JOINT ECDC/EFSA RAPID RISK ASSESSMENT

Multi-country outbreak of *Salmonella* Stanley infections Update

20 September 2012

Main conclusions and recommendations

- An outbreak of *Salmonella* Stanley infection involving 167 confirmed and 254 probable cases is on-going in several Member States of the European Union (EU). As cases do not have travel history outside the EU within the usual incubation period for salmonellosis, these findings strongly suggest a multi-state outbreak currently taking place in several countries in the EU. The descriptive epidemiology of human cases indicates a transmission originating from a persistent common source or multiple sources in the EU that are contaminated with isolates indistinguishable by *Xba*I-PFGE.
- Food and veterinary investigations conducted in Austria, Belgium, Germany, Czech Republic, Poland and Hungary identified an indistinguishable *Xba*I-PFGE fingerprint and a common resistance to nalidixic acid with concomitant decreased susceptibility to ciprofloxacin, among isolates originating from the turkey production chain (turkeys and turkey meat). Isolates with indistinguishable PFGE patterns were also detected in some cases from broiler flocks (breeding and fattening chicken flocks) and meat from other animal species (broiler meat, beef and pork.)
- The epidemiological and microbiological information gathered through the public health, food and veterinary investigations strongly suggest that the turkey production chain is the source of the outbreak. However, the contribution of other food and animal sources, such as beef, pork and broiler meat to the outbreak cannot be ruled out.
- As control measures have not yet been implemented to remove the source of infection and potential food vehicles from the market, it is likely that additional human cases of *S.* Stanley infections will be reported in EU Member States.
- It is important to highlight that persons working in the food chain at all levels (from production to catering) as well as consumers should be very strict with personal (hand washing) and food hygiene (avoid cross-contamination between ready-to-eat and raw meat) when handling raw turkey meat.
- ECDC, EFSA and the EU *Salmonella* Reference Laboratory are encouraging all Member States to perform PFGE analysis on food, animal and human *S.* Stanley isolates from 2011 and 2012, and to submit their data to ECDC (fwd@ecdc.europa.eu). This will provide information on the diversity of *S.* Stanley in the EU, allowing a more accurate assessment of the situation.
- Further information on the trace-back and trace-forward of foods items in the food chain will be necessary to understand and assess the risk associated with this outbreak. In addition, this information will help in the identification of the primary source of the outbreak strain and to track the spreading along the food chain. This information would in turn help to define the risk management actions to be taken in order to control the contamination with this strain in the animal production and food chain. These targeted measures are expected to help control the outbreak and prevent further human cases.
- As soon as the above information becomes available, ECDC and EFSA recommend that further actions should be taken by risk managers to detect and contain the *S.* Stanley infection in turkey production and the subsequent contamination of turkey meat, and when necessary, in the broiler production chain.

Public health issue

A multi-country outbreak of *Salmonella enterica* serovar Stanley (*Salmonella* Stanley) infection in Austria, Belgium, Czech Republic, Germany, Hungary, Slovak Republic and the United Kingdom.

Source and date of request

On 14 September 2012 the European Commission asked EFSA and ECDC for joint scientific and technical assistance on the possible source of the on-going outbreak of *Salmonella* Stanley infection. This assistance applied particularly to:

- a summary of the descriptive epidemiology of human cases and an assessment of the current trend of incidence
- a collation of information on possible sources of *S.* Stanley in the EU,
- an assessment on the robustness of evidence implicating the possible sources of the on-going outbreak based on epidemiological data and molecular analyses both from the human, food and animal perspective.

At the EU level, ECDC is facilitating a coordinated response to the investigation related to human cases by gathering the available epidemiological and microbiological information, supporting the public health investigations in Member States and liaising with EC, EFSA and competent food safety partners in the EU.

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Disease background information

S. Stanley serovar isolations in humans

Salmonella enterica serovar Stanley (*S.* Stanley) is one of the serovars most frequently associated with human infections in south-east Asia. *S.* Stanley was the second most common serovar in human salmonellosis in Thailand in the years 2002 to 2007, accounting for 11% of all salmonellosis cases there [1]. In the central region of Thailand, *S.* Stanley isolates that were collected between 2001 and 2006 from patients, asymptomatic carriers and non-human sources showed highest rates of antibiotic resistance to sulfamethoxazole (92%), tetracycline (80%), and streptomycin (77%), whereas resistance to nalidixic acid and ciprofloxacin was low, at 5% and 2% respectively [2]. In the period 2001 to 2007, *S.* Stanley was among the 20 most frequently reported serovars in Japan, Malaysia, Philippines, Croatia, Denmark, Finland, the Netherlands, and Canada [3].

There is no indication that the clinical presentation of these cases differs from usual Salmonella infections caused by other commonly occurring non-typhoidal serovars, especially in terms of severity.

The following outbreaks of *S.* Stanley infection, as a cause of human gastroenteritis outside south-east Asia, have been reported:

- In 1995, an international outbreak of *S.* Stanley infection in the United States and Finland was traced to alfalfa sprouts grown from contaminated seeds [4].
- In 1999, an outbreak of S. Stanley infection at a day-care centre in the USA was suspected of coming from undercooked roasted turkey [5].
- In 2001, an international outbreak of *S.* Stanley infection in Canada, England and Wales, Scotland and Australia was associated with consumption of imported peanuts [6].
- In 2002, an outbreak of *S.* Stanley infection at a picnic was suspected of originating from carne asada and barbeque chicken, however a specific item could not be identified as the contaminated ingredient [5].
- From September 2006 to February 2007, a nationwide outbreak of gastrointestinal illness caused by *S.* Stanley occurred in Switzerland involving 82 human cases and 23 hospitalisations. Cases were linked to the consumption of a specific brand of soft cheese that was produced in the western cantons of Switzerland [7]. This was the first *S.* Stanley outbreak reported in Europe related to non-imported food items.
- In 2006 there was an outbreak of *S.* Stanley infection in Sweden caused by imported lime leaves. Deficiencies in food preparation contributed to the outbreak [8].
- In 2007, an outbreak of *S.* Stanley infection in Sweden involving 51 human cases was associated with alfalfa sprouts. It was traced back to a domestic processing plant. A contributing factor was inadequate heat treatment [9].
- In 2011, an outbreak of *S.* Stanley infection occurred in Austria due to the consumption of turkey kebabs [10].

