ARTIGO ORIGINAL / *ORIGINAL ARTICLE*

Calicivirus outbreak in a primary school in northern Portugal

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/ Resumo

Investigámos um surto numa escola primária, num município do Norte de Portugal. Os sintomas mais frequentes foram vómitos, dores abdominais e diarreia, afectando crianças e profissionais da escola. Com base no dados iniciais, levantámos a hipótese de se tratar de uma toxinfecção alimentar pela toxina estafilocócica, devida a um alimento contaminado, consumido num dos almoços, nos dias 18 a 20 de Setembro de 2006. Os dados epidemiológicos e laboratoriais levaram-nos a rejeitar essa hipótese. Formulámos então nova hipótese segundo a qual o surto teria resultado da infecção por vírus da família *caliciviridae*, o que veio a ser confirmado por estudo microbiológico. A evidência epidemiológica deverá ser ajuizada com cautela, por causa da potencial influência do viés de memória: este viés típico pode ter afectado a validade da informação resultante dos questionários feitos à comunidade escolar. Contudo, suspeitamos que as toalhas de secar as mãos, de pano, de uso colectivo, possam ter desempenhado um papel importante na disseminação da doença na comunidade escolar.

Palavras-chave: surto; *caliciviridae*; toalhas; escola.

/ Abstract

We investigated and outbreak in a primary school in northern Portugal. Vomiting, abdominal pain and diarrhoea were the most common symptoms, affecting children and adult staff members. Based on initial data collection, we hypothesised that this situation might be a staphylococcal food intoxication outbreak due to the consumption of a food item at lunch time, in one of the days 18 to 20 September 2006. We rejected that hypothesis based on epidemiological and laboratory evidence. We than tested the hypothesis that the outbreak might have been due to infection with caliciviridae viruses, which was confirmed by the microbiological study. Epidemiological evidence must be accessed with extreme caution, most of all because recall bias is likely to have affected the validity of results drawn from questionnaires. Nevertheless, we suspect that terry cloth towels might have played an important role in the spread of the disease.

Key-words: *outbreak; caliciviridae; towels; school.*



/ Introdução

We believe that reporting this outbreak may be useful for the action of other local public health services, in Portugal and elsewhere, because some particular aspects are very illustrative of the potential successes and drawbacks of public health intervention. The risk factors had been identified and recommendations had been made in order to make the appropriate changes. But, if risk factors are not perceived as a real risk, than the recommendations of public health services are not taken into account unless outbreaks occur. Furthermore, the outbreak investigation is illustrative of typical features of field epidemiology activities: the classical methods and steps were followed; initial hypothesis can be rejected and lead to new ones; recall bias can be an issue in questionnaires, especially when small children behaviours are being accessed. Most of all, we would like to help convincing school staff, parents and other professionals that terry cloth towels are a potential hazard in schools.

/ To determine the existence of the epidemic

In the afternoon of 20 September 2006 the local health authority (LHA) of the municipality of Vila Nova de Famalicão (VNF), in the north of Portugal, was informed by the head teacher of a primary school that several children and a teacher had become ill and presented at a local hospital. The hospital also phoned the LHA informing that several children had attended the outdoor clinic in that afternoon with mild illness which included vomiting and diarrhoea in most cases. The hospital physician was asked to tag the clinical records for further study and to collect vomit and stool samples. We designed a strategy to conduct a field investigation (1) and initiated the preparation of operational aspects for the following day, like transportation for the field team, allocation of tasks to the LHA staff and contact with the public health laboratory (National Institute of Health – NIH).

