Journal of Consumer Protection and Food Safety (2026) 21:149–159
https://doi.org/10.1007/s00003-026-01605-8

Journal of Consumer Protection and Food Safety
Journal für Verbraucherschutz und Lebensmittelsicherheit

RESEARCH ARTICLE

Occurrence of *Listeria monocytogenes* in the Swiss food supply (2015–2024)

Giulia Savioli[1,2] · Magali Chollet[1] · Lena Fritsch[3] · Françoise Fridez[1] · Thomas Lüthi[1]

Received: 15 September 2025 / Revised: 27 January 2026 / Accepted: 12 February 2026 / Published online: 5 March 2026

Abstract
Listeriosis, caused by *Listeria monocytogenes* (*Lm*), is a severe foodborne illness predominantly affecting high-risk groups, and has a high case fatality rate. Switzerland has experienced several outbreaks, but a national overview of implicated foods is lacking. We reviewed foodborne listeriosis in Switzerland, investigating *Lm* presence in food and foods linked to outbreaks. Epidemiological data, data on official sampling, reporting and outbreaks were collected from government agencies and the literature. Between 2015 and 2024, on average 53 listeriosis cases were reported annually (incidence 0.61/100,000), with highest incidences in adults over 65 years old and children under one year old. Official sampling found *Lm* most commonly in meat and meat products (38% of positive samples), ready-to-eat foods (22%) and fish and fish products (7.9%). Among cantons with available data (13 out of 26 cantons), common serogroups and serotypes were serogroup IIa (serotypes 1/2a or 3a; 31%), serotype 1/2a (20%), serogroup IVb (serotypes 4b, 4d, 4e; 19%) and serotype 4b (14%). There were 25 recalls and 36 public warnings due to *Lm*. Eleven listeriosis outbreaks with a confirmed link to food were identified in Switzerland since 1983, with case fatality reaching 29%, involving both ready-to-eat and non-ready-to-eat foods of animal and plant origin. Non-ready-to-eat foods were likely associated with outbreaks through cross contamination. National legislation should be expanded to address cross-contamination risks posed by non-ready-to-eat products. A new genomic national information system is planned, which will enhance outbreak investigation, improving timely prevention and control of listeriosis.

Keywords *Listeria monocytogenes* · Food safety · Foodborne outbreaks · Switzerland

1 Introduction

Listeria monocytogenes (*Lm*) is a pathogenic bacterium causing listeriosis in humans and animals. It is among the most severe foodborne zoonoses in the European Union (EU), with 96.5% hospitalisation and 19.7% fatality rates among cases with available data in 2023 consisting mostly of invasive listeriosis (EFSA et al. 2024). Widespread in soil, water, and animal/human faeces (Vivant et al. 2013; Stea et al. 2015; Koopmans et al. 2022), *Lm* primarily infects humans through contaminated food (EFSA 2025). Livestock (EFSA 2024a) and up to 10% of healthy humans (Hafner et al. 2021) can carry and shed *Lm*, contaminating the environment and food via faeces, especially under poor hygiene conditions (Schoder et al. 2022; EFSA 2024b). Listeriosis occurs in invasive and non-invasive forms. Invasive disease affects high-risk groups (elderly, immunocompromised, pregnant women, newborns) (EFSA 2025), and may lead to meningitis, septicaemia, or pregnancy-related complications such as miscarriage or neonatal infection (WHO 2018; Koopmans et al. 2022). Although rare [≈ 2500 cases/year in the EU (EFSA 2025)], invasive listeriosis is severe (WHO 2018; EFSA 2025). Non-invasive listeriosis typically manifests as a mild febrile gastrointestinal disease or is asymptomatic (EFSA 2025). *Lm* may contaminate food at any stage—farm, harvest, processing, or storage—and tolerates harsh conditions, growing at 4 °C and below (Allerberger 2003; Chaturongakul et al. 2008), at pH levels ranging from 4.6 to 9.5 and surviving salt concentrations up to 20% (Buchanan et al. 1989; Bucur et al. 2018; Osek et al.

✉ Giulia Savioli
giulia.savioli@unibe.ch

[1] Federal Food Safety and Veterinary Office, Bern, Switzerland

[2] Veterinary Public Health Institute, Vetsuisse Faculty, University of Bern, Bern, Switzerland

[3] Agroscope, Bern, Switzerland

2022). It resists cleaning through biofilm formation (Nilsson et al. 2011; Rodríguez-López et al. 2018; Lee et al. 2019; Osek et al. 2022), particularly when sanitising protocols are inadequate or resistance has developed (Méndez Acevedo et al. 2024; Gmeiner et al. 2025). *Lm* can therefore persist in processing environments and food businesses, particularly due to deficiencies in hygienic design (Pasquali et al. 2018).

In the context of official controls, foods may be categorised either according to ingredients (e.g., meat and meat products, dairy, fish and fish products, etc.) or according to type of preparation required before they can be consumed. Ready-to-eat (RTE) foods are ready for immediate consumption without further preparation, cooking or washing. Ready-to-heat foods are intended to be consumed after re-heating by the consumer (typically pre-packaged ready meals).

In Switzerland, monitoring and control of foodstuffs for *Lm* takes place on several levels, as does the corresponding data collection. Food business operators (FBOs), including manufacturers, importers, traders and retailers are responsible for protecting public health, and must ensure safety through compliance with the Swiss Ordinance on Foodstuffs and Consumer Goods (LGV 2016). Control of *Lm* in food is governed by the Federal Department of Home Affairs Ordinance on Hygiene in Food Handling (HyV 2016), which requires FBOs to test and comply with microbiological criteria, especially for *Lm* in RTE foods. The official inspection of food producing businesses and enforcement of legal measures are carried out by the cantonal food safety authorities, under the direction of the cantonal chemists and cantonal veterinarians (the latter for abattoirs). All *Lm* isolates from official food samples and human cases undergo Whole Genome Sequencing (WGS) at the National Reference Centre for Enteropathogenic Bacteria and Listeria (NENT). NENT supports outbreak detection and source tracing, sharing sequence data with the Federal Food Safety and Veterinary Office (FSVO) and Federal Office of Public Health (FOPH). Outbreak investigations are primarily conducted by the authorities of the canton in which the outbreak occurs. When multiple cantons are involved, the FOPH and FSVO, in collaboration with the NENT and the Competence Centre for Epidemiological Outbreak Investigations (KEA), coordinate and lead the investigation. In parallel, Agroscope—the Swiss centre of excellence for agricultural research affiliated with the Federal Office for Agriculture (FOAG)—conducts research and surveillance activities in food microbiology, including laboratory testing for *Lm* in food, particularly dairy products. Due to the complexity of the interpretation of the legal framework, the FSVO has issued guidance to aid implementation (FSVO 2020).

Switzerland has recently seen several serious foodborne listeriosis outbreaks (Nüesch-Inderbinen et al. 2021; Speich et al. 2024; Stephan et al. 2024), but a national overview of outbreak-related foods is lacking. The annual EU One Health Zoonosis Report (EFSA et al. 2024) reports data on the occurrence of *Lm* in foods and listeriosis in humans from EU member states and some non-EU countries including Switzerland. A more detailed, published summary of data from Switzerland is however not available. To address these gaps, we aimed to investigate *Lm* presence in food and food business environments (FBEs) and identify products linked to outbreaks in Switzerland.