Between 2006 and 2012, 23 EU/EEA countries have reported a total of 2 995 cases of *S.* Stanley infection to the European Surveillance System. Of the 2 309 cases with a known travel history, 1 724 (75%) were travel-related between 2007 and 2011 (Table 1). Between 2007 and 2011, reported cases decreased by 32% from 682 in 2007 to 464 in 2011 (Table 1). In 2012, 16 EU/EEA countries reported 338 cases by 5 September 2012.

Table 1. Distribution of reported human *Salmonella* Stanley infections by travel status, EU/EEA, 2007–2012

	2007		2008		2009		2010		2011		2012[+]	
	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
Domestic	142	27.2	109	22.0	91	25.6	88	26.5	116	34.2	86	35.1
Travel-related	380	72.8	387	78.0	264	74.4	244	73.5	223	65.8	159	64.9
Unknown travel history	160	-	128	-	105	-	95	-	125	-	93	-
All cases	**682**	**100.0**	**624**	**100.0**	**460**	**100.0**	**427**	**100.0**	**464**	**100.0**	**338**	**100.0**

[+] *Preliminary data, as of 5 September 2012*

Source: The European Surveillance System

During the period 2006–2011, the top five source countries for travel-related *S.* Stanley infections were: Thailand (75% of all cases with known data); Pakistan (5%); India (4%); Vietnam (3%); and the Republic of the Philippines (3%).

S. Stanley populations isolated from clinical samples have shown a considerable genetic diversity in most available studies carried out using PFGE typing. Analysis of strains contained in the PulseNet Europe database evidences a similar population structure, with a high genetic diversity and the absence of a specific genetic group prevailing either temporally or geographically.

Resistance to nalidixic acid has been rarely reported for *S.* Stanley. In a study of 125 *S.* Stanley isolates from Asia and Europe, only 7 (6%) strains were resistant to nalidixic acid and all of them were isolated from travel-related infections [1]. A higher rate of resistance to nalidixic acid has been found among the *S.* Stanley cases reported to the European Surveillance System by 23 EU/EEA countries between 2006 and 2011. Of all reported cases with known resistance status (975), 181 (19%) cases showed resistance to nalidixic acid.

S. Stanley serovar isolations from food animals and feed (Table 2)

S. Stanley serovar has been relatively rarely reported from food and animals by EU Member States and Norway and Switzerland in the framework of the national zoonoses monitoring in accordance with Directive 2003/99/EC. During the years 2004–2011, the countries reported 366 isolations of *S.* Stanley, and these isolations were from: pigs (10 isolates); cattle (two); fowl (*Gallus gallus*, 27); turkeys (291); other poultry (three); reptiles (one); cats (one); dogs (one); hedgehogs (one); pork (two),; turkey meat (seven); broiler meat (six); meat from bovine animals (one); other red meat (one); dairy products (one); food of non-animal origin (one); other food (three); mushroom (one) and other non-specified products of animals origin (two). Four isolations were reported from feed, feed material and pet food during the years 2004–2011. Only 55 isolations were reported from the years 2004–2010, whereas this increased to 311 in 2011.

In addition, in the 2008 EU-wide *Salmonella* baseline survey in holdings with breeding pigs baseline survey, three Member States reported a total of nine isolates of *S.* Stanley (two isolates from Hungary, four from the Netherlands, and three from the United Kingdom).

Most of the *S.* Stanley isolations in 2011 were from turkey fattening flocks, turkey breeding flocks and turkey meat (298 isolations). In addition some isolates reported in 2011 came from: broiler flocks (six), *Gallus gallus* breeding flocks (one), broiler meat (one), pigs (one), and other poultry (three) and hedgehogs (one).

The *S.* Stanley isolations from turkeys and turkey meat in 2011 were made by five Member States: Austria (four isolates from turkey fattening flocks, two from turkey meat), Czech Republic (14 isolates coming from 13 turkey fattening flocks from two holdings), Germany (two from turkey meat), Hungary (30 isolates from five turkey breeding flocks from one holding, 242 isolates from 165 turkey fattening flocks from 16 holdings, three isolates from turkey meat) and Slovenia (one isolate from turkey fattening flocks). Hungary also provided preliminary data from 2012 (up to end June), and no *S.* Stanley isolations had been reported from turkey breeding flocks, whereas 258 fattening flocks from 24 holdings yielded *S.* Stanley isolates. In the years 2004–2010, no *S.* Stanley isolations were reported related to turkeys or meat thereof. Similarly no *S.* Stanley findings were made in the EU-wide baseline survey on *Salmonella* in turkey flocks in the years 2006–2007.

Hungary also reported *S.* Stanley isolations from breeding flocks of *Gallus gallus* and broiler flocks in 2011 and 2012 (up to end June). In both years *S.* Stanley was isolated from one breeding flock, and the serovar was detected in 2011 from six broiler flocks from four holdings, and in 2012 from six broiler flocks from six holdings.

