragten für die Studie Personen, die zwischen Dezember 2012 und Februar 2013 an einer Campylobacter-Infektion erkrankt waren. Sie hätten dabei die Infektion als schwere Erkrankung beschrieben, die im Schnitt sieben Tage gedauert habe.

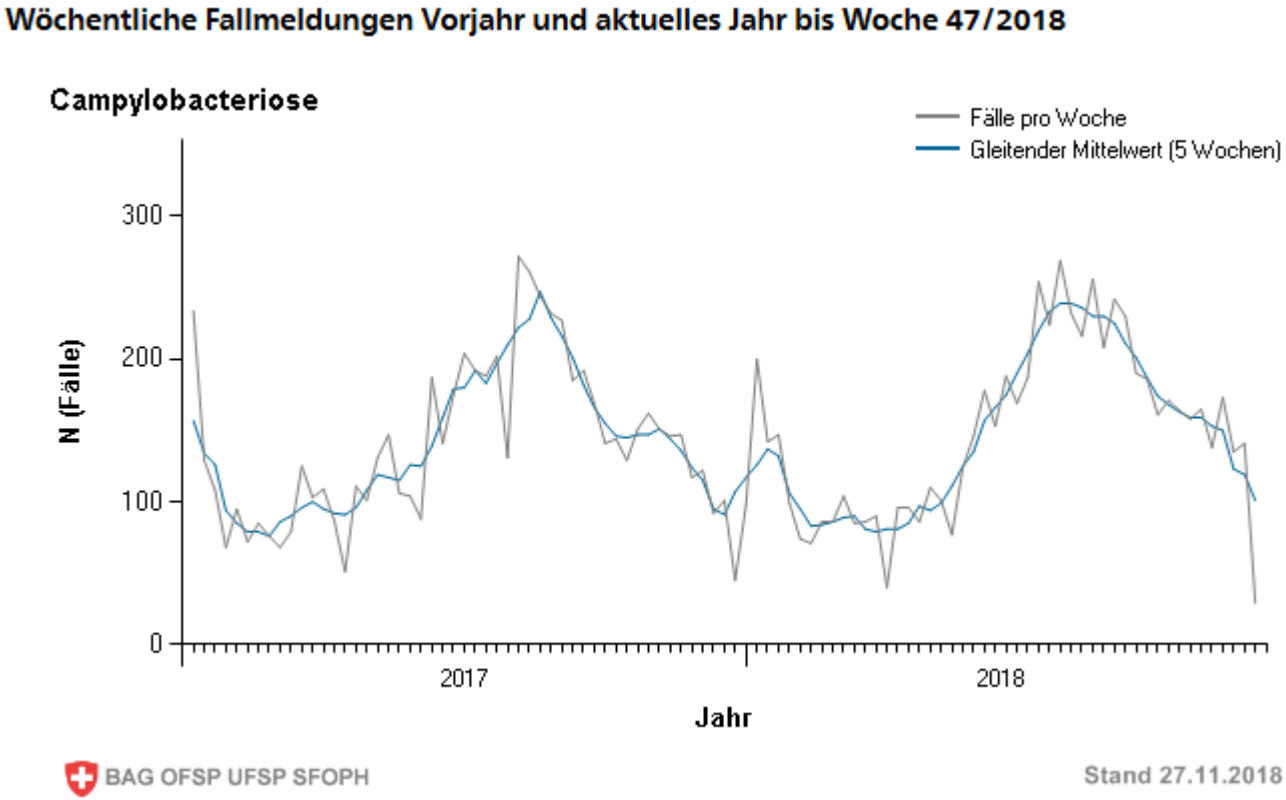
Das Bundesamt für Gesundheit (BAG) hat auch schon Tipps parat, damit die nächste Weihnachtsfeier ohne unschöne Abstecher auf die Toilette über die Bühne geht: **Getrennte Teller für rohes und gekochtes Poulet.** Damit soll das Infektionsrisiko um den Faktor fünf sinken. Zudem soll man zuvor gefrorenes Fleisch verwenden. **pbe**


Fotos: Dukas (2), ddp images, Panos Pictures/VISUM, AFP

**Foodborne outbreaks and food recalls – a recurring topic across the globe**

# (Human) Surveillance in Switzerland

## Campylobacteriosis

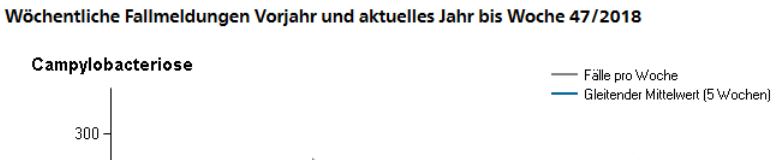



**Case numbers from Switzerland – distinct seasonality with summer and winter peaks**

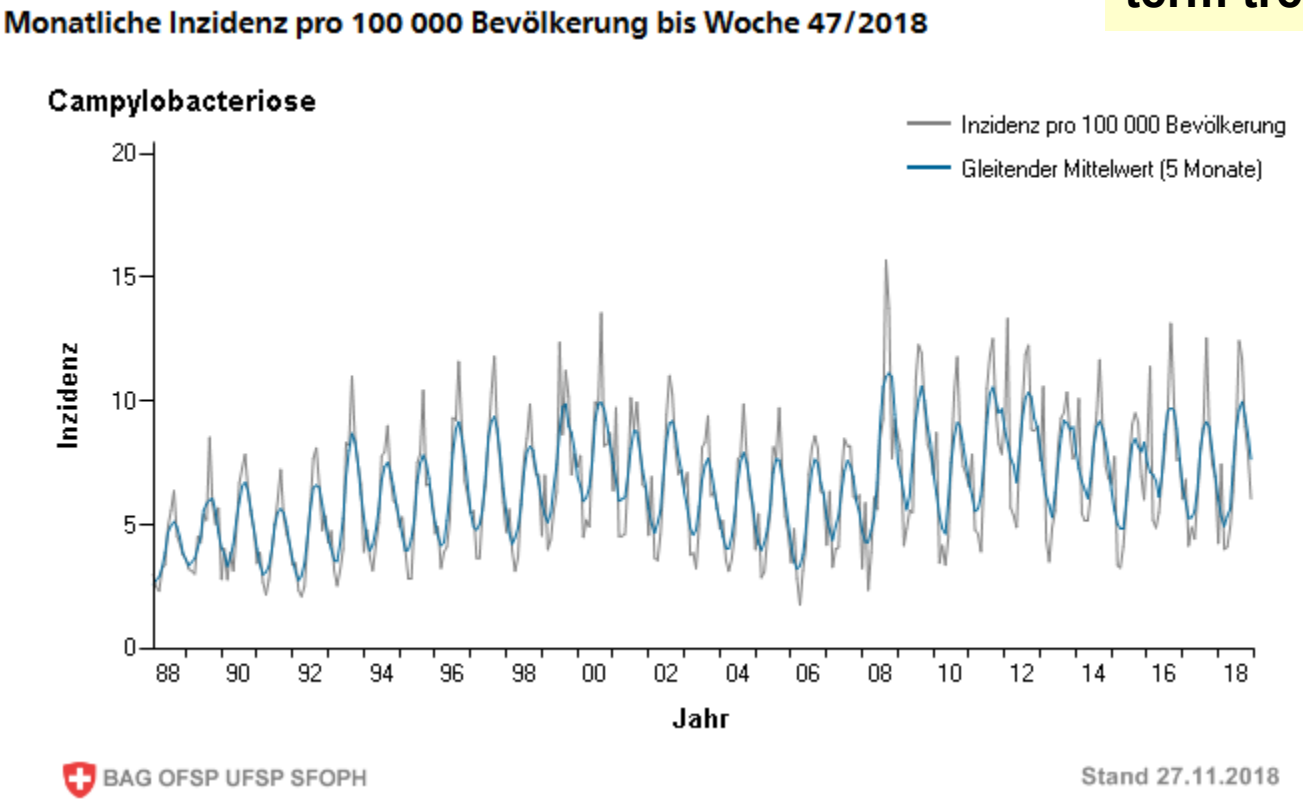
Source: BAG Webpage: 'Zahlen-und-statistiken/zahlen-zu-infektionskrankheiten/meldepflichtige-infektionskrankheiten---woechentliche-fallzahlen.html