2 Material and methods

2.1 Epidemiological data

Human listeriosis case data were acquired from the FOPH, including publicly available lab-confirmed cases in Switzerland (FOPH 2025). Cases from Liechtenstein are also reported in the same dataset. Official FOPH internal data on listeriosis cases further constrain these publicly available data, counting only cases where *Lm* was confirmed from sterile sites in the patients. These internal data were not publicly available for this study, but FOPH confirmed the public figures used here closely reflect internal official counts (personal communication).

2.2 Occurrence of *L. monocytogenes* in foods in Switzerland

Data on routine official inspection and testing of foodstuffs and FBEs for *Lm* were requested from all cantonal food safety offices. We contacted Agroscope, requesting data on systematic controls and individual tests. We accessed internal FSVO sources, including nationally sequenced *Lm* isolates from humans and food, outbreak reports, product recalls and public warnings, and *Lm*-related sampling by border control authorities. We also conducted a literature search to identify publications on foodborne outbreaks of *Lm* in Switzerland through PubMed and Google Scholar using the following search terms: "*Listeria monocytogenes*" AND (food OR "food production" OR "food processing" OR "food manufacturing") AND Switzerland AND (prevalence OR incidence OR "published data" OR contamination OR outbreak). Relevant studies were screened, duplicates removed, and reference lists reviewed for further sources.

3 Results

3.1 Human cases of listeriosis in Switzerland, 2015–2024

From 2015 to 2024, annual human listeriosis cases in Switzerland and Liechtenstein ranged from 33 (2021) to 78 (2022), with a mean of 53 cases/year and an average incidence of 0.61 per 100,000. Incidence was highest in 2022 (0.88) and 2023 (0.82) and lowest in 2021 (0.38) and 2019 (0.42) (Fig. 1). Cases occurred in all cantons except both Appenzells and Uri. Based on standard error estimates, Ticino was the only canton with an incidence significantly higher than the national average (1.44/100,000), with 13 cases in 2016 and a mean of 5.1/year. No sex differences were observed nationally. The incidence was found to be higher in people aged over 65 and under 1 year of age.

3.2 Occurrence in food and food manufacturing businesses

3.2.1 Cantonal authorities data

Lm sampling data were provided by 24 of 26 cantons. Six provided both positive and negative results, others shared only positives. From 2015 to 2024, 627 positive samples were recorded—597 from food, 30 from FBEs. Ticino reported most positives (147), followed by Aargau (117) and Thurgau (82), including both monitoring and outbreak samples. Of 6 cantons with full data, Basel-Country and Thurgau had the highest positive proportions (1.8%) (Table 1). Official sampling during the shelf-life accounted for most positive samples (270, 43%), and outbreak investigations for 23 (3.7%) (Fig. S1 and Table S1, Supplementary Material). Most positive food samples were from meat and meat products (239; 38%), ready-to-eat foods (130; 22%) and fish products (47; 7.9%), and 64 (11%) were not categorised (Fig. 2).

Thirteen out of 26 cantons provided data for 288 samples from 2014 to June 2025 typed either according to serogroup or serotype depending on the canton. Samples were most commonly serogroup IIa (31%), serotype 1/2a (20%), serogroup IVb (19%), and serotype 4b (14%) (Fig. 3).

3.2.2 Agroscope data

From 1983 to 1988, a large listeriosis outbreak in western Switzerland linked to Vacherin Mont d'Or cheese caused 122 cases and 33 deaths (Bille 1989; Büla et al. 1995; Berger et al. 2019). In response, the Swiss Dairy Research Institute (now Agroscope) established a *Listeria* detection lab, creating the *Listeria* Monitoring Programme (LMP) to regularly test cheese dairies and warehouses. Today, the LMP complements but does not replace official controls for *Listeria* by cantonal food safety authorities. Between 2017 and 2023, Agroscope tested 700 to 1,700 cheese and cheese production environment samples annually for *Lm;* proportions of positive samples were always below 0.5% (Table 2). Since 2021, other *Listeria* species are also monitored to gauge process hygiene, their presence indicating potential *Lm* contamination. In 2016, Agroscope led a prevalence study of *Lm* in different Swiss raw milk cheeses (n = 1695). *Lm* was found in one semi-hard cheese type (1/201 samples, 0.5%), while all other cheese types tested were negative (Imhof 2016, unpublished).

Between 2017–2019, an Agroscope study analysed 805 raw meat products (raw sausages, n = 467 and raw cured meat, n = 338) across Switzerland for pathogens. *Lm* was detected in 2.5% of samples and other *Listeria* spp. in 1%. Large enterprises had a threefold higher *Lm* prevalence (Agroscope 2022).

3.2.3 WGS samples

In Switzerland, all *Lm* isolates from official food samples and human cases undergo WGS at the NENT, which supports outbreak detection and source tracing, sharing sequence data with FSVO and FOPH. Isolates of the same core genome Multilocus Sequence Typing (cgMLST) cluster are named and reviewed by FSVO, FOPH, and cantonal authorities. FOPH and FSVO decide whether clusters require further investigation, supported by the KEA, which conducts patient interviews.

The WGS programme began in 2017 but FSVO-recording only became systematic in 2024. Between 2017 and 10 July 2025, 269 food and 150 human isolates were recorded from 17 cantons (Fig. 4). Initially, food type was recorded only when clusters were detected, resulting in 65 samples with unknown sources. Since 2024, food types have been recorded consistently for all samples. Most recorded samples were from meat products (119), with samples increasing from 2022 to 2025 (in 2025, 94 samples by July 10th) (Fig. S2, Supplementary Material). In total, 44 food-related clusters were identified—14 linking human and food isolates, 29 food-only (Table S2 and Table S3, Supplementary Material). Sequence types were not recorded for 95 isolates (45 human, 50 food).