Furthermore, Germany reported additional findings of *S.* Stanley during 2004–2010, and these included isolations from *Gallus gallus* (one isolation), reptiles (four), meat from broilers (four), red meat (seven) and exported fish meal (one).

Table 2. Reported isolations of *S.* Stanley from food, animals and feed by EU Member States and other reporting countries in the framework of Directive 2003/99/EC, from 2004–2011

Source	No. of isolations in 2004–2010	No. of isolations in 2011	Total No. of isolations (2004–2011)
Animals			
Gallus gallus (fowl)	20	7	27
Turkeys		291	291
Other poultry		3	3
Pigs	9	1	10
Cattle	2		2
Reptiles	1		1
Cats	1		1
Dogs	1		1
Hedgehogs		1	1
Food			
Meat from broilers	5	1	6
Meat from turkeys		7	7
Meat from bovine animals	1		1
Meat from pigs	2		2
Meat, red meat	1		1
Dairy products	1		1
Food from non-animal origin	1		1
Other food	3		3
Other products of animal origin	2		2
Mushrooms	1		1
Feed			
Feed material	1		1
Feed for fur animals	1		1
Pet food	2		2
Totals	**55**	**311**	**366**

S. Stanley serovar isolations reported to the Rapid Alert System for Food and Feed (RASFF)

From 2005 to 2012, there have been 17 RASFF notifications on *S.* Stanley. These have mostly concerned food and feed items originating from Thailand, but have also included those from Germany, the Netherlands, Vietnam, Brazil and China. Contaminated food and feed items were dog chew, pet food, organic rapeseed cake, peanuts, frozen beef tenderloin, pak paew (Thai herbs), wild betel leaf bush (herbs), water grass, dried Mu-Err mushrooms, pak-pang (Chinese morning glory from Thailand), kaffir lime leaves (herbs), sweet basil, fresh-water spinach, fresh parsley, fresh pennywort, lemon grass (fresh herbs), white hing choi (*Amaranthus tricolor*), fresh mint and chilled whole chicken.

Event background information

Results of the epidemiological and microbiological investigations in humans

On 29 June 2012, the National Reference Centre for *Salmonella* in Belgium reported through the Epidemic Intelligence Information System for the Food and Waterborne Diseases and Zoonoses (EPIS-FWD) platform a significant increase of human cases of *S.* Stanley infection in 2012. The increase was associated with a nalidixic acid resistant strain sharing an indistinguishable PFGE pattern referred to as the 'outbreak strain' in this document.

Austria, Czech Republic, Germany, Hungary, Slovak Republic and the United Kingdom have since reported laboratory confirmed cases of *S.* Stanley infection sharing an undistinguishable profile with the outbreak strain.

Between 1 August 2011 and 18 September 2012, the seven known affected Member States reported a cumulative number of 421 cases, 167 (40%) of which are confirmed. No country has reported unusual severity of clinical presentation for these *S.* Stanley infections.

Table 3. Distribution of reported human *Salmonella* Stanley infections by confirmation status and affected Member States, 1 August 2011–18 September2012

	Austria	Belgium	Czech Republic	Germany	Hungary	Slovak Republic	United Kingdom	Total
Probable cases*	125	0	4	45	75	5	0	254
Confirmed cases*	34	29	13	13	76	1	1	167
Total	**159**	**29**	**17**	**58**	**151**	**6**	**1**	**421**

** Case definition agreed among the affected Member States, see in annex*

Retrospective investigations showed that cases with the outbreak strain (PFGE confirmed) were already observed in August 2011 in Hungary, while the increase in the number of cases started in most countries in January 2012, with a second increase in May 2012. The overall (probable and confirmed) number of cases per month has risen each month since April 2012 (Figure 1).

Figure 1. Confirmed and probable cases of *Salmonella* Stanley by month* in affected Member States, 1 August 2011 to 18 September 2012 (N=419)**

