

# Nationwide Outbreak of *Salmonella* Panama in Children due to Minisalami Sticks, Germany, Summer 2007

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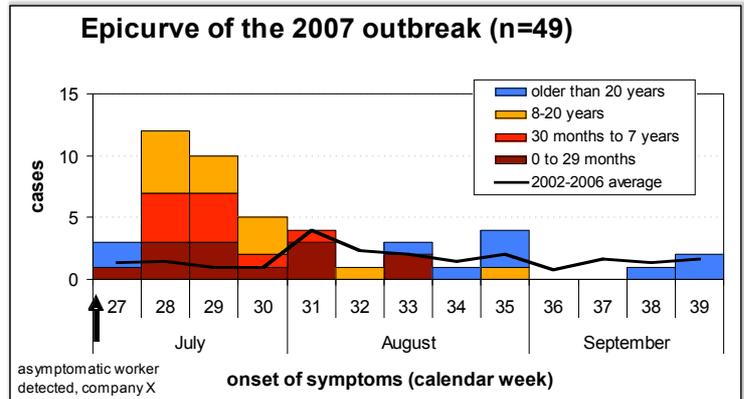
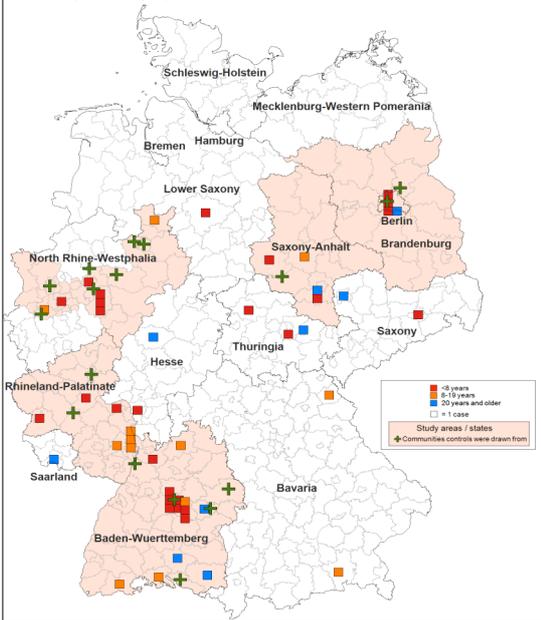
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**Background:** In August 2007, increasing notified infections with *Salmonella* (S.) Panama were noticed by the Robert Koch Institute, Germany's national infectious disease surveillance institution. Cases were spatially scattered, young children most affected. Together with food safety authorities, an outbreak investigation was conducted to identify the outbreak's source and to devise interventions

S. Panama-Infections, Germany 2007  
Non-imported, symptomatic cases, notification weeks 29-39, n=48



**Methods:** A case-control study focused on a specific food vehicle hypothesis. Cases were aged 20 months to 20 years, with onset in July/August (first case per household). Controls were randomly selected from municipal registries, frequency matched on age. Participants or their parents were questioned on food consumption the week before onset (cases) or interview (controls). Case isolates of *S. Panama* were compared microbiologically (PFGE and MLVA). Food safety authorities investigated production and distribution of the incriminated food vehicle.

**Results:** In exploration, two infections had direct links to a factory producing various types of salami products (an asymptotically infected worker and the grandchild of another employee). Other cases had consumed miniature salami. Analyzing 22 cases (of 34 in total) and 63 controls, consumption of small caliber mould-ripened salami sticks (MSS, OR=29.9, 95% CI: 8.2-112.7), and among salami eaters, of MSS likely produced by the implicated factory (OR=12.0, 85% CI: 1.0-141.3), were strongly associated with disease, explaining >70% of cases (100% of those <29 months of age). Microbiologically, case *S. Panama* strains, including those directly factory associated, constituted an outbreak clone. Food safety investigations found no general faults at the production site and failed to demonstrate *S. Panama* in factory and retail product samples.

**The implicated product:**

Minisalami sticks are <1cm in diameter and approximately 10cm long. They are sold in small bags containing multiple sticks. The product is made from raw ground pork, salt and spices without the use of smoke by various producers. The small caliber sausages of the implicated factory ripen for 11 days in two phases: First the pH decreases while the product dries, then a thin layer of desired mould develops on the outside, while the pH rises again. Important for microbiologic food safety are the lactobacilli influencing the pH, the mould and the drying.



**Results of the food safety investigation in Detail:** In 2006/7 *S. Panama* was only rarely isolated from routine samples of foods or from animals. A pork isolate from North Rhine – Westphalia from 2007 matched the outbreak strain. Regrettably trace back of this sample failed and was unable to establish any connection to the outbreak or the implicated factory, except to generally support a pork-based product like minisalami sticks as the food vehicle. Samples of minisalami sticks drawn from retail before and during the outbreak (n=36), as well as stored samples from the factory (n=16) did not yield *S. Panama*. Hygiene in the implicated factory was deemed appropriate upon site visit.

**Risk associated with selected food items queried**

Consumption of ...	% cases explained	odds ratio	95% confidence interval
- in the week before onset (cases)			
- in the week before interview (controls)			
...foods containing raw egg	14	1.5	0.3-6.5
...raw ground meat	0	n.a.	n.a.
...poultry meat, raw or cooked	23	0.2	0.1-0.5
...a certain brand of chocolate	45	0.8	0.3-2.2
...a certain brand of packaged desert	45	2.4	0.9-6.6
...any type of minisalami	73	13.8	4.3-44.1
- ...singly wrapped large minisalami	5	0.6	0.1-5.2
- ...minisalami sticks (MSS)	73	29.9	8.2-112.7

**Risk associated with MSS, by age**

Age group	% cases explained	odds ratio*	95% confidence interval
20-29 months	100	140	7.7-2550.0
30 months - 7 years	80	5.9	1.0-34.9
8 - 18 years	80	56	2.8-1109.4

\* due to zero-cells, "fudging" was used

**Risk associated with MSS of the implicated factory**

Among eaters of MSS: Consumption of ....	% cases explained	odds ratio	95% confidence interval
... MSS brands made by implicated factory	75	12	1.0-141.3

**Conclusion:** MSS containing *S. Panama* likely caused the outbreak. Parents should be aware, that short fermented raw meat products like MSS may harbor viable enteropathogens sufficient to produce infection in children and plausibly those with compromised immune systems. MSS in Germany are frequently marketed specifically to children.