3.2.4 Recalls and public warnings

Companies must withdraw and recall food found or suspected to be unsafe and inform cantonal food safety authorities. For serious risks, FSVO issues public warnings in coordination with cantonal authorities. Between 2015 and

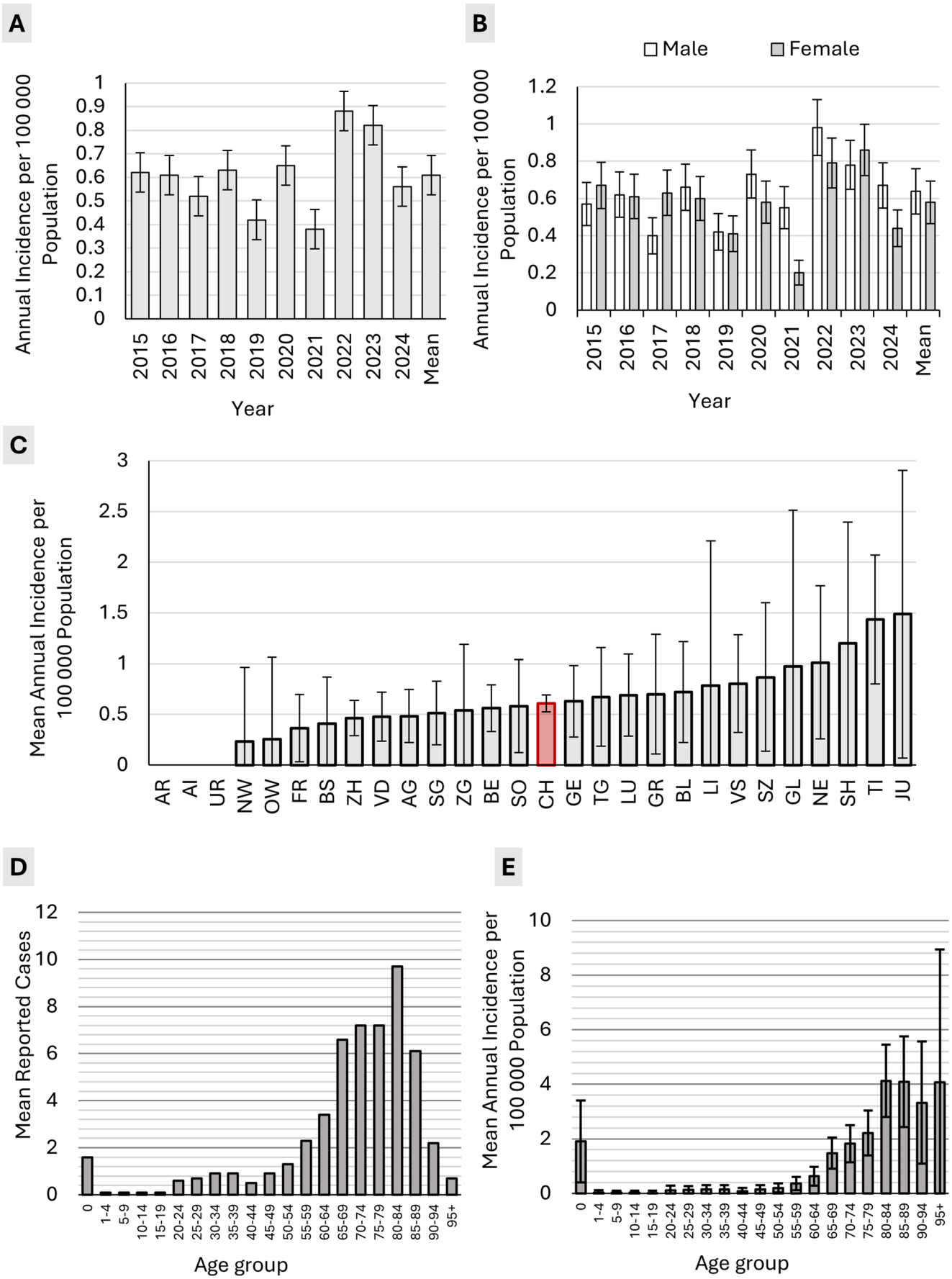
A
Annual Incidence per 100 000 Population
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Mean
Year
B
Male
Female
Annual Incidence per 100 000 Population
1.2
1
0.8
0.6
0.4
0.2
0
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Mean
Year
C
Mean Annual Incidence per 100 000 Population
3
2.5
2
1.5
1
0.5
0
AR
AI
UR
NW
OW
FR
BS
ZH
VD
AG
SG
ZG
BE
SO
CH
GE
TG
LU
GR
BL
LI
VS
SZ
GL
NE
SH
TI
JU
D
Mean Reported Cases
12
10
8
6
4
2
0
0
1-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90-94
95+
Age group
E
Mean Annual Incidence per 100 000 Population
10
8
6
4
2
0
0
1-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90-94
95+
Age group

Fig. 1 Annual incidence of human listeriosis per 100,000 population in Switzerland and Liechtenstein, from 2015 to 2024 (**A**), also according to sex (**B**). Mean annual incidence of human listeriosis per 100,000 population in Switzerland and Liechtenstein (LI) from 2015 to 2024, according to canton (**C**) and age (**E**). Mean annual reported cases of human listeriosis in Switzerland and Liechtenstein, from 2015 to 2024, per age group (**D**). Error bars represent the standard error on incidence. Official abbreviations for cantons are used; CH represents the national average for Switzerland and Liechtenstein. Data: FOPH (2025). For cantonal abbreviations, see: https://www.bfs.admin.ch/bfs/en/home/basics/symbols-abbreviations.html. Accessed 10 February 2026

2024, there were 25 recalls and 36 public warnings due to *Lm*. Most involved cheese (10 recalls, 12 warnings), followed by ready meals/snacks and fish (Fig. 5, Table S4 and Table S5, Supplementary Material). Ready meals are prepackaged foods intended to be consumed with minimal or no preparation by the consumer.

3.2.5 Border control

Routine border controls for *Lm* in imported foods are not conducted; testing is performed on a case-by-case basis according to risk assessments. In 2023, a random check of smoked salmon at airports found all 4 samples compliant. In 2024, 31 French raw-milk cheese samples were tested for *Lm* and other pathogens. None were positive for *Lm* (2 showed *E. coli* and/or *Staphylococcus)*.

3.2.6 Outbreaks of foodborne listeriosis

Human *Lm* infection is notifiable in Switzerland; since 2016, this includes clinical reports by physicians. Foodborne outbreaks, defined as≥2 linked cases or an unusual increase in incidence, must legally also be reported (VMüK 2015; LMVV 2020).

Since 1983, 11 listeriosis outbreaks linked to a confirmed contaminated food source have been reported in FSVO records or literature (Table 3). In 2017, the WGS programme was launched through which all *Lm* isolates have been sequenced, enhancing outbreak investigations. Since 2019, FSVO has promoted outbreak reporting and provided tools (website, guide, manuals) to support cantonal investigations. These developments have led to more reported outbreaks, including smaller ones without a confirmed source which were previously not reported.

Since 2022, an ongoing outbreak linked to baker's yeast has caused 39 confirmed cases as of January 2025 (6 in 2022, 24 in 2023, 8 in 2024, 1 in 2025) and 8 deaths, across 14 cantons (Stephan et al. 2024, FSVO internal reporting).

4 Discussion

The incidence of listeriosis in Switzerland between 2015 and 2024 (mean 0.61 per 100,000; range 0.38–0.88) resembled other European countries (0.43–0.62 between 2015 and 2022) (EFSA et al. 2024). Highest incidences occurred in people over 65 years old and in infants under 1 year old, mirroring European trends (EFSA et al. 2024).

Official sampling found meat and meat products were the most common *Lm*-positive category (38%), followed by RTE foods (22%) and fish (7.9%), mostly from shelf-life sampling. FSVO sequenced isolates records showed similar trends. In comparison, in Europe, European Food Safety Authority (EFSA) data on official sampling at distribution showed highest occurrences of *Lm* in bovine meat products, hard cheeses (raw or low heat-treated milk) and fish and fishery products in 2023 (EFSA et al. 2024). Higher detection in these foods may reflect more frequent testing, rather than true risk (sampling bias). Positive proportions by food category could clarify this, but complete data (including negatives) were unavailable here.