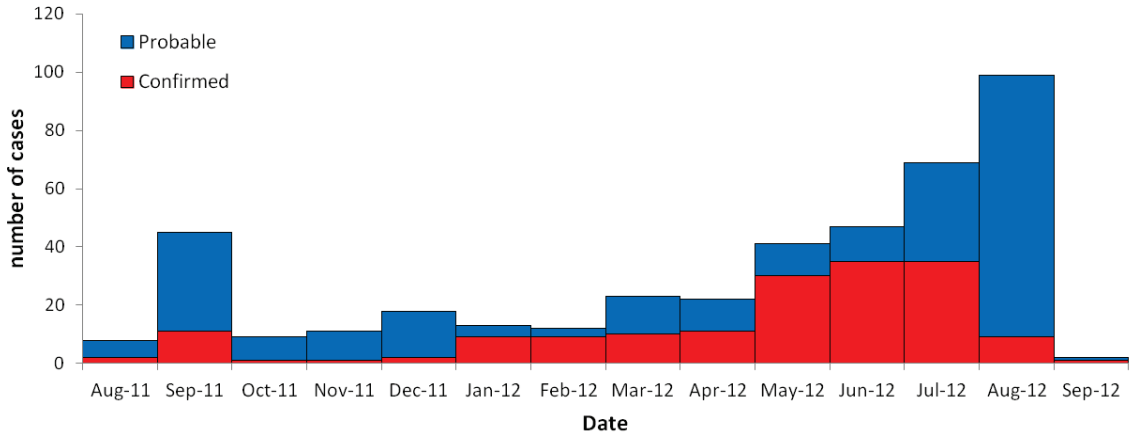
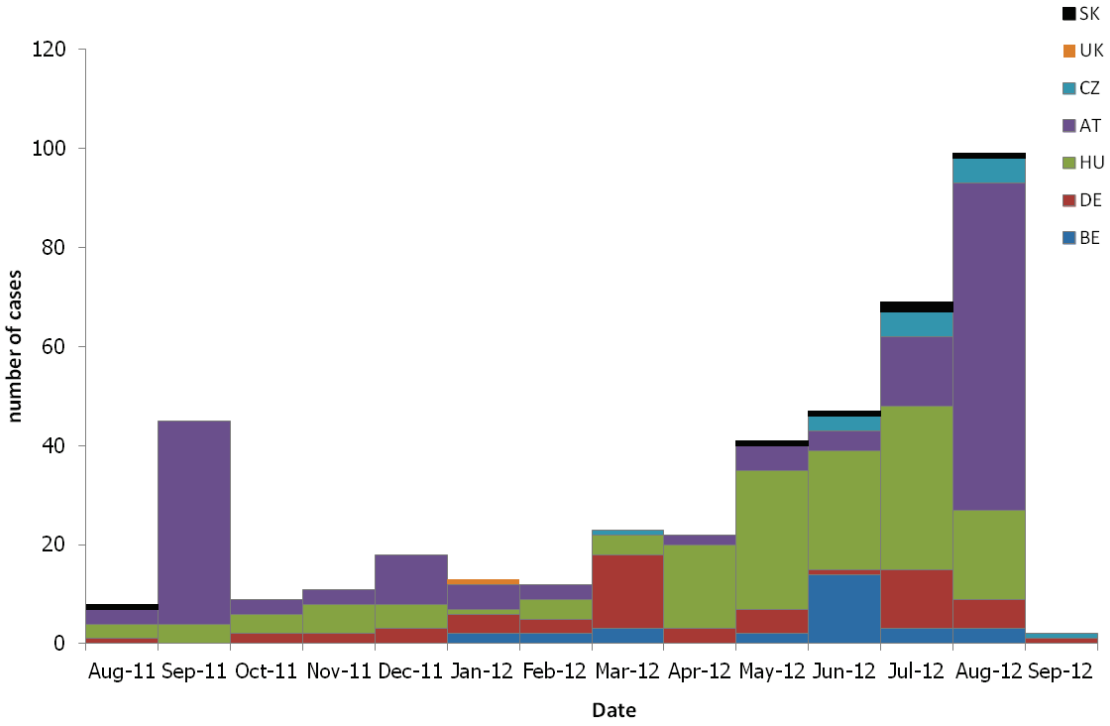


Figure 2. Distribution of cases of *Salmonella* Stanley by affected Member State and month*, confirmed and probable cases, 1 August 2011 to 18 September 2012 (N=419).**

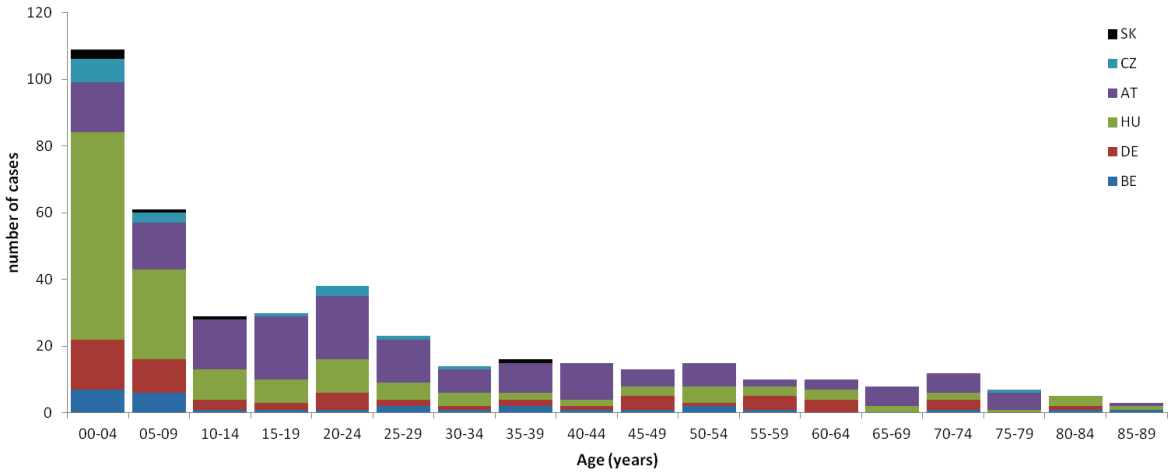


** Month represents month of onset when available, otherwise month of reception of sample at lab if available, otherwise month of diagnosis.*