/ First visit to the school premises

In the morning of 21 September the outbreak investigation team visited the school to collect preliminary data and inspect the school premises. It was not possible to define and count cases. After a

TABLE. ATTACK RATES BY CLASSROOM

Groups of children by classroom / staff	Total	Cases	AR %
Group 1: children aged 8.9 -10.6 years	16	7	44
Group 2: children aged 7.9 - 8.8 years	*17	7	41
Group 3: children aged 8.7-10.6 years	20	8	40
Group 4: children aged 2.9 - 5,7 years.	17	11	65
Staff members	10	3	30
Total	*80	36	45

AR = attack rate

* = it was not possible to interview or collect other relevant data from one child

month holiday period, the primary school had reopened on 18 September. Tap water in the school was supplied by the public municipal system which was informed of the outbreak, on the 20 September, and immediately made an extra measurement of residual chlorine concentration: this found that chlorine levels were adequate. Meals were served daily in the school and were delivered at 11.45 am in containers by an external catering company. The name and address of the company were recorded and sent to a neighbour municipality LHA for inspection of premises and procedures. Because of the size of the canteen and the number of children, lunch is served in three sittings, between 11.45 am and 01.00 pm. A complete list of all food items consumed from 18 to 20 September was provided. Dishes and other utensils were hand washed by canteen staff members.

The most recent routine hygiene inspection at the school had been carried out on 8 March 2006, and reported the following problems: hand soap and terry cloth towels were used by children and staff to wash and dry their hands; three square towels, each of them next to different sinks were used by all children and staff members. The school had two toilet areas, each with a sink for hand washing, and another basin in an *atrium* next to the classrooms.

A staff member of the LHA went to the hospital to confirm and collect additional data. From the consultation of the clinical records, it was concluded that 16 children (out of the total of 71) from the school, aged 7 to 10 years, attended the hospital on the 20 September, plus two staff members aged 21 and 51. All had mild symptoms and were discharged from hospital in a good clinical condition after treatment was given or prescribed. Sudden onset of abdominal pain, vomiting and diarrhoea were the most frequent symptoms. No samples were collected, but containers were given to 3 patients to collect stool samples.

The school staff included 4 teachers and 6 support staff members, aged 21 to 64 (all women). Seventy one children attended four groups, each in a different classroom (Table).

Rice and fried fish samples were collected from the left over's of the lunch of the 20th. These and stool samples from three patients that had attended the hospital on the previous day, were transported to the NIH in that morning.

The head teacher, staff members, a representative of the parents committee and the elected leader of the local borough, met in the school with the LHA, and were informed of the urgent need for strict hygiene precautions and the exclusion from school of symptomatic people.

/ Development of a hypothesis and strategy to test it

By the end of the morning of the 21 September, based on the described signs and symptoms, the short incubation period (Figure), we hypothesised that this situation might be a staphylococcal food intoxication (2) outbreak due to the consumption of a food item at lunch time, in one of the days 18 to 20 September 2006. While waiting for the microbiological results we decided to interview all members of the school community and developed a specific questionnaire covering signs and symptoms and all food items consumed on days 18 to 20. On 22 September four professionals of the LHA conducted the interviews at the school. Some parents of children who did not attend school that day were later interviewed by telephone. In the end, with the exception of one child, all school members (or their parents), were interviewed (n=80). The missing child was excluded from all further analysis.

