Rapport

Gastroenteritis outbreak during a youth camp in East Norway. August 2012.

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Norsk sammendrag

Under en konfirmasjonsleir i uke 32 (06-08-2012-10-08-2012), ble flere syke med gastroenteritt. Etter meldingen om utbruddet gjorde Mattilsynets distriktskontor en inspeksjon av leirskolen, intervjuet noen av de syke og tok ut prøver til analyse. I samarbeid med Mattilsynet og kommuneoverlegen gjorde FHI en spørreundersøkelse blant deltakerne på leiren for å kartlegge mulige kilder til utbruddet og medvirkende faktorer, slik at forbyggende tiltak kan iverksettes.

Det ble sendt ut 198 spørreskjema, og totalt 96 deltakere svarte (svarprosent=48%). Av disse var det 34 som meldte om symptomer på gastroenteritt i den aktuelle tidsperioden. Ingen av de som svarte på spørreskjemaene hadde vært hos lege og tatt prøve for å finne ut av hvilken bakterie eller virus som var årsak til utbruddet. Symptomene oppgitt i spørreskjemaene passer imidlertid godt med norovirusinfeksjon. Norovirusinfeksjoner gir omgangssyke og mer enn halv parten av de syke kaster opp. Symptomer starter vanligvis 12-48 timer etter smitte, men det kan også være kortere. Etter 12-60 timer blir de fleste friske igjen [1,2].

To av de som ble syke rapporterte at symptomene startet allerede morgen / ettermiddag 8. august, men de fleste ble syke enten torsdag kveld eller fredag morgen / ettermiddag. Den klare toppen i antallet elever som ble syke omtrent på samme tid tyder på at de syke har blitt utsatt for en smittekilde omtrent samtidig. Dette passer bra med muligheten for at smittekilden kan være et felles måltid. For å forsøke å finne hvilke matvarer som kunne være smittekilden analyserte vi dataene ved hjelp av epidemiologiske verktøy. Vi sammenliknet andelen syke blant de som spiste en matvare med andelen syke blant de som ikke spiste matvaren. Analysene viser risiko for å bli syk av en enkelt matvare og matvaren med høyest risiko vil dermed være den mest sannsynlige smittekilden basert på analysen.

Analysene peker mot kokt potet servert på onsdag (med tørket persille), men tomat servert på torsdag kommer også ut som risikofaktor (men med mindre risiko). Tacosausen, som flere av elevene og Mattilsynet mistenkte som smittekilde, kom ikke ut som noen risiko faktor i våre analyser. Laboratorieundersøkelser av produktet var også negative.

Kokt potet er i utgangspunktet en lite aktuell smittekilde ettersom de jo kokes før de spises, og i liten grad håndteres etterpå. Og selv om fersk persille er en logisk smittekilde, er tørket persille ikke en vanlig smittekilde. Også det faktum at de har brukt skje for å spre persillen minsker sannsynligheten for at denne kan ha vært kontaminert, selv om det likevel selvsagt kan skje. Til tross for at kokt potet (med tørket persille) ikke er en vanlig smitte kilde, kan potetene forklare langt de fleste tilfellene; 97% av de som var syke hadde spist potet. Blant de som ikke ble syke hadde 64% spist potet. Poteter ble servert med tørket persille én dag før de fleste ble syke – og passer derfor godt tidsmessig med det vi regner som mest sannsynlige smittetidspunkt. Til tross for at potet kommer ut som en sannsynlig smittekilde i analysene tror vi ikke dette er mest sannsynlige kilde til utbruddet. Potet kan være et tilfeldig funn. Vi analyserte mange forskjellige variabler, noe som kan øke sannsynligheten for å finne falske positive. Spørreundersøkelsen ble gjort 10 dager etter at de fleste ble syke. Vi kan derfor heller ikke utelukke en skjevhet i hva de syke og de friske husker av hva de spiste.

En vanlig smittevei i norovirus-utbrudd er smitte av matvarer via smitteførende personer; altså at personer som skiller ut virus i avføringen overfører virus til matvarer via hender og dermed smitter andre. Det skal veldig få virus til for å bli syk. I dette utbruddet er det muligheter for at både kjøkkenpersonale og andre voksne deltakere på leiren, samt elever som hadde vært syke, kan ha overført virus til matvarer som etterpå ble spist av andre. En eller flere av de som allerede var syke kan ha kontaminert matvarer under mathåndteringen eller ved selvbetjening på buffeten. Kjøkkenet har rutiner for å holde personell som er syke hjemme til 48 timer etter at de har blitt friske dersom de har diare eller oppkast. Dette er i tråd med nasjonale anbefalinger. Likevel vet vi at enkelte personer skiller ut virus i langt mer enn 48 timer, slik at personell som kom tilbake på jobb etter sykdom også er en mulig smittekilde.

Mattilsynet hadde ingen alvorlige merknader til orden, renhold og andre hygienerutiner på kjøkkenet. Leieren har en privat vannforsyning med UV desinfeksjon. Vann ble testet og hadde god bakteriologisk/fysikalsk kvalitet.