*** Date is missing for one confirmed and one probable case*

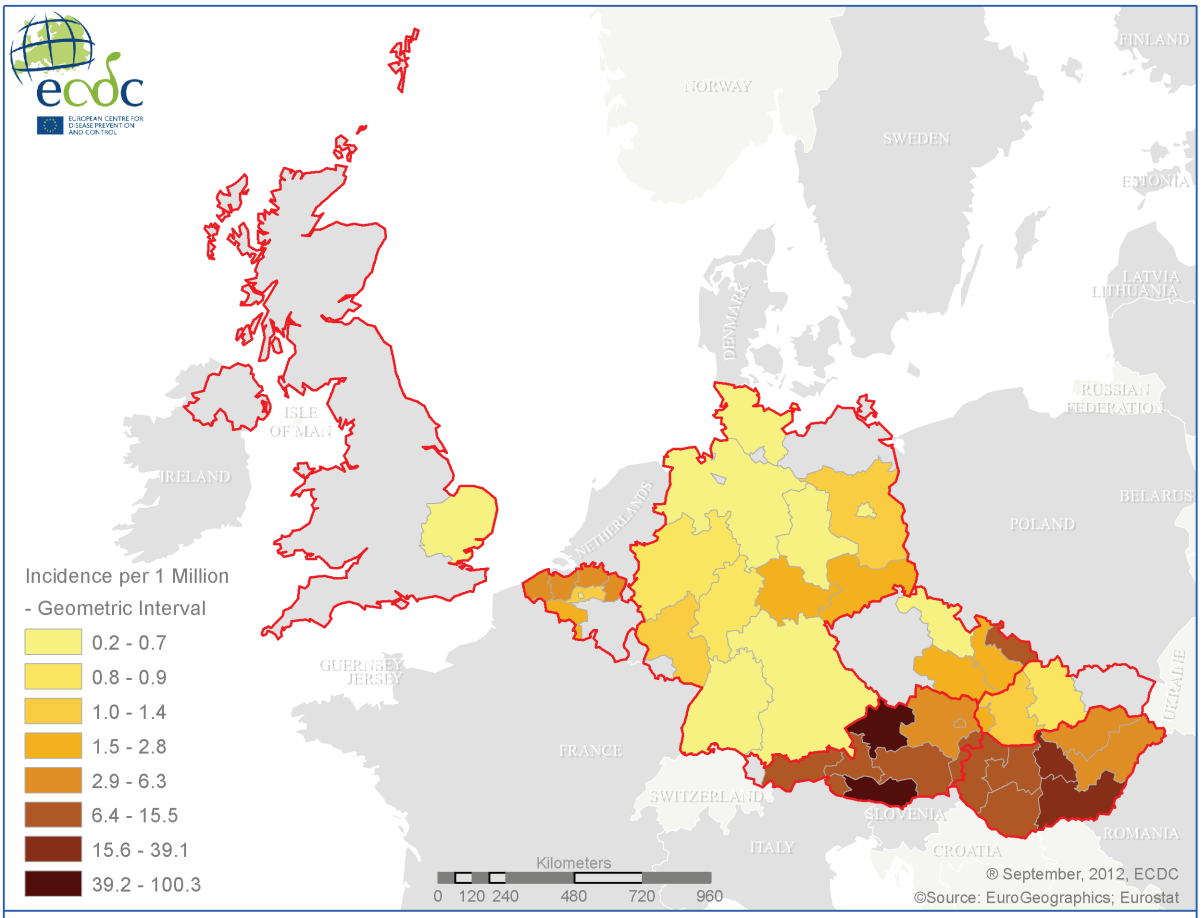
Of the 420 cases with information available, 224 (53%) were male. Of the 418 cases with information available, the median age was 16 years and the mean was 23.5 years (range: 0–89 years). The highest rates were in children age under 5 years.

Figure 3. Distribution of cases of *Salmonella* Stanley by affected Member State and age group, confirmed and probable cases, 1 August 2011 to 18 September 2012 (N=418*).



**Information on age unavailable for three cases, including from the United Kingdom*

Figure 4. Rates of confirmed and probable cases of *Salmonella* Stanley by EU Member State, 1 August 2011 to 18 September 2012 (N=418)



Note: Map shows the distribution of Salmonella Stanley cases' region of residence per 1 million population (Eurostat population datasets: 2011, and 2010 for UK), shaded according to incidences ranges based on the Geometric Interval method. Incidences in Austria, Belgium, Czech Republic, Hungary, and Slovakia are represented at NUTS2 level, and in Germany and UK are represented at NUTS1 level. Cases with no available data on region of residence: Belgium (1), Slovakia (2).

Between 1 August 2011 and 18 September 2012, rates in Austria and Hungary were the highest (18.9 and 15.1 per million respectively), compared to an overall rate of 2.2 per million in all seven affected countries. The lowest rate was in the UK, which reported one confirmed case from January 2012.

Cases in Germany, Hungary and Slovak Republic did not cluster geographically. Cases in Belgium were only reported from the northern, Flemish part of the country and cases in the Czech Republic clustered in the East. In Austria, clustering of cases to Upper Austria (61 cases in August 2012) and Carinthia (32 cases in July to October 2011) can be partially explained by two local outbreaks which comprised 54% of Austria's total cases (93 of 171). The single case in the United Kingdom is in east England (Figure 4).

Outbreaks:

Austria reported 79 cases of infection with the outbreak strain in August 2012. Of these, 53 had an onset date between 17 August and 20 August, were resident of the same region, and were nalidixic acid-resistant. Cases attended a village festival at which potato salad was served by a food handler who subsequently tested positive for the outbreak strain, but was asymptomatic. The salad had been prepared in a private kitchen the night before the event at the same time as turkey, and left unchilled overnight.

Austria reported 32 cases associated with an outbreak from July to October 2011 in Carinthia, Austria. Cases had eaten at a kebab stand that sold only turkey kebabs. No turkey remained for testing, but other food and environment samples from the stand, and human cases all tested positive for *S.* Stanley with the outbreak PFGE strain, confirmed by two enzymes.

Hungary reported an outbreak associated with a summer camp in late June, early July 2012. The commonly eaten food was meat balls containing turkey meat. No prepared food remained available for testing, but frozen turkey meat from the same batch used to make the meat balls remained deep frozen in the same refrigerator. This turkey meat was tested positive for *S.* Stanley. The strain was ciprofloxacin, ampicillin and streptomycin resistant, and the PFGE comparison test with the patients' isolates is ongoing. Investigations at the slaughter house did not identify a connection to any turkey flocks that have tested positive for *S.* Stanley.

