Challenges in investigating transient rash illness in nursery children

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ABSTRACT

Introduction In October 2007, the Thames Valley Health Protection Unit (TVHPU) was notified by a parent that her child developed a transient rash after eating lunch at a nursery in Oxfordshire. An initial investigation undertaken by TVHPU was escalated when similar incidents were reported in nurseries in other parts of England.

Methods A detailed epidemiological and food tracing investigation was conducted to ascertain the aetiology.

Results Investigations revealed 11 incidents affecting 164 children between July and November 2007 in six nurseries operated by two companies. The symptoms included a transient rash around the mouth and hands of children who ate meals prepared on site by the nurseries. Consumption of the lunch main course appeared to be a strong aetiologic factor. Expert opinion pointed to biogenic amines (e.g. histamine) as a possible cause for the symptoms displayed, but there was insufficient evidence to support testing of food samples.

Conclusion The incident highlighted significant gaps in reporting of unexplained symptoms among children in nurseries, indicating that such incidents do not always come to the attention of public health authorities. Timely notification to HPUs will enable prompt investigation, increase the likelihood of identifying the cause and inform appropriate responses to prevent future incidents.

Keywords chemical contamination, children, day care centres, epidemiology, outbreak, rash illness

Introduction

Children attending day-care centres are known to be at higher risk of food-borne illnesses due to the difficulties in maintaining good food safety and hygiene practices.¹,² The majority of outbreaks at child-care centres of food-borne diseases tend to be of infectious origin.³ Outbreaks due to non-infectious causes are rare, but probably are under-recognized and under-reported. In this report, we discuss the investigation of several incidents of transient illness among children attending in nurseries across England, caused probably by a food-borne non-infectious agent, with particular emphasis on the epidemiological findings and the challenges faced.

The index case was reported to the Thames Valley Health Protection Unit (TVHPU) by a parent whose 18-month-old child developed a transient rash after eating lunch prepared at a nursery in Oxfordshire. Enquiries with the nursery management identified similar incidents affecting more children in other nurseries operated by the same chain, prompting the initiation of a full-scale investigation.

Methods

In order to develop a consistent case definition, we elicited the clinical history of signs and symptoms in the affected children from parents and nursery staff who witnessed the rash. For the epidemiological investigation, a case was
defined as a child who developed any form of rash closely related to a meal in the nursery setting in 2007.

To describe the extent of the incident within the nursery, a structured line listing of cases was requested from the nursery staff along with information on denominator populations. To identify similar incidents in other nurseries, an alert was cascaded within the nursery chain by its central management, in Environmental Health departments of Local Authorities by Environmental Health Officers (EHO) and throughout the Health Protection Agency (HPA) via the Incident Reporting Information Service (IRIS) system, an internal system for alerting and communication of significant health protection incidents to senior staff within the agency. Considering the likelihood that similar incidents would have been reported by child-care establishments to the Office for Standards in Education (Ofsted) in the past, attempts were made to request such information directly as well as under the Freedom of Information Act (FOIA) 2000.

To identify the aetiological agent, the pattern of involvement across nurseries and the time course of reported incidents were reviewed. In the absence of photographic evidence and clinical review by healthcare personnel due to the transient nature of the symptoms, the opinions of dermatologists, immunologists and microbiologists were sought regarding a possible aetiology based on reported signs and symptoms. EHOs and HPU staff considered the various potential exposures in nurseries by site visits and eliciting histories from managerial, caring and catering staff. The Food Standards Agency (FSA) and Meat Hygiene Service (MHS) investigated food chain tracing and inspected premises of involved suppliers.

An Incident Control Team (ICT) was established with expert advice provided from the Environmental Health team, Chemical Hazards and Poisons Division (CHaPD) of the HPA, FSA and other parts of the HPA. The ICT directed the investigations and reviewed results in teleconference meetings and round-robin email exchanges.

Results
Description of symptoms
The typical presentation was a transient rash around the mouth, eyes and hands of children occurring within approximately 30 min of eating a meal prepared on the nursery premises. None reported systemic symptoms or rash in areas not in contact with the food. To the best of our knowledge, the rash lasted no more than 2 h and was not accompanied by clinical sequelae, except in the index child where two episodes of mild vomiting were described. The descriptions of rashes from nursery care staff who saw them varied considerably (e.g. blotchy, red patch, hives). None of the children were formally assessed by a healthcare professional in view of the transient nature of symptoms.