For å forebygge videre smittespredning ga mattilsynet råd om servering på tallerken i stedet for buffet. Ved mulige fremtidige utbrudd med mage-tarmsykdom er det viktig at kommunelegen, som er ansvarlig for utbruddsutredningen, sikrer at det tas relevante avføringsprøver så raskt som mulig. I tilfelle av et norovirus utbrudd, er mekanisk rengjøring med såpe og vann spesielt viktig for å fjerne virus.

Summary

During a youth camp as preparation for confirmation in the church that took place in week 32 (06-08-2012-10-08-2012), became several participants ill with gastroenteritis. After notification of the outbreak, the food safety authorities began an initial outbreak investigation and inspected the food premises. Subsequently, FHI, in collaboration of the FSA, started a retrospective cohort study to investigate the source of the outbreak as more youth camps would follow at the same location.

198 questionnaires were sent out in the cohort study, and 96 participants responded to it (response rate = 48%). Of these, there were 34 who reported symptoms of gastroenteritis. Two reported that symptoms started already on the morning/afternoon of 08/08/2012; the rest reported symptoms from the evening of Thursday 09/08/2012 onwards, with a peak in the number of cases between Thursday evening and Friday afternoon. None of the respondents had visited a doctor to determine the infectious agent. The reported symptoms, however, fit well with a norovirus infection.

Because of the lack of etiological diagnosis of the cases, we chose to perform the analyses on the basis of two different case definitions: one with all who had symptoms of gastroenteritis since Thursday, 09/08/2012, and a more narrow definition that included only those who became ill between Thursday evening and Friday afternoon. Both analyses indicate that the boiled potatoes that were served with dried parsley on Wednesday, 08/08/2012, were the cause of the outbreak, but also the tomatoes served on Thursday came out as a risk factor (though, with a lower risk). The suspected taco sauce did not come out as a risk factor, and its laboratory test was also negative.

Boiled potatoes are not a common source for gastroenteritis outbreaks, neither is dried parsley. Nevertheless, the potatoes served with dried parsley could explain most of the cases (97%), and they were served one day before most became ill, which fits well temporally with the estimated period of exposure assuming a norovirus outbreak. Still, potatoes may have been a chance finding, as we analysed many different variables, which increases the

likelihood of finding false positives. Furthermore, the survey was performed 10 days after the peak of the outbreak, which may have caused some recall bias.

Kitchen staff, leaders of the camp or participants may therefore still play a role as source of infection through contamination of food during self-serving or food-handling.

The FSA visited the camp location and did not find serious objections of the cleanliness or hygienic routines in the kitchen. The camp location has a private water supply, which is disinfected by using UV. The water supply was tested and had good bacteriological / physical quality.

To prevent further spread of infections, FSA advised that food should be served on plates instead of at a buffet. In possible future gastroenteritis the responsible municipal doctor should ensure that at least some cases will deliver faeces to enable laboratory confirmation of the outbreak. In case of norovirus, mechanical cleaning with soap and water is particularly important to remove viruses.

Introduction

Overview of the event

A youth camp as preparation for confirmation in the church was held from Monday 06-08-2012 until Friday 10-08-2012. In the camp, 152 pupils aged 14-15 years and 46 (leaders; 34 under 18 years old) were participating. During the night from Thursday (9 August) to Friday, at least 25 cases of gastroenteritis occurred among the participants of the camp. The main symptoms were diarrhoea, fever, nausea and vomiting. The camp organisers notified the responsible municipal medical officer about the outbreak on Friday 10 August. Subsequently, the municipal medical officer informed the local food safety authorities (FSA), who notified the Norwegian Institute of Public Health (FHI) through the outbreak notification system VESUV. The alert that was sent to FHI included the information from the FSA that they suspected norovirus based on the symptoms and the number of cases that occurred at the same time (short incubation time), and that washing with alcohol (Spritvask) was implemented the same day.

Camp schedule

All participants arrived at Monday 6 August and started with a lunch meal. Each day the participants started with breakfast, and before lunch, they received a teaching session followed by an activity that was performed in groups. After lunch, there was an activity session. After dinner, the participants gathered again to discuss the day. Late Thursday night, participants grilled sausages. The participants left the camp Friday 10 August at 12h.

Outbreak investigation

Initial investigation performed by the FSA

The local FSA visited the camp location for inspection of the premises and for an initial investigation of the outbreak on Friday 10 August. At arrival of the FSA about two hours after the notification of the outbreak, some of the participants had already left. FSA distributed questionnaires to those still present (1 employee, 7 participants, 14 leaders); due to some misunderstanding, the questionnaires were only distributed among cases. The questionnaire was designed to obtain information on the menu of Thursday 9 August, as FSA had special

suspicion to the taco-meal served on Thursday night because of the onset of the outbreak just after the meal. In addition to the initial investigation, FHI decided on Wednesday 15 August to carry out a retrospective cohort study among all participants of the youth camp, as more youth camp would take place in the same location in the weeks to come.