Lm prevalence was low in cheeses (<0.5%), likely due to strong hygiene, Hazard Analysis and Critical Control Points (HACCP), and quality standards, reinforced after the 1980s Vacherin Mont d'Or outbreak. However, cheese-linked outbreaks continued to occur (2005, 2018–2020, 2022), involving both Swiss and imported cheeses. Most recalls and warnings involved cheese, followed by RTE meals/snacks—again, possibly due to sampling bias. Given these past outbreaks, continued control of cheese is essential. The rise in recalls and warnings over the years may reflect improved outbreak investigation and reporting, with the advent of WGS and intensified FSVO efforts recently.

One study found a 2.5% *Lm* prevalence in raw meat products, including RTE, with larger enterprises showing higher occurrence (Agroscope 2022). This should be considered in future risk-based controls, with measures targeting large-scale production. EFSA (2019–2023) reports highest *Lm* positive proportions in fermented meat sausages (4.97%) despite fewer samples compared to other categories and 0.68% positivity for other RTE meat products (EFSA 2025). Positive proportions should also be evaluated in Switzerland, to guide monitoring and policy.

Despite regulatory progress, 10 further outbreaks have occurred in Switzerland since the major 1983–1988 event. Several outbreaks were nationally or internationally relevant and long-lasting, with clusters persisting over years. Outbreak lethality rates, up to 29%, often exceeded EU average (9–20% from 2019 to 2023) (EFSA et al. 2024). With higher risk in people over 65 and an ageing Swiss population (FSO 2025), larger outbreaks may become more common. Most outbreaks involved cheeses (n=4); others involved meat

Table 1 Total number of official samples, total positive samples and percentage of positive samples for *Lm* in food and food business environments for 6 cantons in Switzerland with available data. Data are for 2015 to 2024, except for Basel-Country (from 2021 to 2024) and Thurgau (2015 to January 2025)

Canton	Total samples, *n*	Positive samples *n* (%)
Aargau	21,132	117 (0.6)
Basel-Country	496	9 (1.8)
Bern	7250	9 (0.1)
Jura	363	3 (0.8)
Thurgau	4586	82 (1.8)
Vaud	4928	17 (0.3)
Total	38,755	237 (0.6)

(2), fish (2), salad (2), and baker's yeast/various foods (1). Outbreaks were linked to foods of both animal and plant origin, both RTE and non-RTE. Imported foods were also concerned, and enhanced border testing and collaboration with exporting countries are needed to prevent this. Persistent contamination of food production environments remains a concern, as seen in the 2016 and 2018–2020 outbreaks. Due to the pathogen's resilience, proper monitoring of FBEs, equipment, and machinery is essential.

The most recent outbreak, ongoing since 2022, is linked to baker's yeast, a non-RTE food. The outbreak strain (ST 3141 cgMLST CT 18049) was isolated from various foods, not only yeast, suggesting cross-contamination. Non-RTE foods can thus pose serious risks, as also seen in a 2015–2018 EU outbreak linked to blanched frozen vegetables (BIOHAZ et al. 2020). *Lm* was commonly found in meat and meat products during official sampling in Switzerland, many of these products non-RTE, potentially posing a risk of cross-contamination. Legal limits for *Lm* in non-RTE products, as well as requirements for FBE sampling are lacking, and a revised legal approach is needed to address these gaps. Food businesses must focus on good hygiene practices. EFSA recommends consumer education, standardised labelling, public awareness, and additional WGS of *Lm* in food environments (BIOHAZ et al. 2020)—measures that Switzerland should adopt.

Most outbreaks involved serotypes 1/2a and 4b, which were also the most common in official sampling. One outbreak linked to serotype 1/2b, which was rare in official sampling, was tied to imported foods. Previous studies have found serotypes 1/2a, 1/2b, 1/2c, and 4b to be overrepresented in food and clinical isolates (Ward et al. 2008; Orsi et al. 2021). This suggests official Swiss sampling effectively detects serotypes that are likely to cause outbreaks.

Data heterogeneity and quality limit both this study and *Lm* monitoring in Switzerland. While recalls and warnings are well documented, official sampling data lack a centralised national reporting system. Cantonal data vary, and food category classifications are only partially harmonised, complicating data analysis. A unified national reporting system is needed to better link human cases with official sampling and enterprise self-monitoring data.

Listeriosis outbreak investigation is challenging due to the pathogen's ubiquity, small outbreak sizes, and cases mainly in high-risk groups. Low case numbers, a long incubation period and high morbidity cause recall bias, complicating source identification. Transparent data sharing

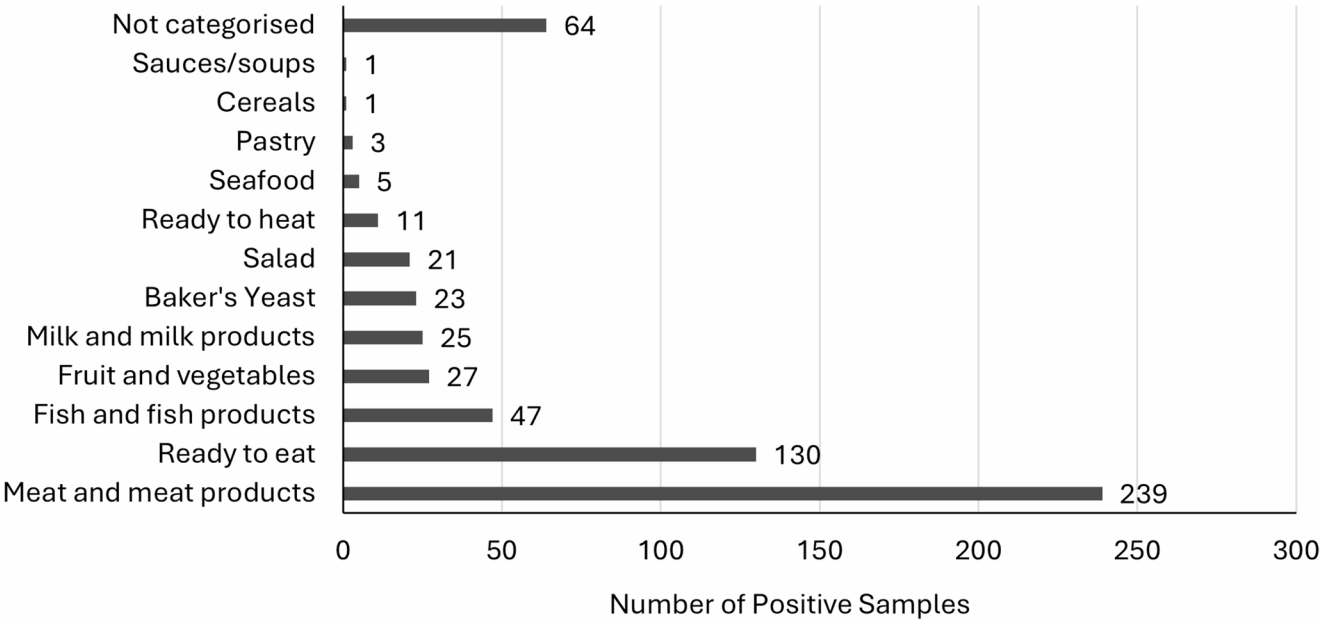

Fig. 2 Number of positive *Lm* samples per food category, from 2015 to 2024, except for the following cantons: for Aargau data were only available from 2016, for Basel-Country from 2021; for Lucerne and Thurgau data from 2015 to January 2025 are shown. Data were not available for cantons Neuchâtel and Valais.