# (Human) Surveillance in Switzerland

Campylobacteriosis



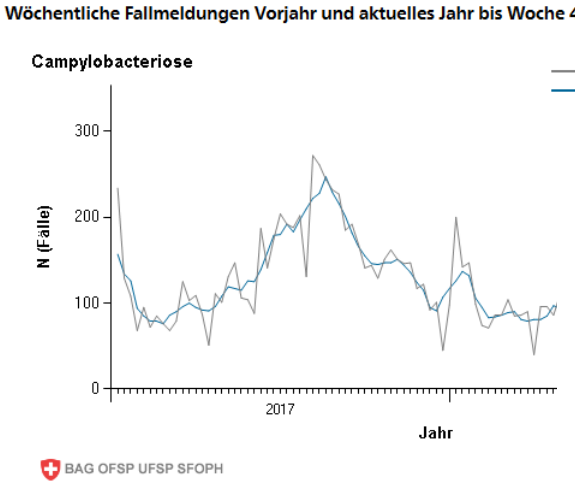

**Swiss notification rate from 1988-2018 –**
**Clear seasonality, but long-term trend not obvious**



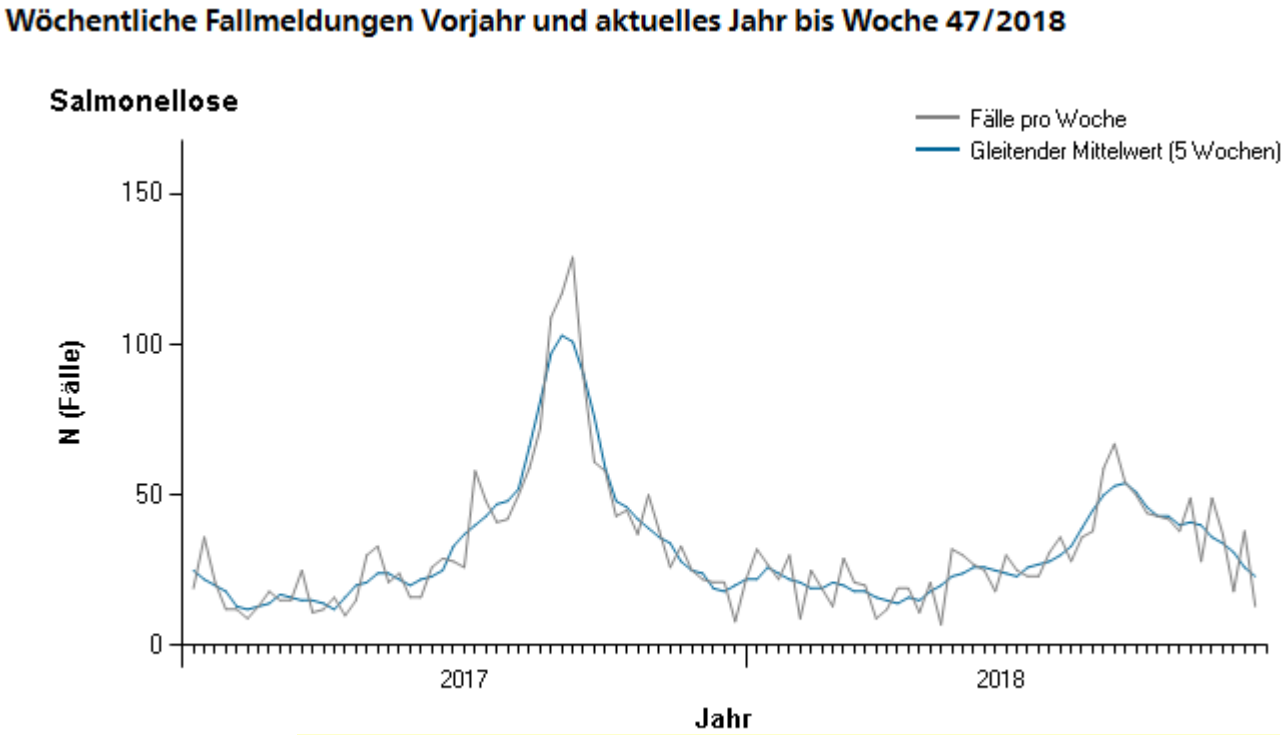

Source: BAG Webpage: 'Zahlen-und-statistiken/zahlen-zu-infektionskrankheiten/meldepflichtige-infektionskrankheiten---woechentliche-fallzahlen.html

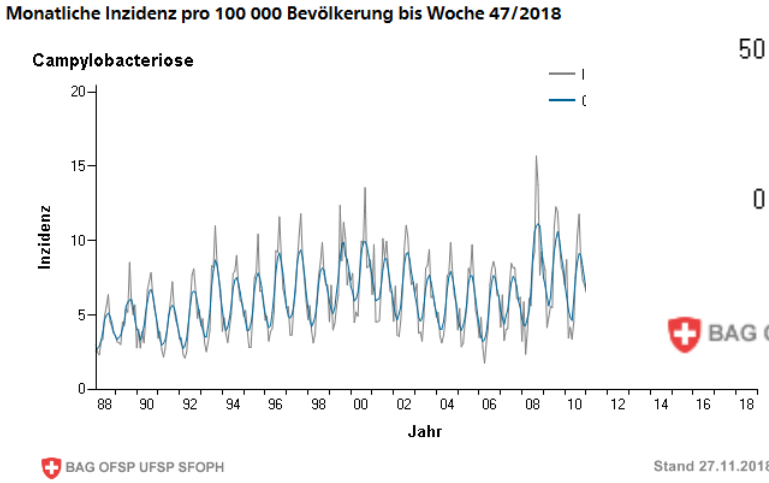
# (Human) Surveillance in Switzerland

Campylobacteriosis




Salmonellosis




**Case numbers from Switzerland – Summer peak later than for campylobacteriosis, no winter peak**

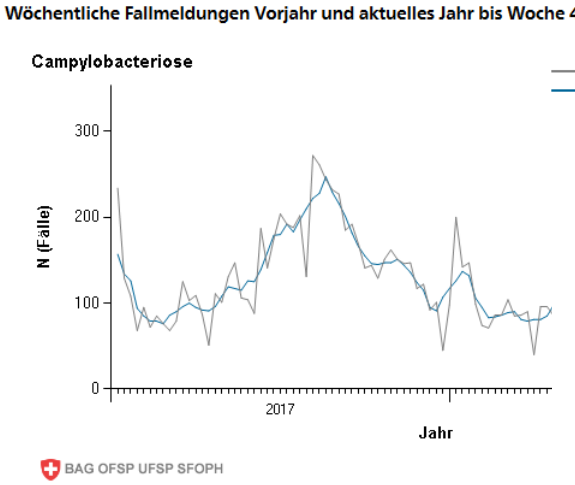
Source: BAG Webpage: 'Zahlen-und-statistiken/zahlen-zu-infektionskrankheiten/meldepflichtige-infektionskrankheiten---woechentliche-fallzahlen.html