Epidemiological investigations

Patients and possible risk factors

Design
We performed a retrospective cohort study among all participants and leaders of the camp.

Objective
The aim of the outbreak investigation was to determine the source of the gastroenteritis outbreak at the youth camp in week 32, 2012 in order to prevent potential future outbreaks at the camp location.

Case definition
A case was defined as

- being present at the camp location in week 32, 2012
- and suffered from at least 1 of the following gastrointestinal symptoms between 09-08-2012 and 15-08-2012: diarrhoea, nausea, vomiting or stomach ache.

The dates of food consumption as defined in the case definition correspond to the dates that were mentioned in the questionnaire.
A second case definition was defined similar to the one described above, but with day of symptom onset between Thursday evening 09-08-2012 and Friday afternoon 10-08-2012 (= peak of the epidemiological curve).

Data sampling
Letters were sent to all leaders of the camp, and to the parents of all the participants, as the participants are younger than 18 years old, and therefore need consent from their parents to be allowed to participate in the study. We sent letters to the 198 persons being present at the camp. Due to administrative reasons, we also sent 130 letters to persons being present at a camp at the same location in week 33, though, in the letter persons only present in week 33 were asked not to answer the questionnaire. The questionnaire was available online through Questback from Monday 20 August up to 15 September. After 11 days, we started calling the 117 persons who had not yet replied to ask if they could fill out the questionnaire. We talked to/sent sms to 86 persons. Thirty-one persons were not reachable by phone (no phone-number listed, wrong phone-number listed etc).

Through the online questionnaire we collected information on sex, whether someone was a participant or leader, which group they had been allocated to during the week, about illness (which symptoms and time of onset, doctor visits, samples taken), contact with others with symptoms and food consumption during the camp. Unfortunately, no information was collected on the grilled sausages that were served late Thursday night. Because all participants of the camp shared the same meals, for the most suspected food items we asked the amount consumed to be able to analyse a potential dose-response relation.

Data analyses
Data was extracted from Questback to Excel. Analyses were performed in STATA 12. The descriptive analyses included description of the respondents (sex, leader or participant), time of symptom onset, the kind of reported symptoms, contact with ill persons (within 2 meters of someone vomiting, nor sharing a room with someone ill were associated with being ill) and the food items. The analytical analysis included both univariable analyses and multivariable analysis. We determined the number of people exposed, number of ill people among exposed and unexposed, attack rate (AR) and risk ratios (RR) with 95% confidence intervals (95% C.I.) of all 71 variables using the cstable command in STATA. In case someone had only indicated the food products that one had consumed, we assumed that one had not consumed any of the other products for which no answer was provided.

The multivariable analyses were performed using logistic regression to determine odds ratios (OR), as the binomial regression model did not converge. We performed 2 different analyses with both the first (broad) case definition as well as for the second (narrow) case definition. For the analysis with the second (narrow) case definition, we excluded cases with onset of symptoms before Thursday evening or after Friday afternoon). We included all variables which had a p value of <0.2 in the univariable analysis and which at least 50% of the cases had consumed. 2) Because of the large number of food products that were significant at a p value of <0.2 and of which least 50% of the cases had consumed the product, we performed a second analysis with the same inclusion as in the first analysis, but only included those food products that were served on Wednesday 08-08-2012 or Thursday 09-08-2012. In both analyses, variables were taken out of the model based on their significance level, so that the final model contains only variables significant at a level of $p<0.05$.

We used the result of the multivariable analysis to determine the median incubation time of the infectious agent using the formula: peak of the epidemiological curve - timing between the suspected exposure (UNC: cphp.sph.unc.edu/focus/vol1/issue5/1-5EpiCurves_slides.ppt). Because of the absence of any laboratory confirmation of the infectious agent, we estimated the time period of exposure, by using the incubation time of norovirus (12 - 48 hours [1,2]) with the following formulas: peak of the epidemiological curve – minimum incubation period = latest exposure date; peak of the epidemiological curve – maximum incubation period = earliest exposure date. The assumption of norovirus is based on the reported symptoms, and was independent from the timing in relation to any exposure.

Microbiological investigations

Patient samples

No samples for laboratory confirmation were obtained.

Environmental samples

The food safety authorities took samples from the meat and the taco sauce of the suspected meal. The taco sauce was tested for norovirus. No other food product was tested.

The camp location has a private water source which includes a UV disinfection step. On 13 August, a sample of the water was obtained and its quality was tested for several parameters (see figure 1).

Parameter	Metode
Kimtall 22°C	NS-EN ISO 6222
E coli MPN	COLLIERT, Int. met.
Total Koliforme MPN	COLLIERT, int.met.
pH	NS 4720
Turbiditet	NS-EN ISO 7027
*Fargetall	NS-EN ISO 7887

*) Laboratoriet er ikke akkreditert for denne analysen

Figure 1: Laboratory investigations on the water of the private source.