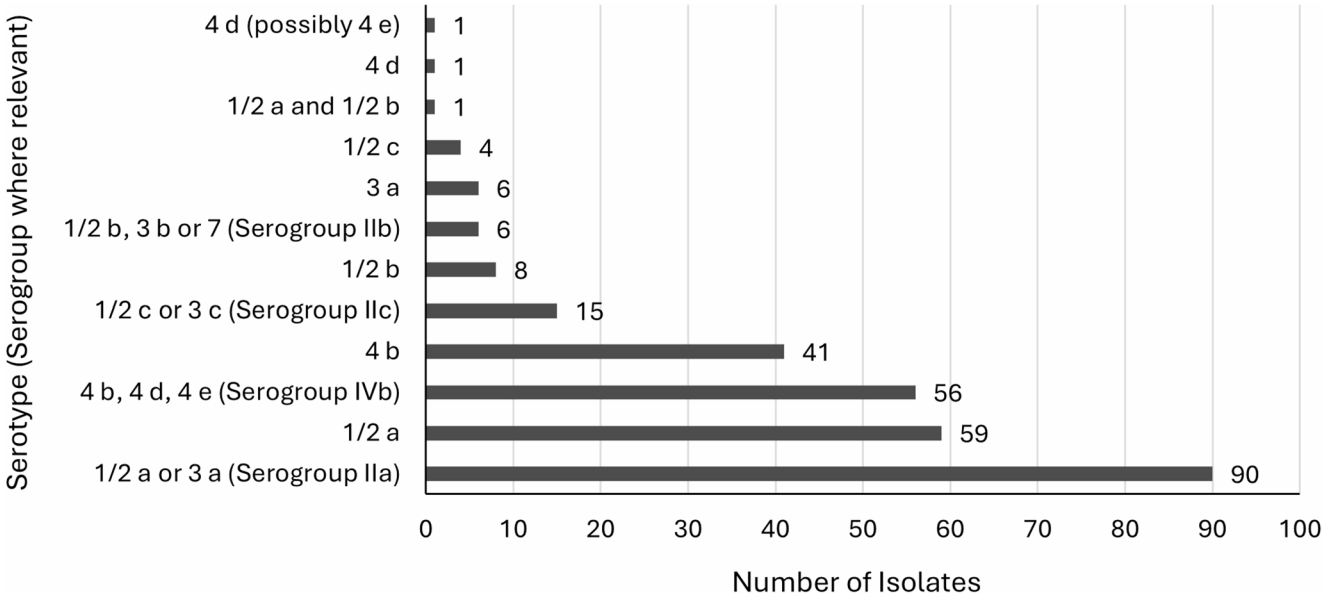

Fig. 3 Number of serotyped isolates collected by 13 cantonal food safety authorities (Aargau, Basel-Country, Graubünden, Glarus, Lucerne, Solothurn, Thurgau, Uri, Schwyz, Obwalden, Nidwalden, Zug, Zurich), according to serotype, between 2015 and July 2025. Serotype information was taken as reported by cantonal laboratories. In some cases, multiple serotypes were listed for the same food sample (e.g., "1/2 a and 1/2 b) likely reflecting isolation of more than one strain from the same food sample. Furthermore, some laboratories undertook serotyping, whilst others only undertook serogrouping, leading to the different classifications displayed here. Laboratory methods used were not reported by the laboratories. Samples may stem from the same food business, during outbreak investigation, therefore double counting of serotypes is possible

Table 2 Results of the LMP testing programme for cheeses in Switzerland, from 2017 to 2023. *Lm* = *Listeria monocytogenes*

Year	Total samples (n)	Positive to *Lm*		Positive to *Listeria spp.*		Cheese type positive for *Lm**
		Samples (n)	% Positive	Samples (n)	% Positive	
2017	1433	1	0.07	–	–	A
2018	1342	2	0.15	–	–	A, B
2019	1072	0	0.00	–	–	–
2020	710	3	0.42	–	–	C
2021	1705	2	0.12	82	4.8	C
2022	1128	4	0.35	25	2.2	C
2023	1165	3	0.26	21	1.8	C

*Cheese types from which positive *L. monocytogenes* samples were taken – A: hard cheeses made from cows' milk – raw or low heat-treated milk, B: soft and semi-soft cheeses made from cows' milk – raw or low heat-treated milk, C: cheeses made from unspecified milk or other animal milk

across government agencies in a One Health context is essential. Currently, FOPH's aggregated listeriosis data are not directly accessible to FSVO or other agencies without further administrative steps due to data protection. A comprehensive, secure data-sharing platform would enable faster outbreak investigations by linking human, food, feed, and veterinary samples, establishing sources and transmission routes. Serological, genetic, and increasingly genomic sequencing support these investigations, with genomic sequencing now being standard worldwide. In 2025, the EU adopted Regulation (EU) 2025/179, mandating WGS on 5 key pathogens, including *Lm*, during outbreaks, with data reported to EFSA (European Commission 2025). Switzerland plans a national genomic analysis system under the revised Federal Act on Controlling Communicable Human Diseases (Epidemics Act 2012). This will allow standardised genome comparisons of isolates from humans, food, animals, and the environment, enabling integrated One Health outbreak investigations, improved cross-agency data sharing, and timely public health responses.

5 Conclusions

Listeriosis outbreaks in Switzerland were often associated with high lethality and national or international impact, and they may persist long-term. Multiple foods were implicated, and persistent FBE contamination is a concern. A uniform,