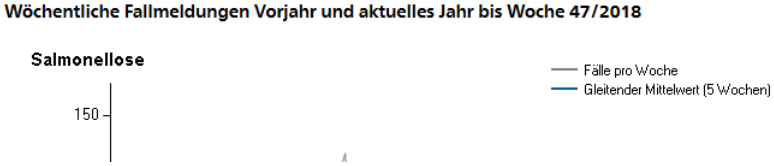
# (Human) Surveillance in Switzerland

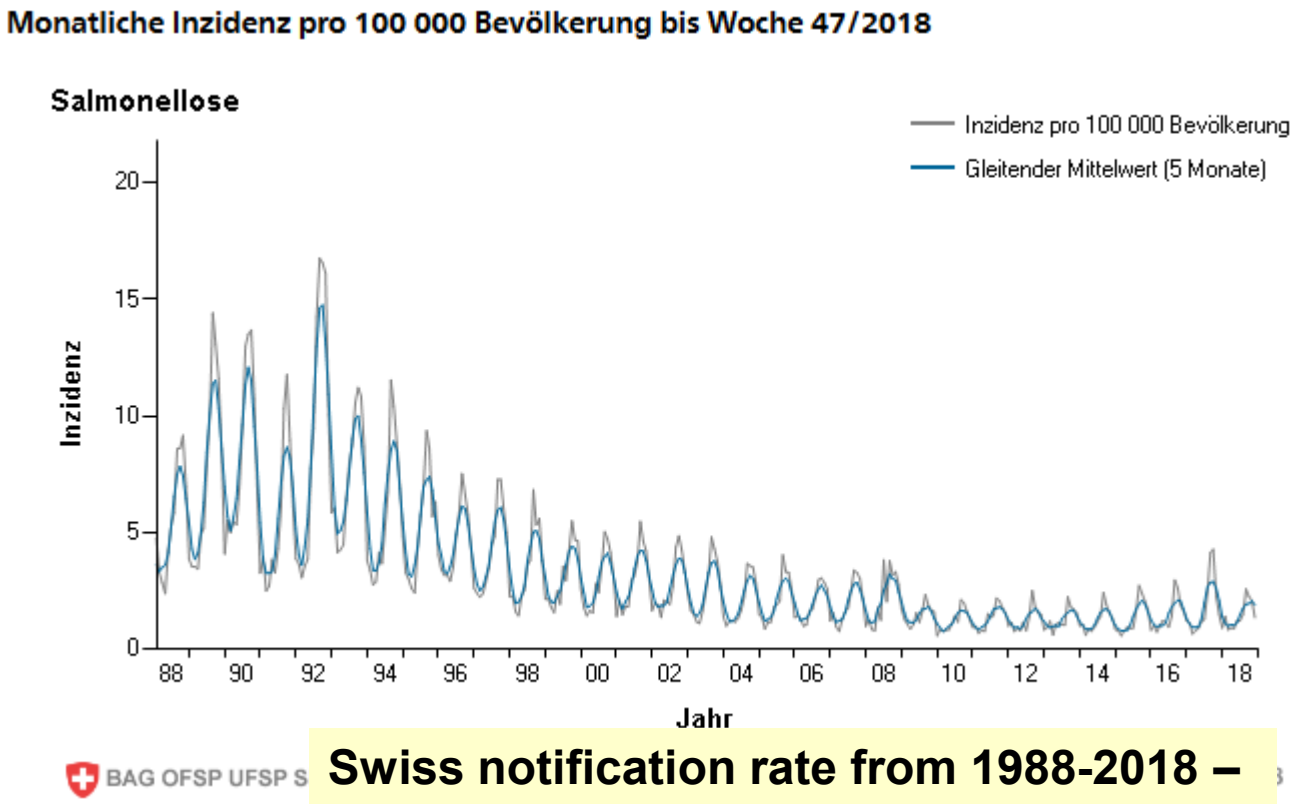
Swiss TPH

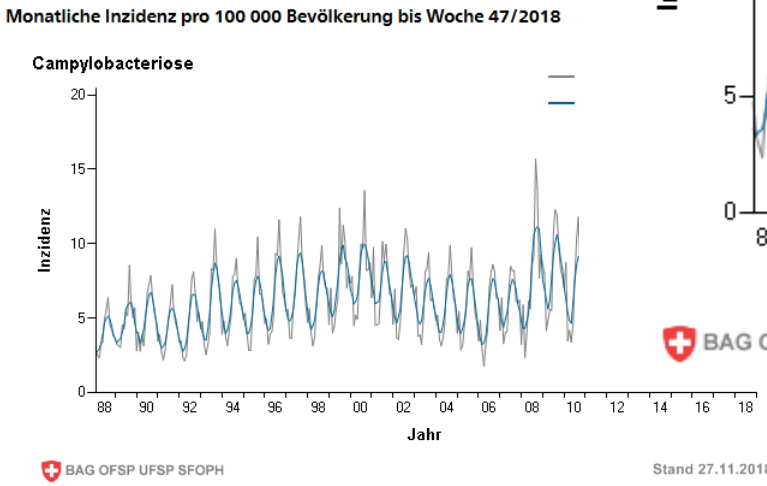
Campylobacteriosis

Salmonellosis



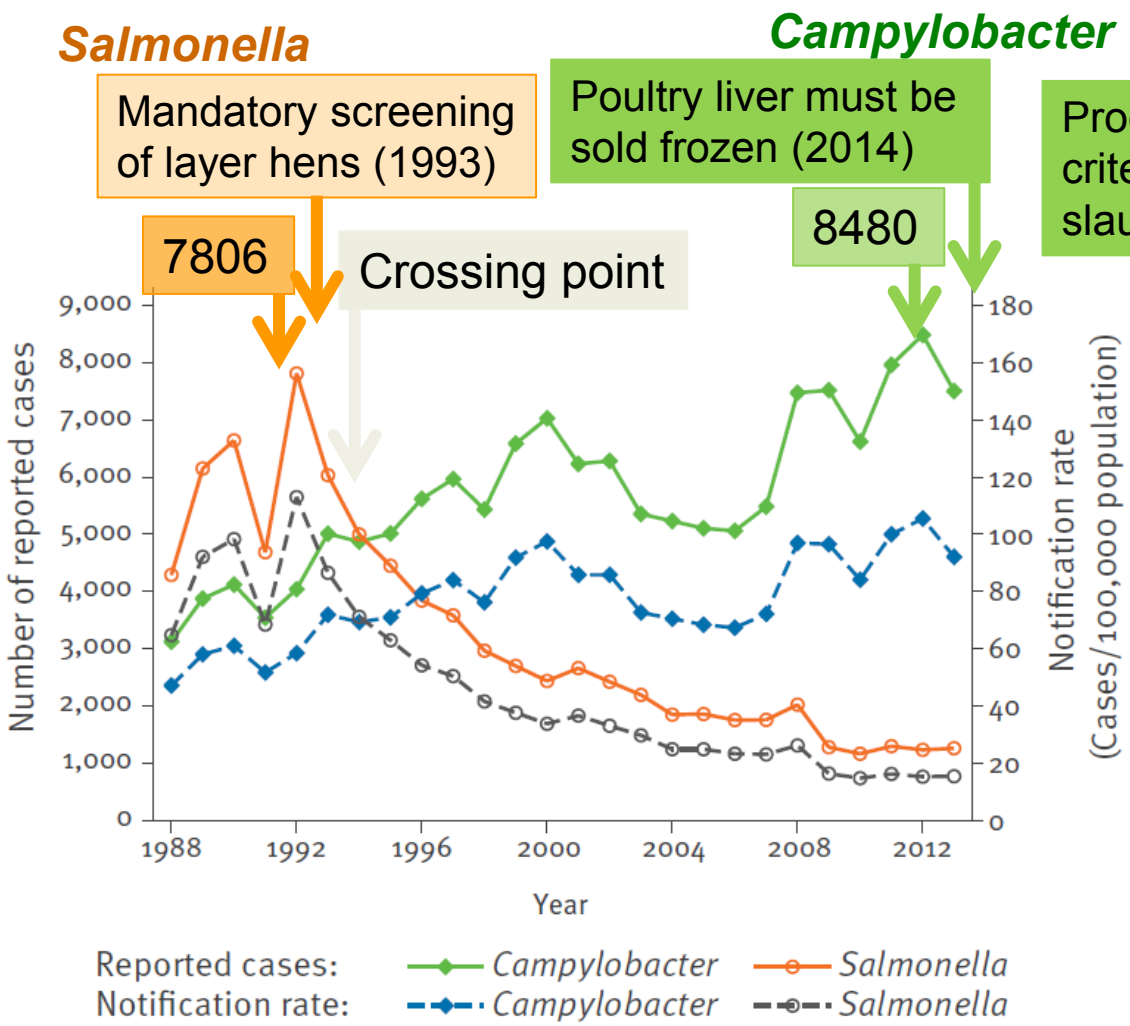




**Swiss notification rate from 1988-2018 – Decreasing long-term trend**

Source: BAG Webpage: 'Zahlen-und-statistiken/zahlen-zu-infektionskrankheiten/meldepflichtige-infektionskrankheiten---woechentliche-fallzahlen.html

# Surveillance in Switzerland

## Human salmonella, campylobacter infections

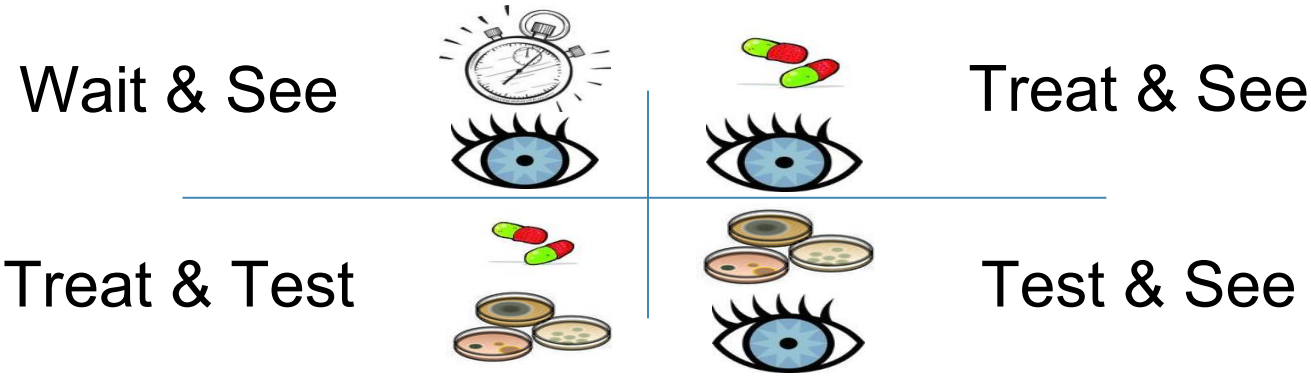



**Salmonella control interventions seem successful – Interventions against campylobacter only recently implemented**

Schmutz, Mäusezahl, *et al.* **Inverse trends of Campylobacter and Salmonella in Swiss surveillance data….** *Eurosurveillance*, 2016