Environmental investigations

Investigation of potential sources, food services and manufacturing conditions

FSA inspected the food premises on cleanliness and checked hygiene routines in the kitchen. FHI contacted the food handlers of the camp location to obtain more information on how specific dishes were prepared.

Results

Initial investigation performed by the FSA

Among the 25 cases that were initially identified by the FSA and who had received the questionnaire, 22 (7 participants, 14 leaders and one employee of the camp location) filled out the questionnaire before leaving. Of the 22 respondents, 21 reported to be ill; 11 reported to have suffered from both, nausea, vomiting and diarrhoea. One case reported illness already on Tuesday evening 7 August, while the time of onset of the other 20 respondents with symptoms, were on Thursday morning (n=2), Thursday Evening (n=2), the night from Thursday to Friday (n=4) and Friday morning (n=12; note that the questionnaire was filled out on Friday around noon).

Based on information of camp location, the FSA suspected that a food-handler could be the source of the outbreak. The food-handler was ill in the weekend of 4-5 August, came to work again on Monday 6 August but was sent home because of the '48-hour rule' for food-handlers after gastrointestinal illness. The food-handler did not work on Monday, Tuesday and Wednesday, but started work again on Thursday 9 August. The children of the food-handler were ill at the moment the food-handler returned to work. The food-handler had prepared the meat for dinner, grated the cheese, and had prepared cold, uncooked taco-sauce for the Thursday night. Furthermore, the suspected food-handler had visited a family at Friday 10 August, from which some of the family had become ill afterwards. Except from the food-handler, none of the other personnel of the camp location had been ill before Friday 10 August.

Epidemiological investigation

Patients

96 individuals (72 participants and 24 leaders) answered the questionnaire of the cohort study; a response rate of 48%. 53% of the respondents were male. 34 reported to have suffered from various symptoms; 32 fitted the first case definition and 28 fitted the second (narrow) case

definition. The respondents were not from one specific allocated group during the camp, nor were the cases.

Figure 2 shows that most cases (n=28; 88%) fell ill between the evening of Thursday 9 August and the afternoon of Friday 10 August. Two participants who reported symptoms (diarrhoea and stomach ache, and 1 reported also fever and a head ache) did not fit the case definition because their symptoms had started already on the 8th of August (morning and afternoon). The form of the epidemiological curve indicated a common point source as exposure.