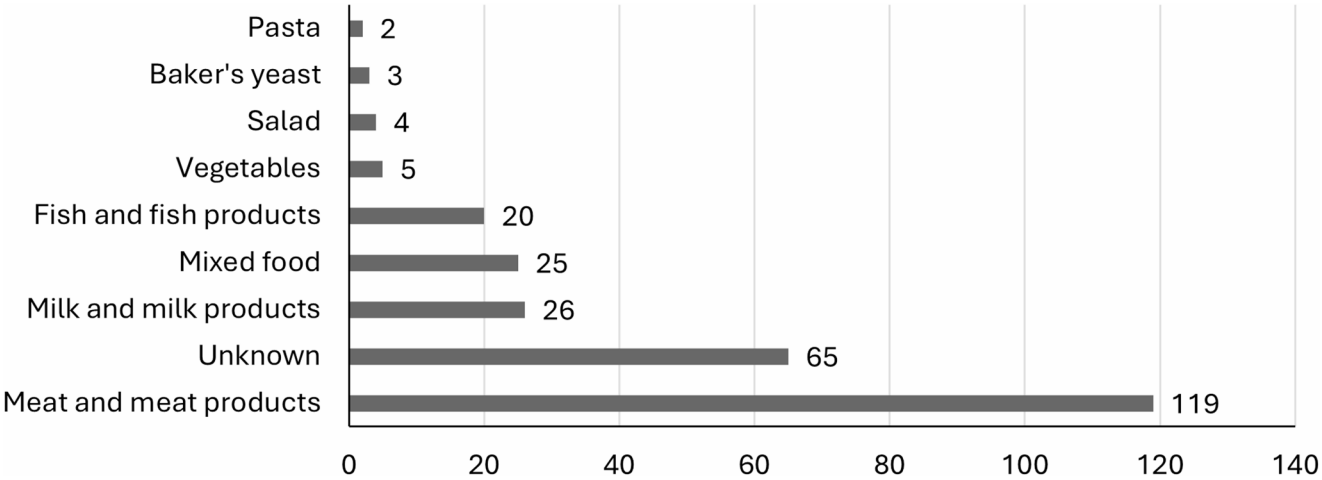

Fig. 4 Sequenced *Lm* isolates from food recorded by FSVO from 2017 to the 10th of July 2025 per food category. For genomic clusters, see Table S2 and Table S3 (Supplementary Material)

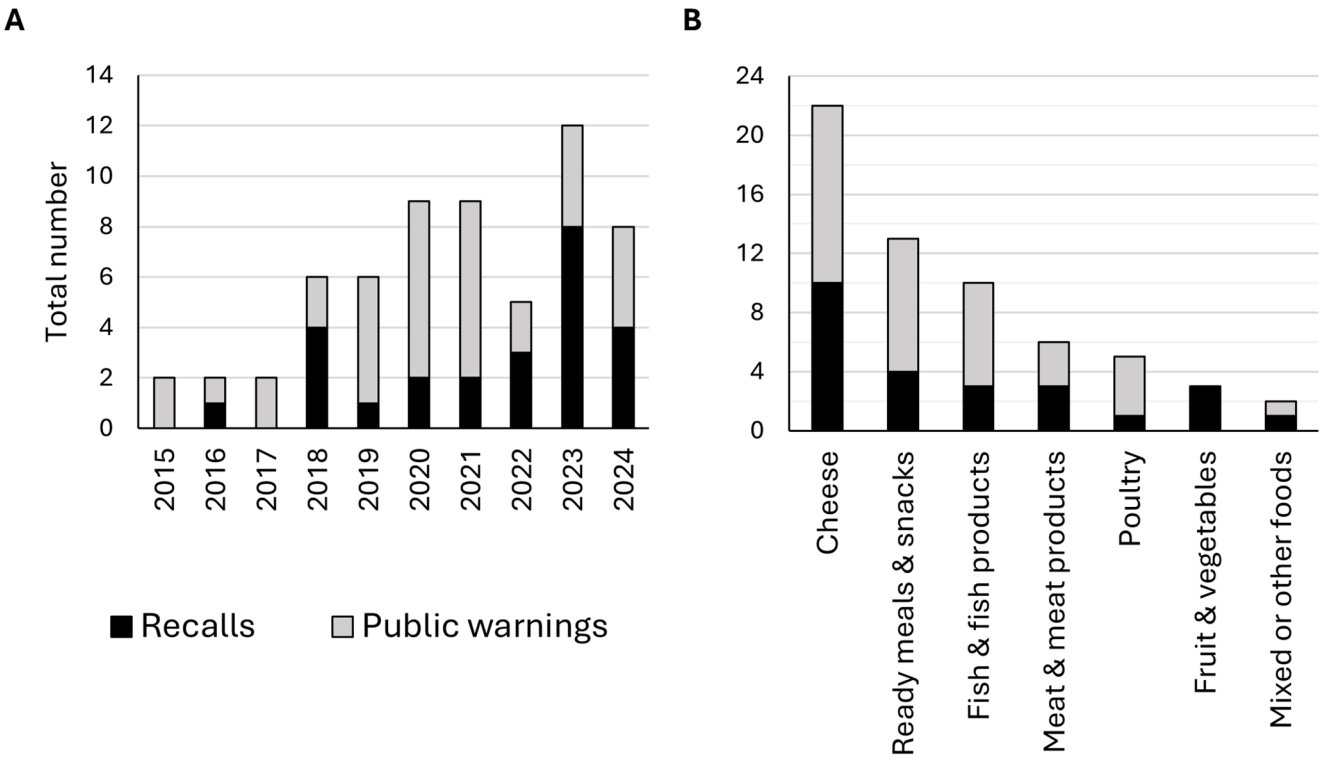

Fig. 5 Total number of recalls and public warnings due to *Lm* in Switzerland, from 2015 to 2024, per year (A) and according to food product category (B). Source: FSVO internal reporting

systematic monitoring program and clear public communication are needed to bolster prevention. Cross-contamination from non-RTE foods is a risk and national laws and practices should be expanded to address this. A transparent, harmonised data management platform is needed, and the planned new national genomic analysis system will fill this gap, allowing timely inter-agency sharing and enhancing outbreak investigation and control.

Table 3 Foodborne listeriosis outbreaks reported in Switzerland, as of 31 January 2025. Extent of the outbreak (number of cantons or national/international extent) is indicated where known

Year	Food product	Confirmed cases (number of cantons)	Pregnancy-associated cases	Fatalities	Case fatality rate	Food group	Strength of evidence†	Serotype	Sequence type (MLST)	Source
1983–1987	Vacherin Mont-d'Or cheese	122	65	33	27%	Cheese	Strong	4b	Not reported	Bille (1989), Büla et al. (1995), Weinmaier et al. (2013)
2005	Tomme cheese	12	2	3	25%	Cheese	Strong	1/2a	Not reported	Bille et al. (2006), Tasara et al. (2016)
2011	Imported cooked ham	6	Not reported	0	0	Meat product	Strong	1/2a	Not reported	Hächler et al. (2013), Tasara et al. (2016)
2013–2014	Pre-cut ready-to-eat green salads	32	1	0	0	Salad	Strong	4b	4	Tasara et al. (2015), Stephan et al. (2015), Kiefer et al. (2016)
2016	Meat pie filling (contaminated mincing machine)	5	0	0	0	Meat product/ food business	Strong	4b	6	Althaus et al. (2017), FSVO internal reporting
2017	Salad	2	Not reported	Not reported	Not reported	Salad	N/A	Not reported	Not reported	FSVO internal reporting
2018–2020	Cheeses (contaminated cheese dairy)	34 (nationwide)	1	10	29%	Cheese/ food business	Strong	4b	6	Nüesch-Inderbinen et al. (2021), FSVO internal reporting
2020–2021	Smoked rainbow trout processed in Denmark	55* (international)	2	3	5%	Smoked fish	Strong	Serogroup IIa	394	Halbedel et al. (2023)
2022	Smoked trout	20 (6 cantons)	Not reported	1	5%	Smoked fish	Strong	4b	388	Speich et al. (2024), FSVO internal reporting
2022	Imported cheese from Italy	6 (1 canton)	0	0	0	Cheese	Weak	4b and 1/2b	Not reported	Bongiovanni et al. (2023)
2022–2025	Baker's yeast	39 (14 cantons)	Not reported	8	21%	Yeast/ cross-contamination of other foods	Strong	1/2a	3141	Stephan et al. (2024), FSVO internal reporting

MLST, multilocus sequence typing

†Refers to EFSA definitions of strong and weak evidence in relation to identification of the source of a foodborne disease outbreak

*Only 1 out of 55 confirmed cases in the rainbow trout-associated outbreak of 2020–2021 occurred in Switzerland

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00003-026-01605-8.