# Physicians' case management influence notification

**Surveillance – We see what we measure**




**Acute gastroenteritis and campylobacteriosis**

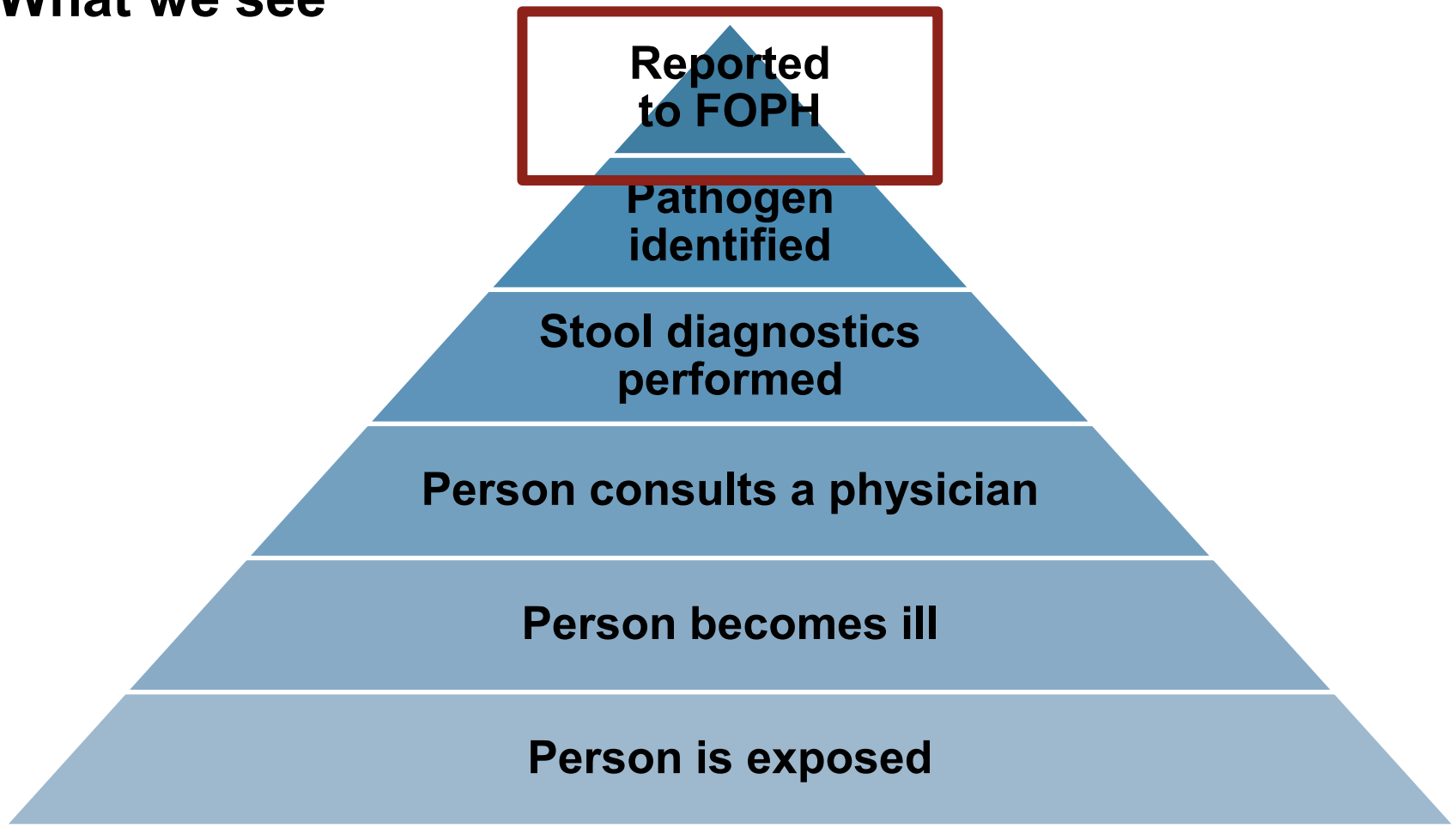
- Up to 60% of **telephone consultations** only
- **Self-limiting or easy to treat** – except for vulnerable individuals
- **Antibiotics** prescribed: **8.5%** → Most receive symptomatic treatment only
- Initiating **stool testing**: **12.3%** → Most patients not captured in NNSID
- Testing bias: **travel history** (7 days): **OR 3.6** → Travellers overrepresented
- On **sick leave: 86.3%** of employed adults / median **4 days** → high impact

**A large proportion of patients (telephone consultation only; no stool testing) is not captured by the surveillance system**

Bless, *et al.* **Acute gastroenteritis and campylobacteriosis in Swiss primary care: the general practitioner.** *PLoS One*, 2016
Schmutz, Bless, *et al*. **Attending primary care due to acute gastroenteritis – the Swiss Sentinel Surveillance Network** . *Infection*, 2017

# Understanding determinants of notification

## What we see

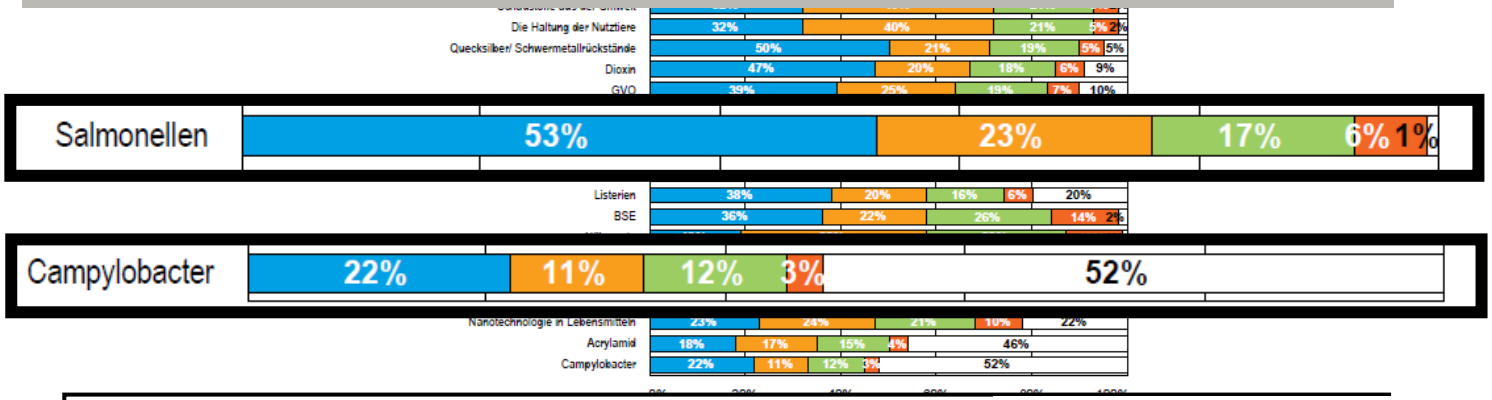



**Notifications reflects the tip of the iceberg – The burden of disease is determined at a much lower levels and depends on the populations' behaviour**

# Consumer awareness / behaviour

**Frage 12:** Wenn Sie ein Lebensmittel kaufen, inwieweit sind Sie über folgende Themen beunruhigt, bzw. nicht beunruhigt? Wenn Sie ein Thema nicht kennen, kreuzen Sie bitte „Kenne ich nicht“ an.

When buying foodstuff: are you worried about…?




- Very much worried
- Somewhat worried
- Not really worried
- Not worried
- Don’t know (the pathogen/topic)

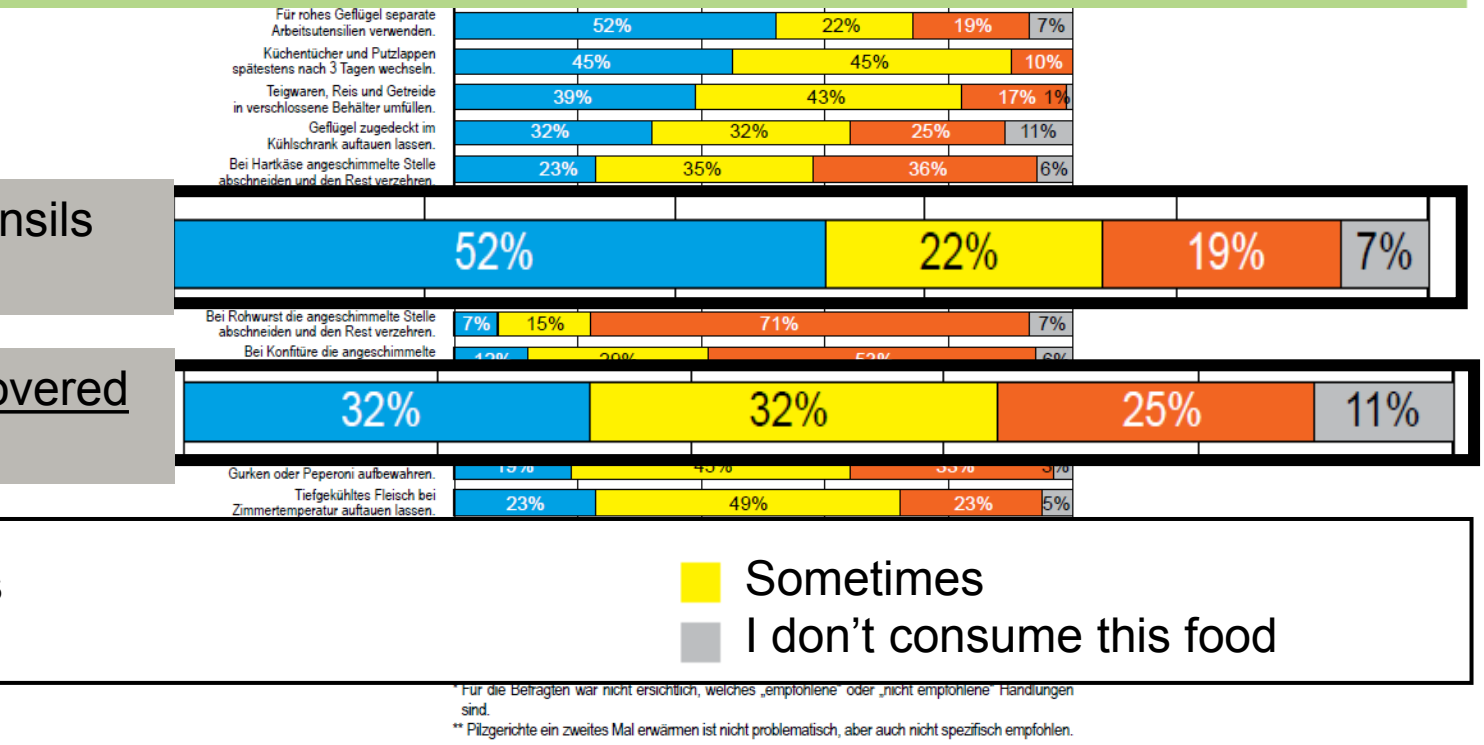
**Campylobacter is not known by Swiss consumers**

Source: Coop-Studie Ess-Trends im Fokus «Essen? Aber sicher!», 2011

# Consumer awareness / behaviour

**Frage 25:** Wie häufig führen Sie folgende Handlungen durch?*

How often do you…?




Use separate utensils for raw poultry

Defrost poultry <u>covered</u> in fridge

* Für die Befragten war nicht ersichtlich, welches „empfohlene" oder „nicht empfohlene" Handlungen sind.