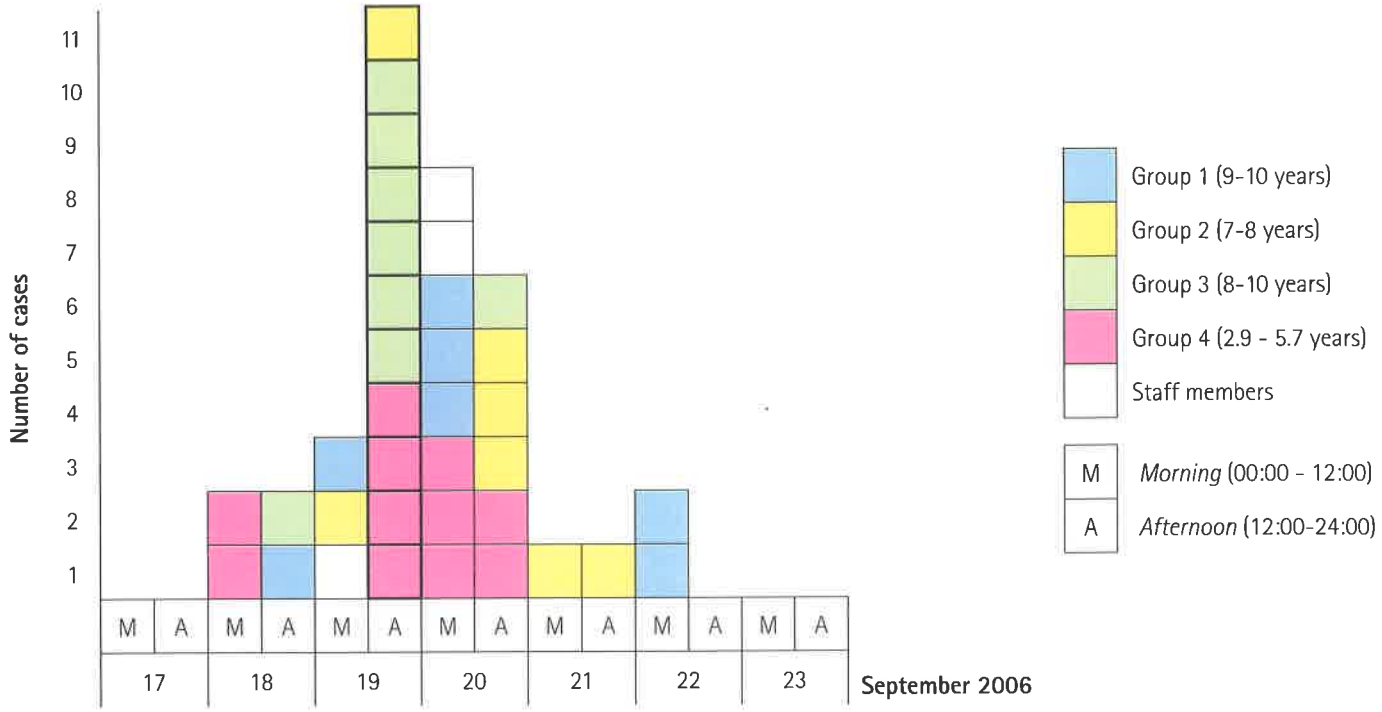

Figure – Dates of illness onset for 36 cases in an outbreak in a school in the north of Portugal, in September 2006

/ Data analysis and first interpretation of data from the questionnaires

Epi Info software (3) was used for data entry and analysis. Preliminary analysis was done between 25 and 29 of September. Initially, by self assessment, 45 children and staff members reported having been ill. After revising the signs and symptoms reported in the questionnaire we decided to choose a case definition, based on clinical information, while waiting for the lab results. A case was defined as an episode with two or more symptoms, one of which was vomiting or diarrhoea, and date of onset had been in the period 18-22 September 2006. This led to the exclusion of some cases of self-reported illness.

Based on this case definition 36 episodes were classified as cases. The most reported symptoms were vomiting (83%), abdominal pain (83%), diarrhoea (47%) and headache (44%). The staff reported that none of the episodes of vomiting occurred inside the school premises, but when interview data was reviewed, four children said that they had vomited during school hours. The overall attack rate in the school was 45% (36/80). The highest attack rate (AR) was observed among the youngest children (Group 4) and the lowest among the staff members, but those differences were not statistically significant (Table).

The onset of most cases (77%) was reported to have occurred during the 19 and the 20 September (Figure). The first two cases were in a brother and sister aged 3 and 5 years. These children had vomiting between midnight and 04.00 am on 18 September and developed watery diarrhoea some hours later; the questionnaire recorded that their mother had also vomited around the same time as the two children. Neither child had eaten lunch during the period 18 to 20 September, but had drunk milk distributed in the school.

Having had lunch at school did not increase the risk of becoming ill. No statistically significant association was found between food items consumed in the school and being a case. Food handlers showed no signs of skin wounds or infectious lesions.

Based on this information we discarded the original hypothesis and raised a new one that the outbreak may have been due to a norovirus infection. By this point no pathogenic bacteria or toxins had yet been identified by the laboratory. Small quantities of processed stool samples from three patients were available and sent to the virology lab (NIH), to search for astroviruses and caliciviruses. We also decided to visit the school again, in order to reinforce hygiene precautions and collect information to test the new hypothesis and assess a likely mode of transmission.