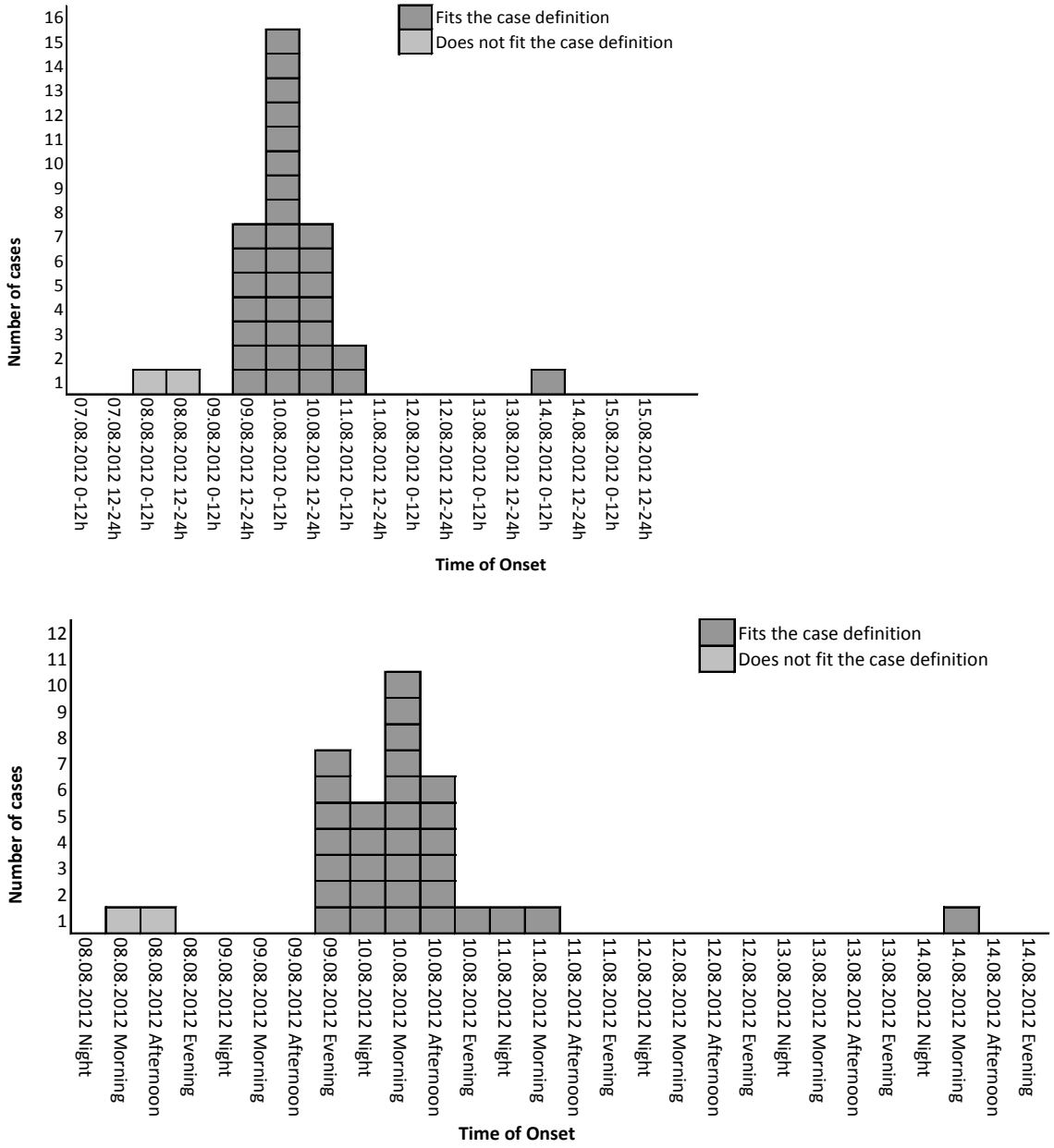

Figure 2: Distribution of date of onset of symptoms overtime. As it is convention to use a quarter of the incubation period as the unit of the epidemiological curve, and this period is unknown, we presented the epidemiological curve with 2 time units: Above: the unit which is used is 12 hours. Below: the unit we used is 6 hours (as was asked in the questionnaire). Note that 1 case whose symptoms started on 10 August did not know at which time point the symptoms had started. This case is presented on 10 August 0-12h / morning.

Clinical picture

The reported symptoms of cases who fitted the first broad case definition are presented in Table 1. Nausea (84%), vomiting (69%) and diarrhoea (59%) were the most common symptoms.

Table 1: Distribution of reported symptoms by cases fitting the first case definition.

Symptom	Frequency	Percentage of total
Nausea	27	84%
Vomiting	22	69%
Diarrhoea	19	59%
Stomach ache	16	50%
Fever	13	41%
Head ache	7	22%
Other non-specified symptoms	6	19%

The duration of the symptoms ranged from 1 day to 5 days, with the majority reporting 1 (22%), 2 (31%) or 3 (22%) days of symptoms. The ones fitting the second, narrower case definition reported a very similar distribution of symptoms and duration of symptoms (not shown).

Analytical study

Univariable analysis

Neither having been within 2 meters of someone vomiting, nor sharing a room with someone ill were associated with becoming a case (respectively, RR 1.04 [0.59-1.85], p=0.885 and RR=1.32 [0.72-2.41], p=0.391).

The number of cases and the attack rate by consumption of food items are presented in Table 2.

Table 2: Results of the univariable analysis using the first (broad) case definition. Only variables with a p value of <0.2 and which at least 50% of the cases had consumed are presented. Results are sorted by day of serving and from the most significant result to the least significant result.

	Exposed			Unexposed			% of cases explained	Univariable analysis	
	Total	Cases	AR%	Total	Cases	AR%		RR (95% CI)	P value
Daily breakfast									
Egg	33	16	48.5	63	16	25.4	50 %	1.91 (1.10-3.31)	0.023
Monday 6 August									
Blueberry	51	20	39.2	45	12	26.7	63 %	1.47 (0.81-2.66)	0.193
Tuesday 7 August									
Dressing Tuesday	36	19	52.8	60	13	21.7	59 %	2.44 (1.38-4.32)	0.002
Salad Tuesday	71	28	39.4	25	4	16	88 %	2.46 (0.96-6.33)	0.033
Hamburger	87	31	35.6	9	1	11.1	97 %	3.21 (0.49-20.79)	0.137
Wednesday 8 August									
Potato Wednesday	73	31	42.5	23	1	4.4	97 %	9.77 (1.41-67.65)	0.001
Fish cookies	72	29	40.3	24	3	12.5	91 %	3.22 (1.08-9.63)	0.012
Salad Wednesday	40	19	47.5	56	13	23.2	59 %	2.05 (1.15-3.64)	0.013
Cream (fromage)	55	22	40	41	10	24.4	69 %	1.64 (0.87-3.08)	0.109
Thursday 9 August									
Tomato Thursday	35	18	51.4	61	14	23.0	56 %	2.24 (1.28-3.93)	0.004
Rice with fish	58	24	41.4	38	8	21.1	75 %	1.97 (0.99-3.91)	0.039
Tortilla	84	31	36.9	12	1	8.3	97 %	4.43 (0.66-29.5)	0.05
Grated cheese	86	31	36.1	10	1	10	97 %	3.60 (0.55-23.64)	0.098
Salad Thursday	74	28	37.8	22	4	18.2	88 %	2.08 (0.82-5.29)	0.086
Jelly dessert	55	22	40	41	10	24.4	69 %	1.64 (0.87-3.08)	0.109
Vanilla sauce	53	21	39.6	43	11	25.6	66 %	1.55 (0.84-2.85)	0.147
Compound variables:									
Salad + Dressing Tuesday	72	28	38.9	24	4	16.7	88%	2.33 (0.91-5.98)	0.046
Dessert Thursday	56	22	39.3	40	10	25	69%	1.57 (0.84-2.94)	0.143