** Pilzgerichte ein zweites Mal erwärmen ist nicht problematisch, aber auch nicht spezifisch empfohlen.

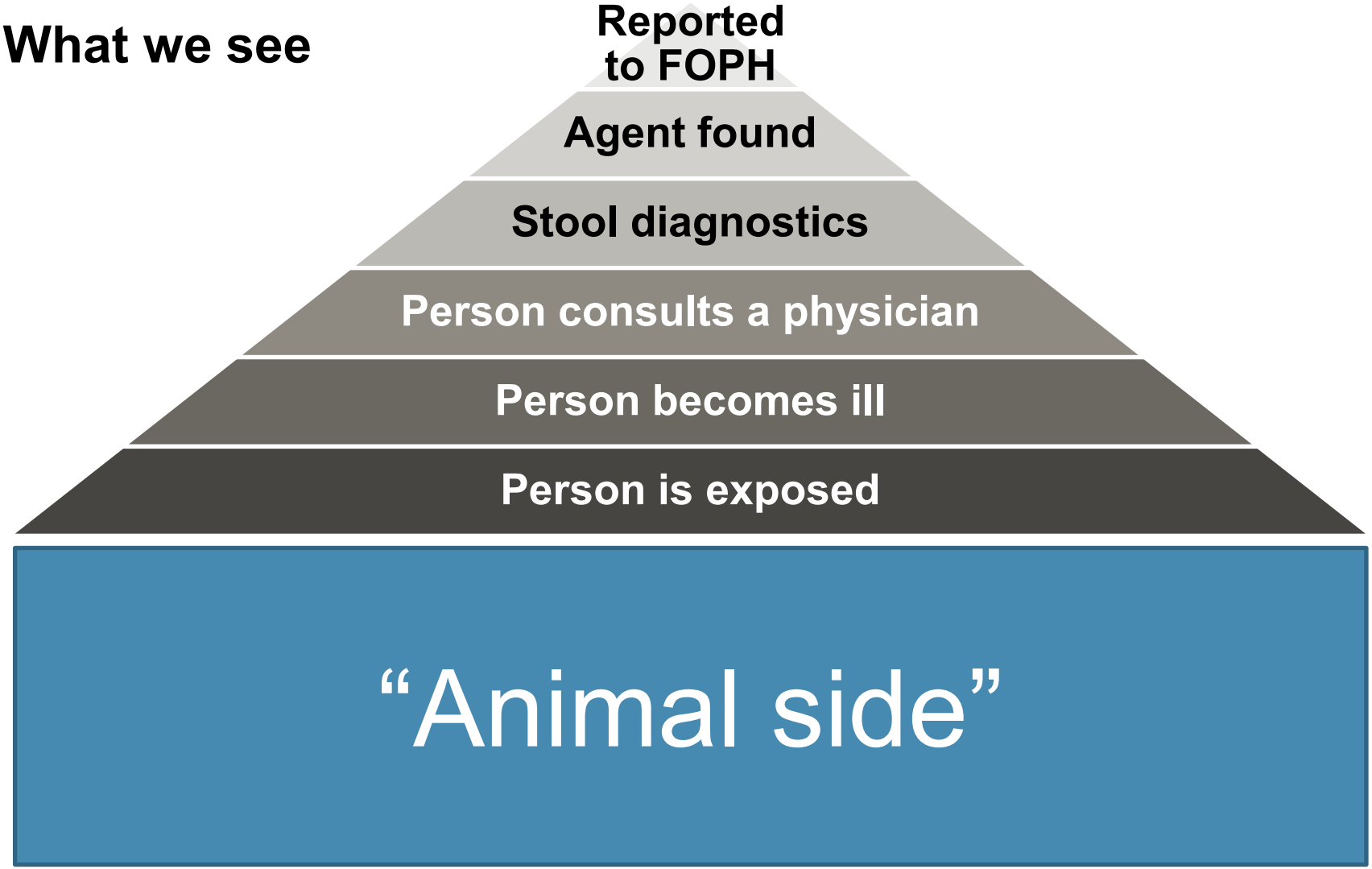
**Simple kitchen hygiene "rules" are not known / followed**

Source: Coop-Studie Ess-Trends im Fokus «Essen? Aber sicher!», 2011

# Foodborne zoonoses

Swiss TPH

**What we see**




**What about the animal part?**

# Animal surveillance in Switzerland

Swiss TPH

**Epizootic disease regulation**

916.401

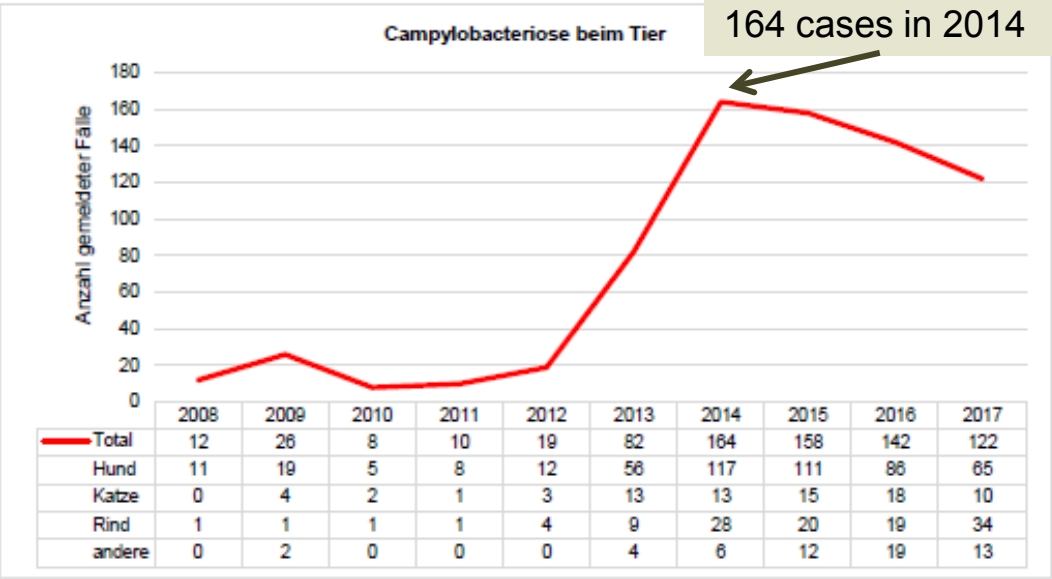
**Tierseuchenverordnung**
**(TSV)**
vom 27. Juni 1995 (Stand am 1. Juni 2018)

*Der Schweizerische Bundesrat,*
gestützt auf die Artikel 10, 16, 20, 32 Absatz 1bis, 53 Absatz 1 und 56*a* Absatz 2 des Tierseuchengesetzes vom 1. Juli 1966[1] (TSG)
und auf Artikel 32 Absatz 1 des Tierschutzgesetzes vom 16. Dezember 2005[2,3]
*verordnet:*

1. **Highly contagious plagues** (“Hochansteckende Seuchen”)
   e.g. foot-and-mouth disease, cattle plague
2. **Eradicable plagues** (“Auszurottende Seuchen”)
   e.g. rabies, tuberculosis, brucellosis
3. **Plagues to be combatted** (“Zu bekämpfende Seuchen”)
   e.g. **salmonellosis**, leptospirosis
4. **Plagues to be surveyed** (“Zu überwachende Seuchen”)
   e.g. **campylobacteriosis**, listeriosis, toxoplasmosis)

**Law defines active approach for *Salmonella*, passive approach for *Campylobacter***

# Veterinary surveillance: *Campylobacter & Salmonella*




| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|
| Total | 12 | 26 | 8 | 10 | 19 | 82 | 164 | 158 | 142 | 122 |
| Hund | 11 | 19 | 5 | 8 | 12 | 56 | 117 | 111 | 86 | 65 |
| Katze | 0 | 4 | 2 | 1 | 3 | 13 | 13 | 15 | 18 | 10 |
| Rind | 1 | 1 | 1 | 1 | 4 | 9 | 28 | 20 | 19 | 34 |
| andere | 0 | 2 | 0 | 0 | 0 | 4 | 6 | 12 | 19 | 13 |

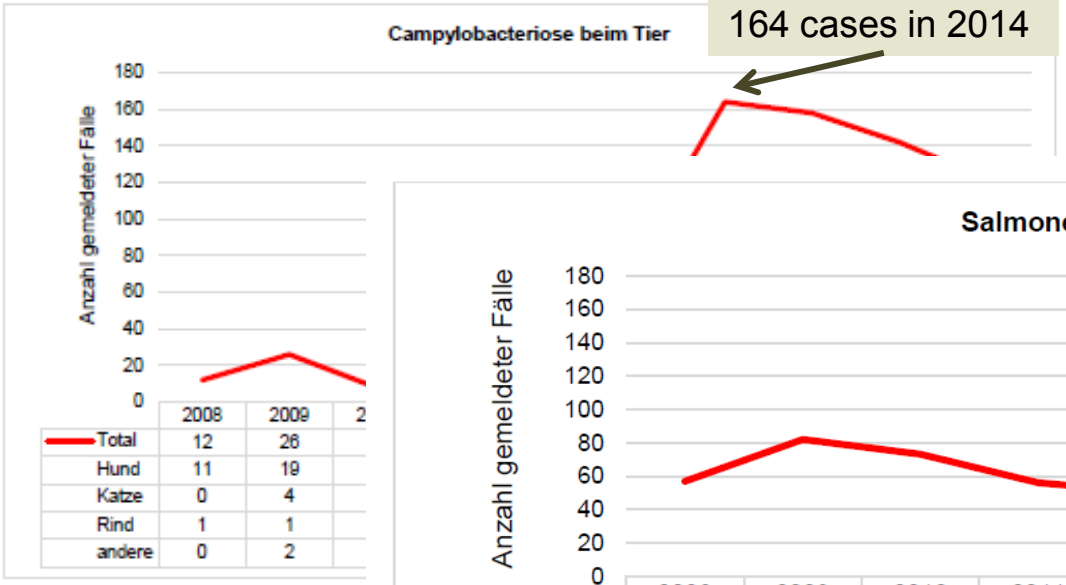
**Abbildung CA—2:** Anzahl gemeldeter Campylobacteriose-Fälle beim Tier 2008–2017.
(Quelle: InfoSM, BLV; Stand März 2018)