No case has reported travelling outside EU/EEA countries prior to infection.

In Austria, 14 human isolates from 2011 and 2012 with indistinguishable *Xba*I PFGE patterns from the outbreak profile were analysed with a second enzyme (*Bln*I) and the results showed indistinguishable patterns among them that were indistinguishable from the Belgium outbreak profile with *Bln*I. This indistinguishable pattern using *Bln*I was also identified in ten isolates from seven different Austrian turkey fattening farms, four isolates from the Austrian turkey hatchery, one isolate from the parental flock in Hungary, and from food samples in 2011 and 2012, including ones from the 2011 turkey kebab outbreak in Austria.

Epidemiological investigations with trawling questionnaires in the affected Member States were conducted and no hypothesis was generated regarding a common exposure. Considering some cases have had recent onset of symptoms and thus recent exposures, (date of onset in September 2012), ECDC is currently developing a questionnaire specific for this outbreak which could be used for recent cases and new cases should they arise. The questionnaire will be shared through EPIS-FWD to the entire network.

Update on food and veterinary investigations

Finding of the outbreak strain in food, animals and feed as reported in August–September 2012

Austria reported the isolation of *S.* Stanley with a PFGE profile indistinguishable from the outbreak strain from turkey fattening farms, from a turkey hatchery (in Austria), and from samples identified by Austria as originating from a turkey parent flock (located in Hungary). The rearing period of the affected Hungarian turkey flock was taken until the slaughtering of the flock, 29 of July, 2011.

Germany also reported the isolation of *S.* Stanley with a PFGE profile indistinguishable from the outbreak strain from turkey farms (two isolates), turkey meat (four), tongue dish (likely from beef) (one), cavapcici-meat product (one) and one swab from refrigerator.

Hungary reported *S.* Stanley with an indistinguishable PFGE profile to the outbreak strain from turkey breeding flocks (three isolates) and fattening flocks (15 isolates), turkey meat and neck skin (two isolates), as well as from breeding flocks of *Gallus gallus* (one isolate) and broiler flocks (two isolates). In two cases, Hungary also found *S.* Stanley isolates with a different PFGE profile to the outbreak strain from fattening turkey flocks.

Belgium reported isolation of *S.* Stanley isolate with a PFGE profile indistinguishable from the outbreak strain from turkey meat.

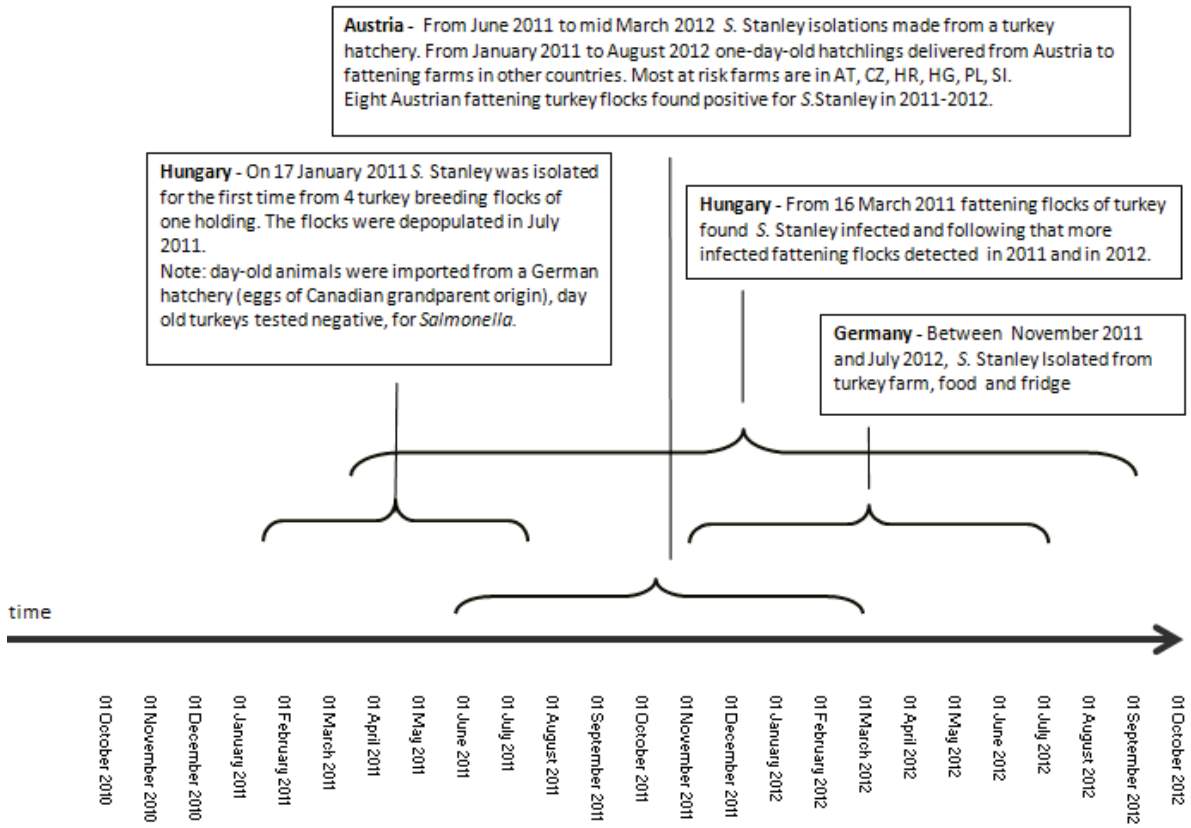
The Czech Republic reported *S.* Stanley isolates with a PFGE profile indistinguishable from the outbreak strain from fattening turkey flocks and in minced pork and beef meat.