The univariable analysis shows that potatoes served on Wednesday had the highest RR (9.8, 95%CI 1.4-67.7), followed by the tortilla served on Thursday (RR=4.4, 95%CI 0.66-29.5). The attack rate was highest for the dressing served on Tuesday (53%) followed by the tomatoes served on Thursday (51%), egg served every day at breakfast (48%) and the salad served on Wednesday (48%). Most of the cases could be explained by having eaten potatoes on Wednesday, tortilla on Thursday, grated cheese on Thursday or hamburgers on Tuesday (all 97%). The suspected uncooked taco-sauce was not significantly associated with becoming ill (AR=41%; RR= 1.5 [0.76-2.96], p=0.221; 75% of cases and 62% of the non-cases had consumed the taco-sauce). For none of the significant food items we had asked the amount someone had consumed. We, therefore, did not conduct any analysis for a dose-response association.

Multivariable analysis

The result of the multivariable analysis is presented in Table 3.

Table 3: Results of the multivariable analysis. The results of the final model are presented for both, the first and the second (broad) case definition.

Exposure	**Used case definition**	**OR**	**(95% OR)**	**P value**
Potato Wednesday	Case definition 1	15.6	1.95-125.2	0.010
	Case definition 2	13.5	1.66-109.2	0.015
Tomato Thursday	Case definition 1	3.4	1.3-8.9	0.012
	Case definition 2	4.1	1.5-11.1	0.006

In all multivariable analyses (with the first or the second case definition, as well as when starting with all products selected based on significance and percentage of cases exposed, or only with selected products served on Wednesday or Thursday) the same food products remained in the multivariable model after model selection. The potatoes served on

Wednesday had the highest OR, followed by the tomatoes served on Thursday (see Table 3). Both products were statistically significant with a p-value of ≤0.015. Note that the 95% confidence interval of the OR for potatoes was very wide. The attack rate of the potatoes and tomatoes were 42% and 51%, respectively. 97% of the cases (96% of cases with narrow case definition) reported to have eaten the potatoes on Wednesday; only 1 case reported likely not to have eaten potatoes. 56% of the cases (61% of cases with narrow case definition) reported to have eaten tomatoes on Thursday; 8 cases reported not to have eaten tomatoes, 3 reported probably not to have eaten tomatoes and 3 did not answer the question on tomatoes, so we therefore assumed them also not to haven eaten tomatoes.

Estimation of time of exposure and incubation period
The estimated period of exposure assuming a norovirus outbreak was between Wednesday morning 8 August and Thursday evening 9 August. The estimated incubation period based on potatoes served on Wednesday evening was 36 hours.

Open comments of respondents of the cohort study
In total 22 of the 96 respondents answered the question what they thought what could be the cause of the outbreak. Eight respondents mentioned 8x tacos (including minced meat and taco sauce), 5 mentioned fish cakes and 5 mentioned grill sausages. One person suggested that it could not have been the tacos or grill sausages because these were served after someone at the camp had already become ill.

Microbiological investigation

Environmental samples
The taco sauce tested negative for norovirus. No samples were obtained from any of the cases. The test results of the water source showed good water quality (see Figure 3).

Parameter	Metode	Resultat	Enhet
Kimtall 22°C	NS-EN ISO 6222	**2**	/ml
E coli MPN	COLLIERT, Int. met.	**<1**	/100ml
Total Koliforme MPN	COLLIERT, int.met.	**<1**	/100ml
pH	NS 4720	**6,5**	
Turbiditet	NS-EN ISO 7027	**0,84**	FNU
*Fargetall	NS-EN ISO 7887	**7,5**	mg/l Pt

*) Laboratoriet er ikke akkreditert for denne analysen < betyr: Mindre enn

Figure 3: Laboratory results of the water of the private source.

Environmental investigations

Inspection of food services and manufacturing conditions
At the time of inspection of the food premises by the FSA, some preventive measures were already implemented. FSA did not find any serious objections to the cleanliness or hygienic routines in the kitchen. At all sinks and at the toilets, Antibac was available, and routines were implemented to use Antibac regularly on door handles or other contact points. Antibac was used additionally to liquid soap with paper towels.

The camp location has a private water source, and water is disinfected by UV treatment. FSA checked the supply and tested the water. The water had good bacteriological / physical quality.

While many products were bought readymade, the food handlers of the camp location reported to have prepared themselves the remulade and strawberry sauce for Wednesday, and taco sauce, jelly dessert and vanilla sauce for Thursday dinner. The food handlers reported that the potatoes served on Wednesday were cooked after peeling the same day and were served with dried Parsley, which was sprinkled on the potatoes using a jar. Food was served from a buffet – participants served themselves.