| Active surveillance | Fattening pigs | Broilers |
|---|---|---|
| 2016 | | 35% |
| 2017 | 57% | |

| Food: self-control | |
|---|---|
| 2017 | 27% |

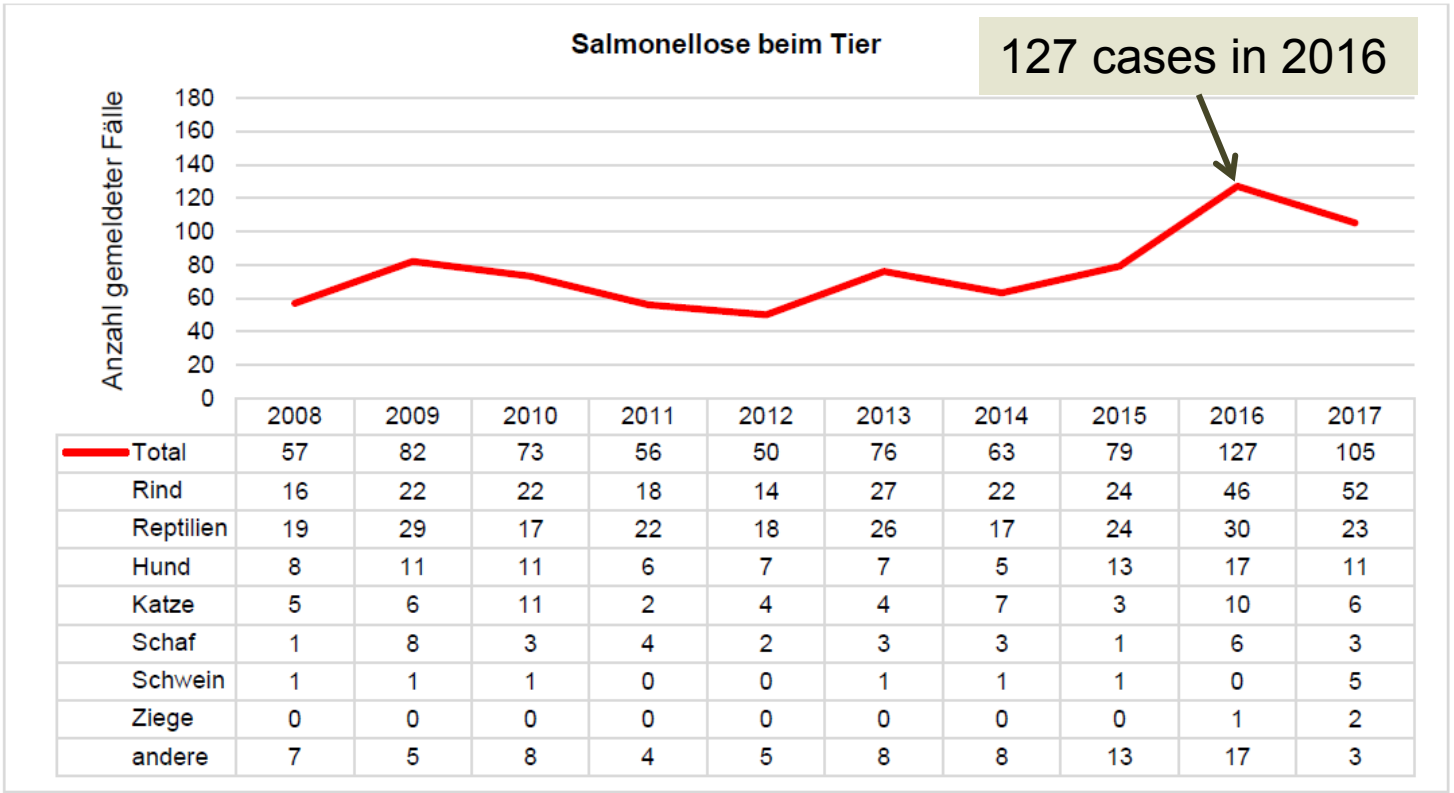
**Campylobacter negligible according to case numbers from animal (passive) surveillance; active surveillance reveals "real" extent of the problem**

# Veterinary surveillance: *Campylobacter & Salmonella*




164 cases in 2014

**Abbildung CA—2:** Anzahl gemeldet
(Quelle: InfoSM, BLV; Stand März 2(




127 cases in 2016

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|
| Total | 57 | 82 | 73 | 56 | 50 | 76 | 63 | 79 | 127 | 105 |
| Rind | 16 | 22 | 22 | 18 | 14 | 27 | 22 | 24 | 46 | 52 |
| Reptilien | 19 | 29 | 17 | 22 | 18 | 26 | 17 | 24 | 30 | 23 |
| Hund | 8 | 11 | 11 | 6 | 7 | 7 | 5 | 13 | 17 | 11 |
| Katze | 5 | 6 | 11 | 2 | 4 | 4 | 7 | 3 | 10 | 6 |
| Schaf | 1 | 8 | 3 | 4 | 2 | 3 | 3 | 1 | 6 | 3 |
| Schwein | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 5 |
| Ziege | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| andere | 7 | 5 | 8 | 4 | 5 | 8 | 8 | 13 | 17 | 3 |

**Abbildung SA—2:** Anzahl gemeldeter Salmonellose-Fälle beim Tier 2008–2017.
(Quelle: InfoSM, BLV; Stand März 2018)

| **Active surveillan** | |
|---|---|
| 2016 | |
| 2017 | |

| **Food: self-contro** | |
|---|---|
| 2017 | 27 % |

**Comparably low case numbers for *Salmonella***

# National surveillance – *Salmonella* in poultry

**Keeping prevalence in poultry at low levels to reduce human cases**
(for serovars of human relevance)

- Target: ≤1% prevalence in breeding animals and in retail
- Target: ≤2% in laying hens Control measures if detected
- Cases registered in official surveillance system “InfoSM”
- InfoSM: **6 cases** in 2017

- Poultry keeping with more >250 breeding animals, >1000 laying hens, 5000 broilers or >500 turkeys must be checked for *Salmonella* **(self-control)**
- 2017: **16 suspected cases** in laying hens & broilers – not confirmed

**Majority of poultry is kept in small farms not falling under this regulation (self-control); eggs from “the neighbour’s farm” is considered safe…**

# *Salmonella*: Successful interventions

Swiss TPH

**Infected eggs - Addressing the key risk factor in the past:**

**Consumption** of raw or soft-boiled **eggs** (or egg in foods)

- Symptomless, invasive infection in laying hens: **colonisation of ovaries** → transmission of bacteria to the contents of eggs
- Development of **ELISA** to test shell eggs for antibodies against *S.* Enteritidis → rapid & simple screening
  - Declared mandatory (~1995)
  - Culling of positive flocks
- **Gastronomy**: safe handling of dishes containing raw eggs
- Decrease prevalence in broiler (chicken meat): sanitation measures, import (?)

➔ **Vertical and horizontal transmission** in breeding and laying birds

**Successful control of *Salmonella* by interrupting vertical transmission cycle – Few breeding farms distributing eggs and chickens across European countries**

# *Salmonella*: Current control measures

**Food safety criteria** (concerns products in trade) → Food recall

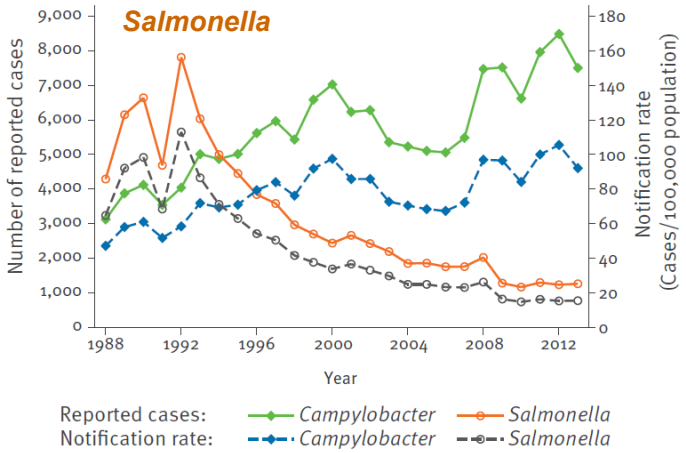
- **Not detectable in 25g**: **minced meat**, **raw meat** for consumption, **poultry** products, **cheese**, butter and raw milk **cream**, ice cream, **egg-containing** products, **ready-to-eat foods** with raw eggs, cooked crustacean and molluscs, ready-to-eat **germlings**, …

**Process hygiene criteria** (products not [yet] in trade)

➔ not detectable in carcasses. Measures taken if x/50 samples positive

- Cattle, sheep, goats and horses if >2/50
- Pigs if >3/50
- Broilers and turkeys if >5/50

**Strict limits in Swiss legislation – Immediate actions in case of detection (food safety criteria)**



# *Campylobacter*: where and how to intervene?

Swiss TPH


**Preventing contact of flocks with *Campylobacter***

- Biosecurity
  - Hygiene barriers
  - Fly screens
- Drinking water
- Reducing age at slaughter
- No thinning