Poland reported isolation of seven *S.* Stanley isolates from turkeys (one isolate), turkey meat and minced meat of turkey (three), broiler meat (one), minced poultry meat (one), feed for fur animals (one) with a PFGE profile indistinguishable from the outbreak strain.

Finland and the United Kingdom both reported 10 *S.* Stanley strains with PFGE profiles different to the outbreak strain from dogs, cats, fur animal feed, imported broiler meat and turkey meat, imported peppermint and seagull.

Forward and backward investigation of occurrence of *S.* Stanley in turkeys in the EU with a PFGE type indistinguishable from the human outbreak strain.

Figure 5 ***Salmonella*** **Stanley isolates from animal, food/feed and environment and time occurrence of PFGE profiles undistinguishable from the outbreak strain, October 2010–October 2012, EU.**



Hungary:

In Hungary, *S.* Stanley first appeared in four turkey breeding flocks in a same holding on 17 January 2011. Subsequently, the first isolations were made in turkey fattening flocks on 16 March 2011. After this more turkey fattening flocks have tested positive for *S.* Stanley in 2011–2012. Most *S.* Stanley isolates that were molecular typed from these breeding and fattening flocks had a PFGE profile indistinguishable from the outbreak strain. In 2012, 24 holdings were found to be infected with *S.* Stanley, with four holdings rearing 80% of the *S.* Stanley positive animals (report from Hungary on 17 September 2012).

Austria:

Boot swabs obtained from the house of one of the Hungarian turkey parent flocks that were collected as part of the self-monitoring scheme of the Austrian turkey hatchery, were positive for nalidixic acid-resistant *S.* Stanley repeatedly from June 2011 until mid-March 2012. Hungary informed that the affected Hungarian flocks were de-populated in July 2011. After the depopulation of the flocks, samples were taken from all flocks of the holding in the framework of the *Salmonella* eradication programmes and tested negative. Specimens collected from the Austrian hatchery were positive for nalidixic acid-monoresistant *S.* Stanley repeatedly from June 2011 until mid-March 2012. Since April 2012, environment dust samples from the Austrian hatchery have been negative for *S.* Stanley.

The Austrian Reference Laboratory re-tested a selection of *S.* Stanley isolates from 2012 Austrian human cases, environmental samples from the Austrian turkey hatchery, fattening farms, the 2011 outbreak, and food samples from 2012 and found them to be indistinguishable of each other.

Polish, the Czech Republic's, Slovenian, Hungarian, Croatian and Serbian farms received at high risk, hatchlings from the Austrian hatchery. These were derived from hatching eggs from Hungarian parental flocks of which some units were infected with *S.* Stanley (report from Austria, September 2012).

Results of the investigation in other Member States and countries participating in the ECDC food and water borne network

As of 17 September 2012, 23 countries (excluding affected countries) reported that they have not observed a similar unusual increase of infections associated with the outbreak strain. These included 19 EU/EEA countries, Norway, Luxembourg, Canada and the United States.

The United States have not observed any increase in the number of cases of *S.* Stanley, however they reported one case with an indistinguishable PFGE pattern. The patient reported onset of illness on 23 July 2012. He did not report travelling in the week prior to this date. This particular pattern appears to be very rare in the United States. All of the isolates in the US PulseNet database are from human clinical sources. In 2009, *S.* Stanley was identified in ready-to-eat (i.e., fully cooked) pork bratwurst sausage, but the PFGE pattern is different from the outbreak strain.

The International Food Safety Authorities Network (INFOSAN) issued an alert on 20 July 2012 to identify cases outside of the EU but no country has so far reported associated cases.

Threat assessment for the EU

From 1 August 2011 to 18 September, 167 confirmed cases of *S.* Stanley infections have been reported in seven EU Member States (Austria, Belgium, Czech Republic, Germany, Hungary, Slovak Republic and the United Kingdom) in relation with a nalidixic acid resistant isolates with an indistinguishable *Xba*I-PFGE pattern. For another 254 non travel-related cases of S. Stanley infections reported in these MS, the PFGE pattern is not available.

A subset of human isolates from Austria with indistinguishable *Xba*I PFGE patterns from the outbreak profile were subjected to confirmatory analysis using a second enzyme (*Bln*I). The results with the second enzyme confirm the existence of an indistinguishable genotype among the isolates from human cases.

As cases do not have travel history outside the EU within the typical incubation period for salmonella, these findings strongly suggest a multi-state outbreak with exposure currently taking place in several countries in the EU. Considering the high diversity of *S.* Stanley among human isolates, the finding of one single *Xba*I and *Bln*I PFGE pattern in isolates from different countries suggests a multinational outbreak related to a common persisting source of infection, or to multiple sources in the EU that are contaminated with indistinguishable isolates.

The two most recent cases have onset of disease in September 2012; therefore, the outbreak is still ongoing. Delays in serotyping result in underestimating the most recent cases and therefore generate uncertainty along the right edge of the curve.

So far, the interviews of the cases with trawling questionnaires have not generated any hypotheses that could link the cases epidemiologically. However, due to the fact that turkey meat is considered as a 'stealth vehicle', it is unlikely that further epidemiological study of sporadic cases would provide more evidence of the link between the human cases and the turkey production.

However, epidemiological investigation of three large clusters of cases suggested a link with consumption of turkey. In Hungary, turkey meat stored in a fridge with a food vehicle eaten by cases, tested positive for *S.* Stanley and is also suspected epidemiologically as the vehicle of the outbreak. In Austria, 32 cases were linked to eating turkey kebab from one stand where environmental samples also tested positive for the outbreak strain. In a third cluster in Austria of 54 cases, the epidemiological association was with a potato salad prepared at the same time as turkey meat, and left overnight un-refrigerated.