/ Second visit to the school

The investigation team visited the school again on 6 October, and re-interviewed the 5 years old girl who had been one of the two primary cases in the school. We were able to trace part of the events of the morning of 18 September, when she went to the girl's toilet to defaecate, than washed her hands in the sink (without drying) and went to the canteen area 20 metres away to dry her hands on the terry cloth towel next to another sink. The auxiliary staff and the teacher of the other co-primary case (a 3 year old boy) did not remember whether he had visited the toilet on morning of the 18 September.

A number of additional cases became ill during the week after our first visit but we could not get precise information on that.

We informed the head teacher and other staff members of the norovirus hypothesis and the need to reinforce hygiene precautions, and to replace the terry cloth towels with disposable paper towels. A copy of the written report on the premises was handed over to her. The teachers were asked to interview the children on hygiene habits in the school on the days 18 and 19 September, specifically to find out if and where they had washed and/or dried their hands.

/ Microbiological results

On 13 October 2006, we were informed that no pathogenic micro-organisms, known to be associated with foodborne outbreaks had been isolated in the food items studied. On the 23 October 2006, it was reported that the three stool samples had been found positive by RT-PCR for *caliciviridae* family and negative for *astroviridae* family. The technique was not able to identify the genera *noroviridae* within the *caliciviridae* found. Bacteriological results from the stool samples that had previously reported by telephone, were received on the 14 November 2006: staphylococcal enterotoxin was not detected.

/ Results from the interview on hygiene habits

The questionnaires on hygiene habits on the 18 and 19 September were sent by the school on the 8 November. The teachers conducted the interviews and filled the questionnaires for the children of groups 1, 2 and 4; students of group 3, filled the questionnaire themselves. No data was available from adults. The data from 68 questionnaires, including 34 cases was analysed using Epi Info (3).

Fifty one (75%) children reported that they had washed their hands in sink at the school on the 18 September and 54 (79%) on the 19 September. On both days, all the youngest children (Group 4) washed their hands in the lavatory sink in the canteen and used terry cloth towel hanging next to the sink to dry their hands. Children from other groups reported different combinations of places to wash and dry their hands after it.

Hand-washing in school premises on the 18 September was associated with an increased risk of getting ill (P=0.0008), but no association was observed with the sink used (P=0.47) or drying the hands on terry cloth towels (P=0.72). On the 19 September, none of these variables were associated with the disease.

/ Discussion

The validity data from the questionnaire on the use of sinks and towels is very limited because of recall bias, and statistically significant associations observed must be assessed with extreme caution, but the data obtained enables some conclusions and likely explanations for what happened to be made.

An outbreak of a mild disease caused by a virus from the *caliciviridae* family occurred in the school community, similar to outbreaks observed elsewhere (4,5). The virus was probably introduced in the school by two siblings (brother and sister) on the morning of 18 September and spread very rapidly. We can not know the importance of the unapparent infections in this outbreak (2).

From the possible modes of transmission described in the literature (2) we can discard foodborne and waterborne transmission. Indirect transmission through contaminated objects in toilets (for e.g. door handles, taps and towels) seems to have happened but, as said before, the validity of available questionnaires is weak. Although we found nothing in the literature reporting an association between the use of terry cloth towels and infection with *caliciviridae* viruses, these objects have previously been identified as potentially hazardous for the transmission of other infections (6), so the possibility that they played a role in the mode of transmission cannot be excluded. Taking into account the rapid spread, the fecal-oral route, direct contact and airborne transmission from fomites cannot be ruled out. As in other outbreaks (7), vomiting may also have had a role in the transmission.

Unlike other settings with younger children (4) the adult staff members were not particularly affected. The higher attack rate (statistically not significant) among the youngest group could be explained by immunity in older children and adults, or mode of transmission.

This outbreak also illustrates the difficulties in convincing school staff and local boroughs on the importance of hygiene practices and appropriate material, particularly adopting disposable towels. Despite systematic visits by the LHA staff, followed by teaching sessions and written reports with recommendations, this type of outbreak, which might have been prevented or limited, can still happen.

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