**Reducing susceptibility of flocks**

- Bacteriocins
- Bacteriophages
- Vaccination
- Feed and water additives
- Selective breeding

**Reducing bacterial load in bird gut**

- Feed and water withdrawal before slaughter (effect questionable)
- Cleaning and disinfection of crates for transport

**Possibilities for intervention at animal level – none is mandatorily implemented in CH**

EFSA Panel on Biological Hazards. Scientific Opinion on Campylobacter in broiler meat production: control options and performance objectives and/or targets at different stages of the food chain. *EFSA Journal*; 2011; 9(4):2105

# *Campylobacter*: where and how to intervene?

Swiss TPH


**Improved processing**

- Prevent spillage of intestinal contents
- Scheduled slaughter
- Logistic slaughter

**Decontamination (chemical)**

- Organic acids (lactic/acetic)
- Chlorine
- Aqueous chlorine dioxide
- Acidic electrolysed oxidising water
- Acidified sodium chlorite
- Peracetic acid
- Trisodium phosphate

**Decontamination (physical)**

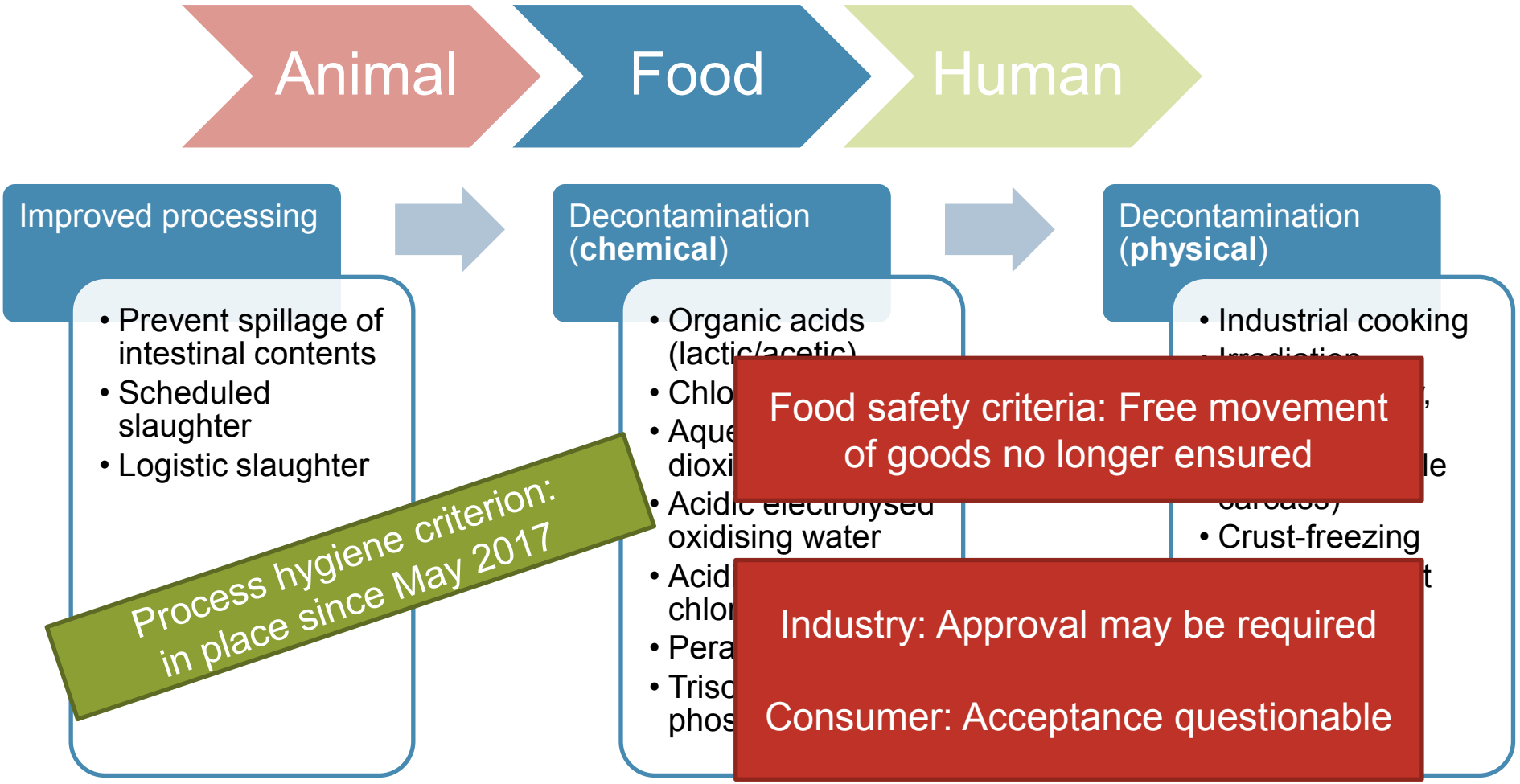
- Industrial cooking
- Irradiation (gamma, x-ray, electron)
- Freezing (whole carcass)
- Crust-freezing
- Heat treatment (e.g. steam)

**Possibilities for intervention at food production level**

EFSA Panel on Biological Hazards. Scientific Opinion on Campylobacter in broiler meat production: control options and performance objectives and/or targets at different stages of the food chain. *EFSA Journal*; 2011; 9(4):2105

# *Campylobacter*: where and how to intervene?

Swiss TPH

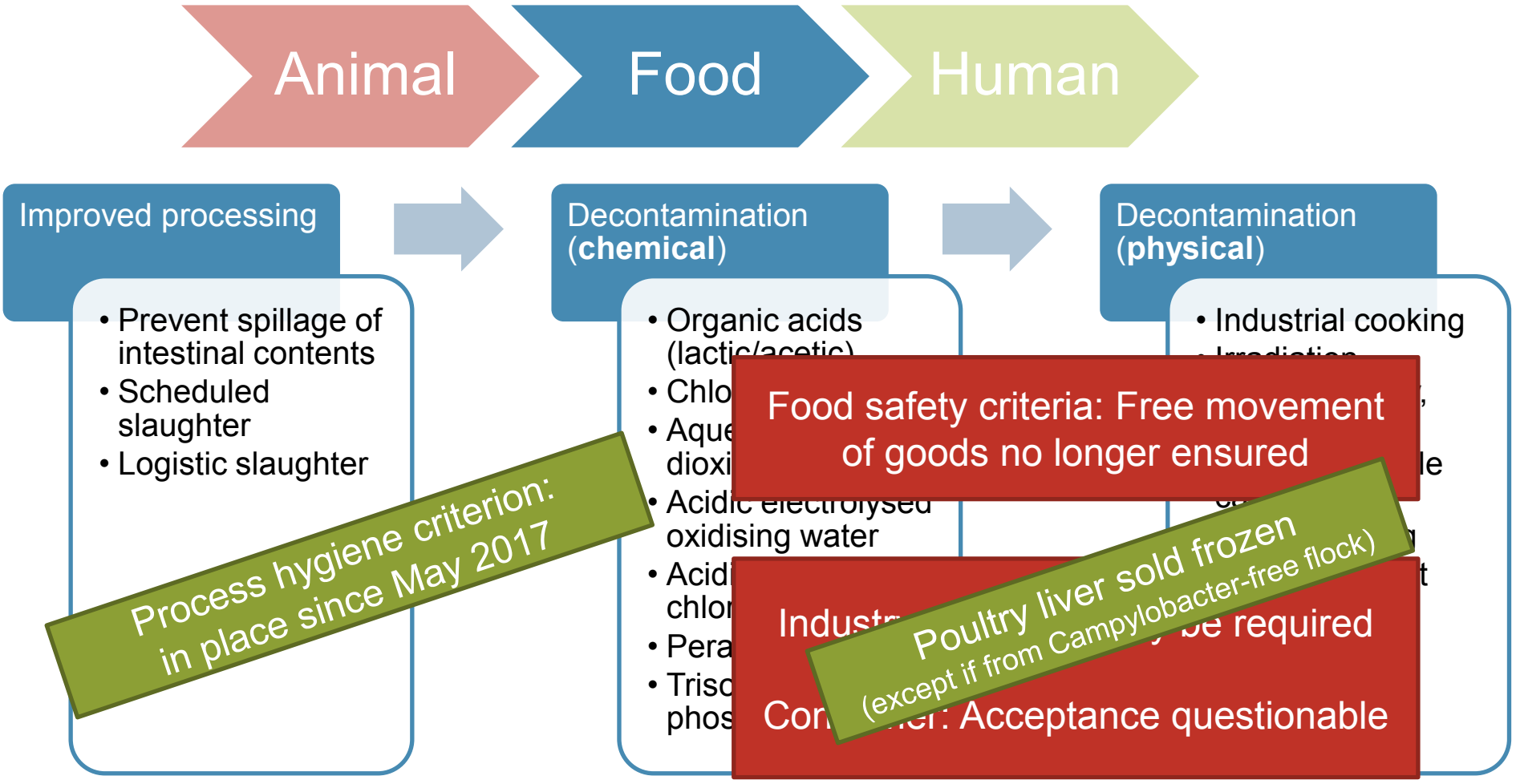



**Possibilities for intervention at food production level – industry lacks incentive for taking action**

EFSA Panel on Biological Hazards. Scientific Opinion on Campylobacter in broiler meat production. *EFSA Journal*; 2011

# *Campylobacter*: where and how to intervene?

Swiss TPH




**Possibilities for intervention at food production level – Industry lacks incentive for taking action**

EFSA Panel on Biological Hazards. Scientific Opinion on Campylobacter in broiler meat production. *EFSA Journal*; 2011