Food and veterinary investigations conducted in Austria, Belgium, Germany, Czech Republic, Poland and Hungary identified an indistinguishable *Xba*I-PFGE fingerprint and a common resistance to nalidixic acid among isolates originating from the turkey production chain (turkeys and turkey meat).

In 2011, there was a sudden increase in the number of *S.* Stanley isolations in food and animals reported to EFSA, with 311 isolations in 2011 compared to 51 isolations for the 2004–2010 period. Ninety-six percent of the isolations (n=298) in 2011 originated from turkey fattening flocks, turkey breeding flocks and turkey meat.

Isolates with the *S.* Stanley outbreak PFGE profile were identified by Austria, Belgium, Czech Republic, Poland, Germany and Hungary in isolates from turkeys and turkey meat, but also in some countries in broiler flocks and meat from various animal species (broiler meat, beef and pork). In addition, some *S.* Stanley isolates with PFGE profiles that differ from the outbreak strain were reported from meat, turkeys, other animal species, and feed by four Member States.

It appears that in some Member States, the broiler (chicken) breeding and production flocks might also have become infected with *S.* Stanley.

The concomitant upsurge of human cases of *S.* Stanley sharing the same PFGE profile, and of *S.* Stanley isolation in turkeys and turkey meat in four of the affected countries, plus the isolation of the outbreak strain in turkeys and turkey meat samples in 2011 and 2012, clearly suggests that the turkey production is the most likely source of the outbreak. However, the contribution of other food and animal sources, such as beef, pork and broiler meat to the outbreak cannot be ruled out.

At this stage, a comprehensive trace-back and trace-forward of the turkey chain is necessary to understand the distribution of the potentially infected animal and contaminated meat, and as a result, the magnitude of the risk. Matching trace-back and trace-forward information from farms and slaughterhouses where the outbreak strain has been identified with the geographical distribution of cases would provide additional epidemiological evidence. The very striking geographical distribution of cases (e.g. cases only in Flemish part of Belgium) could indicate a link with distribution of specific turkey meat containing products distributed that could be further assessed through such ecological studies looking at spatial correlation.

ECDC, EFSA and the EU *Salmonella* Reference Laboratory are encouraging all Member States to perform PFGE analysis on food, animal and human *S.* Stanley isolates from 2011 and 2012 and to submit their data to ECDC. This will provide information on the diversity of *S.* Stanley in the EU allowing the assessment of the situation to be refined.

As control measures have not yet been implemented to remove the source of infection and potential food vehicles from the market, it is likely that additional human cases of *S.* Stanley infections will be reported in EU Member States.

Conclusions and Recommendations

An outbreak of *Salmonella* Stanley involving 167 confirmed and 254 probable cases is on-going in several Member States of the EU. As cases do not have travel history outside the EU in the usual incubation period for salmonellosis, these findings strongly suggest a multi-state outbreak with exposure currently taking place in several countries in the EU. The descriptive epidemiology indicates a transmission originating from a persistent common source or multiple sources in the EU that are contaminated with indistinguishable isolates.

Food and veterinary investigations conducted in Austria, Belgium, Germany, Czech Republic, Poland and Hungary identified an indistinguishable *Xba*I-PFGE fingerprint and a common resistance to nalidixic acid among *S.* Stanley isolates originating from the turkey production chain (turkeys and turkey meat). In addition, isolates with indistinguishable PFGE patterns were also detected in some cases from broiler flocks (breeding and fattening) and meat from other animal species (broiler meat, beef and pork).

The epidemiological and microbiological information gathered through the public health, food and veterinary investigation strongly suggest that the turkey production chain is the source of the outbreak. However, the contribution of other food and animal sources, such as beef, pork and broiler meat to the outbreak cannot be ruled out.

As control measures have not yet been implemented to remove the source of infection and potential food vehicles from the market, it is likely that additional human cases of *S.* Stanley infections will be reported in EU Member States.

It is important to highlight that persons working in the food chain at all levels (from production to catering) as well as consumers should be very strict with personal (hand washing) and food hygiene (avoid cross-contamination between ready-to-eat and raw meat) when handling raw turkey meat.

Further information on the trace-back and trace-forward of foods items in the food chain will be necessary to understand and assess the risk associated with this outbreak. In addition, this information will help in the identification of the primary source of the outbreak strain and to track the spreading along the food chain. This information would in turn help to define the risk management actions to be taken in order to control the contamination with this strain in the animal production and food chain. These targeted measures are expected to help control the outbreak and prevent further human cases.

As soon as the above information becomes available, ECDC and EFSA recommend that further actions should be taken by risk managers to detect and contain the *S.* Stanley infection in turkey production and the subsequent contamination of turkey meat, and when necessary, in the broiler production chain.

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Annex

EU epidemic case definition for *Salmonella* Stanley multi country outbreak

Confirmed case

A laboratory confirmed case of *Salmonella* Stanley with PFGE pattern matching the 'Belgium outbreak strain'
AND
Onset of symptoms after August 2011
AND
Without travel history outside the EU in 1–7 days prior the onset of symptoms

Probable case

A laboratory confirmed case of *Salmonella* Stanley, **no PFGE available**
AND
Onset of symptoms after August 2011
AND
Without travel history outside the EU in 1–7 days prior the onset of symptoms

Exclusion criteria
If the *Salmonella* Stanley strain has a different PFGE profile it should be excluded.