Interpretation

Conclusions

The outbreak investigation consisted of several parts. The environmental analysis did not find any serious objections, neither did the microbiological analyses. The descriptive analysis, specifically the epidemiological curve suggested a common point source of infection because of the clustering of cases in a short time period. The results of the analytical part of the cohort study indicate that the cooked potatoes served with dried parsley on Wednesday may be the source of the outbreak, which fits well the estimated period of exposure. Although the tomatoes which were served on Thursday were also a risk factor, the time between serving the tomatoes (dinner) and the onset of the outbreak was short. Sharing a room with a case or being less than 2 meters of someone vomiting was not associated with illness. The reported symptoms (>50% vomiting and diarrhoea [1]), the duration of illness (on average 1-2 days) and the estimated incubation time based on assumptions originating from the cohort study, fit well with a norovirus outbreak.

Despite the high OR with small p-value and the well-fitting timing of the outbreak with the potatoes as suspected exposure, the result may be found by chance. We initially analysed many different variables (n=71), which increases the likelihood of finding false positive findings. Furthermore, the survey was performed 10 days after the peak of the outbreak, which may have caused some recall bias. It should be known that some participants were already ill before the point-source outbreak started. These participants may have played an important role in the outbreak e.g. through contamination of the potatoes during self-serving / food-handling. Because of the shape of the epicurve, a common point-source was suspected; it is therefore less likely that the participants that were already ill earlier have infected all others at the same time. Although possible, a very high level of virus shedding as well as bad hand hygiene would have been required to explain person-to-person as main source of infection in this outbreak. The late case at August 14 may be the result of secondary transmission, possibly after the camp by a friend-participant, as virus shedding can occur for as long as 1 week after symptoms have resolved [3].

Before the cohort study was performed, it was hypothesised that the food-handler, who had been ill, could have been the source of the outbreak through contamination of the food. The food-handler did not work on the day that the suspected cooked potatoes were served, but came back to work on Thursday. Although the food handler had been at home for 48 hours after recovery of diarrhoea or vomiting following the national guidelines, we know that some people excrete virus in far more than 48 hours [3]. A role as source of infection by the food handler can therefore not be excluded. Because of the shape of the epicurve, a common point-source was suspected; it is therefore less likely that the participants that were already ill earlier have infected all others at the same time. Although possible, a very high level of virus

shedding as well as bad hand hygiene would have been required to explain person-to-person as main source of infection in this outbreak.

Implemented measures to stop the outbreak

To prevent further spread, or further outbreaks, the FSA recommended that food should be served on plates instead of at a buffet, which prevents contamination by participants during self-serving.

Recommendations for preventing similar situations in the future

In this outbreak, none of the cases had had a sample taken for laboratory confirmation. In this outbreak, none of the cases had a sample taken for laboratory confirmation. In possible future outbreaks, the responsible municipal doctor should ensure that at least some cases will deliver faeces to enable laboratory confirmation of the outbreak. In this outbreak, norovirus was suspected to be the cause. In order to reach a 90% probability of detecting a norovirus outbreak, at least 3 samples should be tested using RT-PCR, and 6 samples when using an ELISA [4]. Laboratory confirmation can guide the implementation of appropriate control measures. In this outbreak it was reported that washing with alcohol (Spiritvask) was implemented additionally to liquid soap with paper towels. It should be noted that washing with alcohol is not sufficient in case of a norovirus outbreak, so it was good that additional soap was available. Good hand and kitchen hygiene, including frequent hand washing with soap and running water, should be performed. While earlier advice has been given about the use of alcohol-based hand rub in case of a norovirus outbreak, new research shows that this does not prevent infection well enough [5]. In case of norovirus, mechanical cleaning with soap and water is particularly important to remove viruses (see Smittevernboka at www.FHI.no).

The importance of food-handlers staying at home until 48 hours after recovery of gastrointestinal illness should be emphasized. While the food-handler was sent home because of previous gastrointestinal illness, the food-handler may not have been aware of the 48h rule, as the food-handler came initially to work on Monday.

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Appendix: Questionnaire

Utbrudd av gastroenteritt på konfirmasjonsleir
Hei,
Takk for at du vil svare på denne spørreundersøkelsen! Det tar cirka 10 minutter å fylle ut skjemaet. Det er viktig at både de som ble syke og de som ikke ble syke svarer, da vi skal sammenlikne og se om de syke har gjort eller spist noe annet enn de som ikke ble syke.
All informasjon vi samler inn blir behandlet konfidensielt.
På forhånd takk for hjelpen!

1) Kjønn?
Mann
Kvinne

Det tre sniffede leirdeltakernummeret ditt finner du uten på konvolutten som brevet kom i, det står sammen med navnet ditt over til venstre.
2) Hva er ditt leirdeltakernummer?

3) Var du leder eller konfirmant?
Leder
Konfirmant

4) Hvilken gruppe tilhørte du?
Velg alternativ

SYKDOM
5) Hadde du omgangssyke (kvalme, oppkast eller diare i perioden 1 august til 14 august?
Ja Nei Vet ikke

6) Hvilke symptomer hadde du?
Diare
Oppkast
Kvalme
Magesmerter
Feber
Hodepine
Annet, spesifiser her

7) Hvilken dag ble du syk?