# *Campylobacter:* Current control efforts

Swiss TPH

Animal → Food → Human

- **Compulsory hygiene instructions**
  Poultry meat products and minced meat


- **Public campaigns**


**Hygiene instructions not attracting attention; public campaign not known**

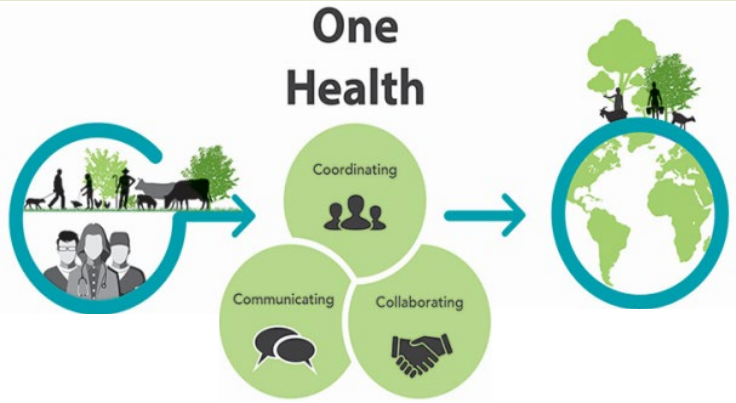
Source: BLV/FSVO: www.sichergeniessen.ch / www.savourerensecurite.ch / www.sicurezzaatavola.ch

## Interventions and campaigns – what Switzerland does

- **"Campylobacter-Plattform"** (2008-2016)
  - **Multi-stakeholder platform** to reduce human campylobacteriosis – close knowledge gaps, evaluate possible control measures
- **Food safety regulations**
  - Poultry liver must be frozen
  - Instructions on safe handling/preparation on packaging of meat products
  - Process hygiene criterion
- "Unterorgan «**One Health**»"
  - Supporting detection, surveillance, prevention and control of zoonoses and vectors
  - Institutionalising & facilitating collaboration between national and cantonal actors

Source: FSVO, 2018

**Industry partners no longer part of political structures to control *Campylobacter***



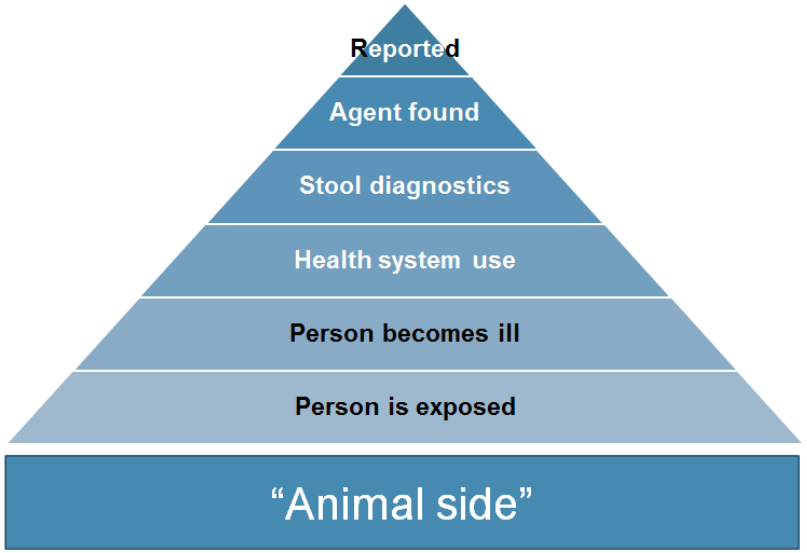


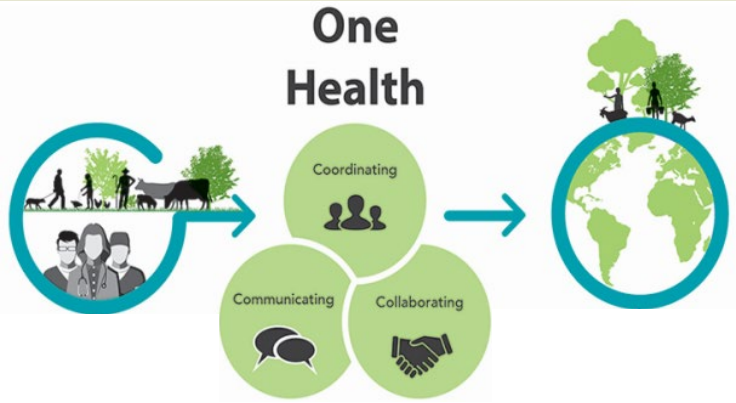
**Control measures and interventions at large are well established**

- Improve “Farm-to-Fork” upstream at production level is a ‘political’ agenda
- Improving consumer behaviour: Population *vs.* individual risk reduction?
- Accuracy of data – limits are known

**Open agenda**

- Better understand patient pyramid and behavioural economics
- Support in outbreak investigations
- Antimicrobial resistance/AMR along the entire “Farm-to-Fork” continuum



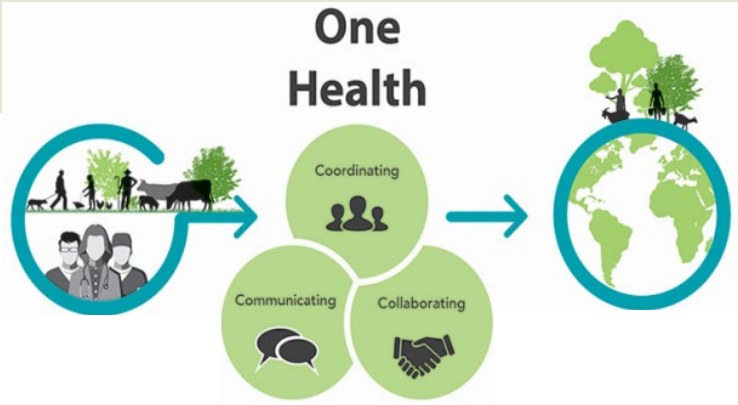



**Control measures and interventions at large are well established**

- Improve “Farm-to-Fork” upstream at production level is a ‘political’ agenda
- Improving consumer behaviour: Population *vs.* individual risk reduction?
- Accuracy of data – limits are known

**Open agenda**

- Better understand patient pyramid and behavioural economics
- Support in outbreak investigations
- Antimicrobial resistance/AMR along the entire “Farm-to-Fork” continuum



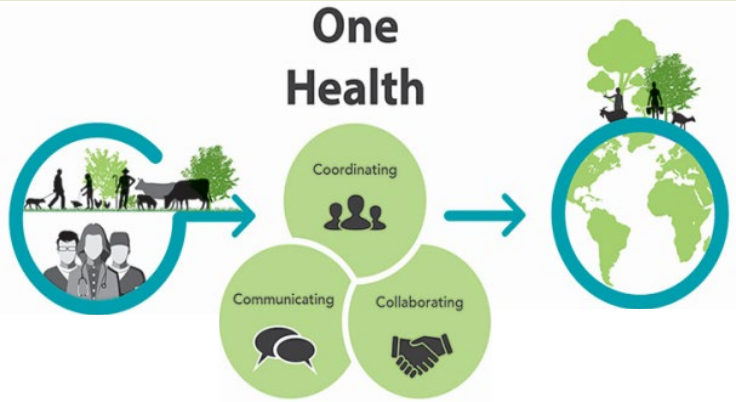


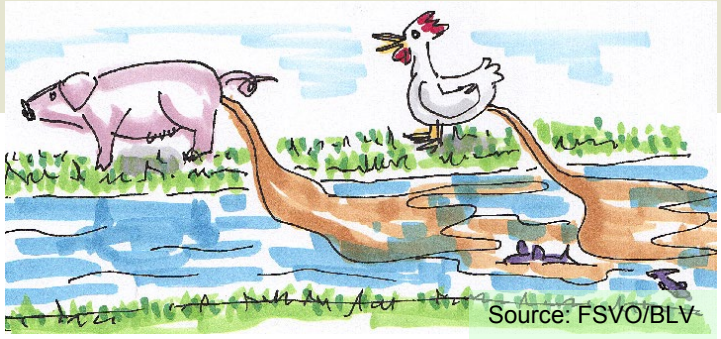
**Control measures and interventions at large are well established**

- Improve “Farm-to-Fork” upstream at production level is a ‘political’ agenda
- Improving consumer behaviour: Population *vs.* individual risk reduction?
- Accuracy of data – limits are known

**Open agenda**

- Better understand patient pyramid and behavioural economics
- Support in outbreak investigations
- Antimicrobial resistance/AMR along the entire “Farm-to-Fork” continuum




**Developed world**

- Sporadic
- Low prevalence in asymptomatic
- Seasonal
- Poultry (pigs)
- Poultry, dairy, food, common source
- In young and old age

**Open agenda**

- Better understand patient pyramid and behavioural economics
- Antimicrobial resistance/AMR along the entire “Farm-to-Fork” continuum
- Support in outbreak investigations

**Developing world**

- Endemic
- Common in asymptomatic
- Low/not seasonal / endemic
- Multiple risk factors (ubiquitous agent!)
- Mostly in infants, children
- Limited diagnostic methods
- Use of antibiotics in chicken farming

➔ Options for control limited

**Open agenda**

- Explanatory model for diseases!
- Diagnostics: Recurrent infection & child development
- AMR in relation to BoD & socio-ecology

**Problem in “the North” very different from problem in “the South”**

# Thank you


Typhus in Zermatt, 1963