Acknowledgements Many thanks to the Swiss cantonal food safety authorities for sharing their data and their kind collaboration, to Michelle Raess of FOPH, Jörg Hummerjohann of Agroscope, and our FSVO colleagues of the Food and Nutrition Division for their support.

Author contribution GS, TL and FF conceived and designed this study. GS conducted data analysis and drafted the manuscript. All authors contributed to data collection and interpretation and reviewed, revised and approved the final manuscript.

Funding No specific funding was received for this publication.

Data availability All publicly available data are referenced. Internal government agency data are not publicly available.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical approval No ethical approval was required for this work. All analyses were conducted on publicly available data, or anonymised aggregated data.

References

Agroscope (2022) Abschlussbericht Arbeitsprogramm Agroscope 2018–2021

Allerberger F (2003) *Listeria*: growth, phenotypic differentiation and molecular microbiology. FEMS Immunol Med Microbiol 35:183–189. https://doi.org/10.1016/S0928-8244(02)00447-9

Althaus D, Jermini M, Giannini P et al (2017) Local outbreak of *Listeria monocytogenes* serotype 4b sequence type 6 due to contaminated meat pâté. Foodborne Pathog Dis 14:219–222. https://doi.org/10.1089/fpd.2016.2232

Berger T, Fritsch L, Imhof R et al (2019) Experiences from Listeria consulting—summary of the colloquium of 29 August 2019

Bille J (1989) Anatomy of a foodborne listeriosis outbreak. Foodborne listeriosis, proceedings of a symposium on September 7, 1988 in Wiesbaden, FRG. Behr's Verlag, Hamburg and Technomic Publishing Company, Lancaster, pp 39–46

Bille J, Blanc DS, Schmid H et al (2006) Outbreak of human listeriosis associated with tomme cheese in northwest Switzerland, 2005. Euro Surveill 11:91–93

BIOHAZ, EFSA Panel on Biological Hazards et al (2020) The public health risk posed by *Listeria monocytogenes* in frozen fruit and vegetables including herbs, blanched during processing. EFSA J 18:e06092. https://doi.org/10.2903/j.efsa.2020.6092

Bongiovanni M, Barda B, Lucchini GM et al (2023) Invasive listeriosis in southern Switzerland: a local problem that is actually global. Clin Infect Dis 77:161–162. https://doi.org/10.1093/cid/ciad193

Buchanan RL, Stahl HG, Whiting RC (1989) Effects and interactions of temperature, pH, atmosphere, sodium chloride, and sodium nitrite on the growth of *Listeria monocytogenes*. J Food Prot 52:844–851. https://doi.org/10.4315/0362-028X-52.12.844

Bucur FI, Grigore-Gurgu L, Crauwels P et al (2018) Resistance of *Listeria monocytogenes* to stress conditions encountered in food and food processing environments. Front Microbiol 9:2700. https://doi.org/10.3389/fmicb.2018.02700

Büla CJ, Bille J, Glauser MP (1995) An epidemic of food-borne listeriosis in western Switzerland: description of 57 cases involving adults. Clin Infect Dis 20:66–72. https://doi.org/10.1093/clinids/20.1.66

Chaturongakul S, Raengpradub S, Wiedmann M, Boor KJ (2008) Modulation of stress and virulence in *Listeria monocytogenes*. Trends Microbiol 16:388–396. https://doi.org/10.1016/j.tim.2008.05.006

Epidemics Act (2012) SR 818.101 - Federal Act of 28 September 2012 on Controlling Communicable Human Diseases (Epidemics Act, EpidA). https://www.fedlex.admin.ch/eli/cc/2015/297/en

EFSA, European Food Safety Authority (2024a) Listeria | EFSA. https://www.efsa.europa.eu/en/topics/topic/listeria. Accessed 17 Jan 2025

EFSA, European Food Safety Authority (2024b) *Listeria monocytogenes* story map. In: ArcGIS StoryMaps. https://storymaps.arcgis.com/stories/629e6627e6c64111bfd5b9257473c74a. Accessed 8 July 2025

EFSA, European Food Safety Authority (2025) Listeria dashboard | EFSA. https://www.efsa.europa.eu/en/microstrategy/listeria-dashboard. Accessed 13 Jan 2025

EFSA, European Food Safety Authority, ECDC, European Centre for Disease Prevention and Control (2024) The European Union One Health 2023 Zoonoses report. EFSA J 22:e9106. https://doi.org/10.2903/j.efsa.2024.9106

European Commission (2025) Whole genome sequencing within the frame of foodborne outbreak investigations (implementation of Regulation (EU) 2025/179): Frequently asked questions. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwibjdHUifmRAxVF9gIHHfR4Ai8QFnoECBkQAQ&url=https%3A%2F%2Ffood.ec.europa.eu%2Fdocument%2Fdownload%2Fbb6b197a-cce2-4ebf-aca2-ebb6696c803f_en&usg=AOvVaw3pHmIBtOV9CJ0rMgJpUCYx&opi=89978449

FOPH, Federal Office for Public Health (2025) Zahlen zu Infektionskrankheiten. https://www.bag.admin.ch/de/zahlen-zu-infektionskrankheiten. Accessed 6 Aug 2025

FSO, Federal Statistical Office (2025) Ageing in Switzerland. https://www.bfs.admin.ch/content/bfs/en/home/statistics/cross-sectional-topics/ageing-switzerland.html. Accessed 6 Aug 2025

FSVO, Federal Food Safety and Veterinary Office (2020) Informationsschreiben 2020/7: Umgang mit dem Lebensmittelsicherheitskriterium für «*Listeria monocytogenes*» in genussfertigen Lebensmitteln

Gmeiner A, Ivanova M, Njage PMK et al (2025) Quantitative prediction of disinfectant tolerance in *Listeria monocytogenes* using whole genome sequencing and machine learning. Sci Rep 15:10382. https://doi.org/10.1038/s41598-025-94321-6

Hächler H, Marti G, Giannini P et al (2013) Outbreak of listerosis due to imported cooked ham, Switzerland 2011. Euro Surveill 18:20469

Hafner L, Pichon M, Burucoa C et al (2021) *Listeria monocytogenes* faecal carriage is common and depends on the gut microbiota. Nat Commun 12:6826. https://doi.org/10.1038/s41467-021-27069-y