8) Hvilket klokkeslett ble du syk?
0-6 om natten
6-12 om morgenen
12-18 om ettermiddagen
18-24 om kvelden
Vet ikke

9) Hvor lenge var du syk?
0-12 timer
13-24 timer

25-36 timer
37-48 timer
>48 timer
Fortsatt syk

10) Ble noen i din familie syke med tilsvarende symptomer etter at du kom hjem?
Ja Nei Vet ikke

Hvis du fremdeles er syk eller noen andre i familien din, vil vi gjerne at dere leverer en avføringsprøve hos legen deres. På den måten kan vi finne ut hva slags bakterie eller virus dere har blitt syke av. Kontakt t i tilfelle Heidi Lange (tel …)

11) Oppsøkte du fastlege / legevakt i forbindelse med at du var syk?
Ja Nei Planlagt i dag

12) Leverte du avføringsprøve hos legen?
Ja Nei Ikke ennå, planlagt å gjøre i dag

13) Ble det funnet sykdomsfremkallende bakterier eller virus i prøven din?
Ja Nei Vet ikke

14) Hva ble funnet i prøven?

Neste spørsmål er om hva du har spist på leir

15) Hva spiste du vanligvis til frokost på leiren?

	Ja, hver dag	Ja, en eller noen dager	Nei	Vet ikke
Yoghurt				
Cornflakes				
Brød				
Knekkebrød				
Hvit ost				
Brun ost				
Skinke				
Salami				
Leverpostei				
Kaviar				
Mayonaise				
Egg				
Syltetøy				
Tomat				
Agurk				

16) Hva drakk du vanligvis til frokost på leiren? Angi ca hvor mange glass pr dag.

	Ingen	1	2	3	>3
Vann (inkl saft)					
Melk					
Juice					

17) Hva spiste du av kald mat til lunsj på leiren?

	Ja, hver dag	Ja, en eller noen dager	Nei	Vet ikke

Brød
Knekkebrød
Hvit ost
Brun ost
Skinke
Salami
Leverpostei
Kaviar mayonaise
Syltetøy
Blandet salat
Agurk
Tomat
Frukt salat
Dressing

18) Hva drakk du vanligvis til lunsj på leiren? Angi ca hvor mange glass pr dag.

Ingen	1 glass	2 glass	3glass	>3glass
Vann (inkl saft)				
Melk				
Juice				

19) Spiste du pytt-i-panne til lunsj mandag på leiren?

Ja	Sannsynligvis ja	Sannsynligvis nei	Nei

20) Spiste du betasuppa til lunsj tirsdag på leiren?

Ja	Sannsynligvis ja	Sannsynligvis nei	Nei

21) Spiste du varmrett til lunsj på onsdag?

Ja	Sannsynligvis ja	Sannsynligvis nei	Nei
Pasta			
Ost			
Urtesaus			

22) Spiste du risrett med fisk til lunsj på torsdag?

Ja	Sannsynligvis ja	Sannsynligvis nei	Nei

23) Hva spiste du til middag mandag på leiren?

Ja	Sannsynligvis ja	Sannsynligvis nei	Nei
Tomatsuppe			
Pastaskjell			
Pannekaker			
Blåbær			

24) Hva spiste du til middag tirsdag på leiren?

Ja	Sannsynligvis ja	Sannsynligvis nei	Nei
Hamburger			
Salat			
Dressing			
Båtpoteter			
Skåret melon			

25) Hva spiste du til middag onsdag på leiren?

Ja	Sannsynligvis ja	Sannsynligvis nei	Nei
Fiskekaker			
Råkost			
Remulade			
Potet			
Fromage			
Jordbær saus			

26) Ca hvor mange skjeer remulade spiste du?

1 2 3 >3 Vet ikke

27) Ca hvor mange serveringsskjeer jordbærsaus spiste du?

1 2 3 >3 Vet ikke

28) Hva spiste du til middag torsdag på leiren?

Ja	Sannsynligvis ja	Sannsynligvis nei	Nei
Tortilla lefser			
Kjøttdeig			
Revet ost			
Salat			
Tomat			
Agurk			
Løk			
Mais			
Rømme			
Dressing			
Salsa (tacosaus)			
Gele			
Vaniljesaus			

29) Ca hvor mange skjeer salsa (tacosaus) spiste du til sammen på tacoene dine?

1 2 3 >3 Vet ikke

30) Ca hvor mange glass vann (inkl saft) drakk du per dag til middag på leiren?

1 2 3 >3 Vet ikke

31) Hadde noen av de du delte rom med omgangssyke i løpet av leiroppholdet?

Ja	Sannsynligvis ja	Sannsynligvis nei	Nei

32) Var du i nærheten (<2 meter) av noen som kastet opp?

Ja Nei

33) Hva tror du selv hva var årsaken til at så mange ble syke?

34) Har du noen kommentarer?