Halbedel S, Sperle I, Lachmann R et al (2023) Large multicountry outbreak of invasive listeriosis by a *Listeria monocytogenes* ST394 clone linked to smoked rainbow trout, 2020 to 2021. Microbiol Spectr 11:e0352022. https://doi.org/10.1128/spectrum.03520-22

HyV (2016) SR 817.024.1 - Verordnung des EDI vom 16. Dezember 2016 über die Hygiene beim Umgang mit Lebensmitteln (Hygieneverordnung EDI, HyV) | Fedlex. https://www.fedlex.admin.ch/eli/cc/2017/183/de. Accessed 6 Aug 2025

Kiefer S, Kling K, Stephan R et al (2016) How can patients and their physicians contribute to an outbreak investigation? Experiences from a nationwide listeriosis outbreak in Switzerland. Swiss Med Wkly 146:w14366. https://doi.org/10.4414/smw.2016.14366

Koopmans MM, Brouwer MC, Vázquez-Boland JA, van de Beek D (2022) Human listeriosis. Clin Microbiol Rev 36:e00060-19. https://doi.org/10.1128/cmr.00060-19

Lee B-H, Cole S, Badel-Berchoux S et al (2019) Biofilm formation of *Listeria monocytogenes* strains under food processing environments and pan-genome-wide association study. Front Microbiol 10:2698. https://doi.org/10.3389/fmicb.2019.02698

LGV (2016) SR 817.02 - Lebensmittel- und Gebrauchsgegenständeverordnung vom 16. Dezember 2016 (LGV) | Fedlex. https://www.fedlex.admin.ch/eli/cc/2017/63/de. Accessed 6 Aug 2025

LMVV (2020) SR 817.042 - Verordnung über den Vollzug der Lebensmittelgesetzgebung (LMVV). https://www.fedlex.admin.ch/eli/cc/2020/460/de?version=20241231&print=true

Méndez Acevedo M, Rolon ML, Johnson BB et al (2024) Sanitizer resistance and persistence of *Listeria monocytogenes* isolates in tree fruit packing facilities. J Food Prot 87:100354. https://doi.org/10.1016/j.jfp.2024.100354

Nilsson RE, Ross T, Bowman JP (2011) Variability in biofilm production by *Listeria monocytogenes* correlated to strain origin and growth conditions. Int J Food Microbiol 150:14–24. https://doi.org/10.1016/j.ijfoodmicro.2011.07.012

Nüesch-Inderbinen M, Bloemberg GV, Müller A et al (2021) Listeriosis caused by persistence of *Listeria monocytogenes* serotype 4b sequence type 6 in cheese production environment. Emerg Infect Dis 27:284–288. https://doi.org/10.3201/eid2701.203266

Orsi RH, Jagadeesan B, Baert L, Wiedmann M (2021) Identification of closely related *Listeria monocytogenes* isolates with no apparent evidence for a common source or location: a retrospective whole genome sequencing analysis. J Food Prot 84:1104–1113. https://doi.org/10.4315/JFP-20-417

Osek J, Lachtara B, Wieczorek K (2022) *Listeria monocytogenes* - how this pathogen survives in food-production environments? Front Microbiol 13:866462. https://doi.org/10.3389/fmicb.2022.866462

Pasquali F, Palma F, Guillier L et al (2018) *Listeria monocytogenes* sequence types 121 and 14 repeatedly isolated within one year of sampling in a rabbit meat processing plant: persistence and ecophysiology. Front Microbiol 9:596. https://doi.org/10.3389/fmicb.2018.00596

Rodríguez-López P, Rodríguez-Herrera JJ, Vázquez-Sánchez D, López Cabo M (2018) Current knowledge on *Listeria monocytogenes* biofilms in food-related environments: incidence, resistance to biocides, ecology and biocontrol. Foods 7:85. https://doi.org/10.3390/foods7060085

Schoder D, Guldimann C, Märtlbauer E (2022) Asymptomatic carriage of *Listeria monocytogenes* by animals and humans and its impact on the food chain. Foods 11:3472. https://doi.org/10.3390/foods11213472

Speich C, Stephan R, Dhima N et al (2024) Rapid detection of the source of a *Listeria monocytogenes* outbreak in Switzerland through routine interviewing of patients and whole-genome sequencing. Swiss Med Wkly 154:3745. https://doi.org/10.57187/s.3745

Stea EC, Purdue LM, Jamieson RC et al (2015) Comparison of the prevalences and diversities of *Listeria* species and *Listeria monocytogenes* in an urban and a rural agricultural watershed. Appl Environ Microbiol 81:3812–3822. https://doi.org/10.1128/AEM.00416-15

Stephan R, Althaus D, Kiefer S et al (2015) Foodborne transmission of *Listeria monocytogenes* via ready-to-eat salad: a nationwide outbreak in Switzerland, 2013–2014. Food Control 57:14–17. https://doi.org/10.1016/j.foodcont.2015.03.034

Stephan R, Horlbog JA, Nüesch-Inderbinen M, Dhima N (2024) Outbreak of listeriosis likely associated with Baker's yeast products, Switzerland, 2022–2024. Emerg Infect Dis 30:2424–2426. https://doi.org/10.3201/eid3011.240764

Tasara T, Ebner R, Klumpp J, Stephan R (2015) Complete genome sequence of *Listeria monocytogenes* N2306, a strain associated with the 2013–2014 listeriosis outbreak in Switzerland. Genome Announc 3(3):e00553-15. https://doi.org/10.1128/genomeA.00553-15

Tasara T, Klumpp J, Bille J, Stephan R (2016) Genome sequences of *Listeria monocytogenes* strains responsible for cheese- and cooked ham product-associated Swiss listeriosis outbreaks in 2005 and 2011. Genome Announc 4(2):e00106-16. https://doi.org/10.1128/genomeA.00106-16

Vivant A-L, Garmyn D, Piveteau P (2013) *Listeria monocytogenes*, a down-to-earth pathogen. Front Cell Infect Microbiol 3:87. https://doi.org/10.3389/fcimb.2013.00087

VMüK (2015) SR 818.101.126 - Verordnung des EDI über die Meldung von Beobachtungen übertragbarer Krankheiten des Menschen (VMüK). https://www.fedlex.admin.ch/eli/cc/2015/892/de. Accessed 10 Feb 2026

Ward TJ, Ducey TF, Usgaard T et al (2008) Multilocus genotyping assays for single nucleotide polymorphism-based subtyping of *Listeria monocytogenes* isolates. Appl Environ Microbiol 74:7629–7642. https://doi.org/10.1128/AEM.01127-08

Weinmaier T, Riesing M, Rattei T et al (2013) Complete genome sequence of *Listeria monocytogenes* LL195, a serotype 4b strain from the 1983-1987 listeriosis epidemic in Switzerland. Genome Announc 1(1):e00152-12. https://doi.org/10.1128/genomeA.00152-12

WHO, World Health Organisation (2018) Listeriosis. https://www.who.int/news-room/fact-sheets/detail/listeriosis. Accessed 13 Jan 2025