Active case finding
As a result of information cascaded within the nursery chain A, the HPA IRIS system and EHO circulars, 10 further incidents were reported (Fig. 1). The initial direct request as well as the subsequent request under FOIA to Ofsted to provide information on similar incidents reported from nurseries or schools did not elicit any further useful data as Ofsted did not hold the information in the requested format.

Descriptive epidemiology
Investigations identified 11 incidents across the country between July and November 2007, affecting 164 children in six nurseries operated by two different companies, A and B. Figure 1 shows the epidemic curve. In chain A, children in four nurseries were affected on 24 October 2007. A further three incidents on 13 November 2007 were reported from the same chain, of which two (Hampshire and Sussex) had been involved in the earlier cluster on 24 October 2007. A single nursery operated by chain B was affected on 27 September and 11 October 2007. The attack rate was in the range of 1–10% in nursery chain A, whereas it varied from 20 to 90% in nursery chain B. There was however substantial variation in the attack rate across rooms within nurseries as well as across nurseries. The ages of

![Fig. 1 Epidemic curve of transient rash illness in nursery-attending children in England, 2007.](https://academic.oup.com/jpubhealth/article-abstract/32/2/173/1606983/174)
affected children ranged from 6 months to 5 years. The age distribution of affected children in selected nurseries where full epidemiological information was available is given in Fig. 2, which showed no preponderance for any specific age group. One adult who consumed the meal was noted to have transient symptoms in nursery chain B. There were no reports of similar illness in other adults, particularly food handlers either at the nursery or at the food preparation sites.

### Aetiology

The four reported incidents that occurred on 24 November 2007 in chain A were the focus of extensive investigations as the clustering of cases was associated with marked similarities in the food menu and common suppliers. EHO inspections and discussions with nursery management confirmed similar food menus used in nurseries. Consumption of the main lunch course seemed to be a strong candidate for causing these symptoms in view of common suppliers for meat and vegetables. All affected children developed symptoms during or shortly after the meal and never before. There was some evidence to suggest that vegetarian children were not affected. However, the small numbers of unaffected vegetarian children were well within the variable attack rates within each room and across nurseries. Expert opinions were sought from microbiologists, dermatologists, paediatricians, immunologists and toxicologists on the possibility of chemical agents such as biogenic amines (e.g. histamine) or bleaching agents causing the symptoms due to contamination at the level of food suppliers. Given the transient nature of local symptoms without any associated features and the effect of heating the meal at the nursery prior to intake, these were considered unlikely to cause the symptoms displayed. Infectious causes were considered very unlikely in view of the close time correlation to meal intake, the transient duration and trivial nature of symptoms.

During site investigations undertaken at the affected nurseries, EHOs and HPU staff assessed food history and other exposures around meal time such as chemical wipes, face cloths, cotton wipes and cleaning products. Non-food exposures were discounted due to lack of a common link between the affected nurseries and the absence of time correlation following exposure. Additionally, there were no significant changes made in the supply of cleaning products by the nursery chain in the period immediately prior to and after the first reported incident.

### Food investigations

Nursery staff denied any unusual quality of the food in terms of odour or colour. No children were reported to have refused their meal due to strange smell, taste or colour. Food and cleaning products were ordered centrally by the management for all nurseries in the chain. Inspection of one of the meat distributor’s premises by the MHS highlighted glycolic acid and cationic surfactants coming in contact with raw chicken, but this was not considered relevant to the symptoms displayed. Minor concerns in food handling and preparation were noted during inspection of another supplier, but the overall conclusion was that no definite cause could be identified. The meat and vegetable suppliers had an extensive supply chain with products delivered to numerous customers across the country. This limited the ability to undertake investigations to identify if any concerns were raised by other consumers. No reports of illness were received from other locations by the HPA or FSA or food suppliers, although active efforts were not made to confirm this by contacting all recipients and consumers. The main meals provided to the children at Nursery chain B were prepared at a hospital kitchen on site, which also supplied to patients and staff at the hospital canteen. The hotel services manager for the hospital confirmed that no reports of similar illness amongst patients or staff were received for the two incident dates. Testing of food samples was not undertaken, mainly based on expert advice from the FSA and CHaPD that testing would not provide any useful information due to a lack of plausible explanation of these chemicals to cause such transient symptoms. Although it did not affect the decision to test, there was a lack of clarity regarding payment of costs of food analysis among the agencies involved (whether FSA, HPA or Local Authorities).

### Outcome

After the four incidents on 24 October 2007, the nursery management A informed us that they had voluntarily decided to change their supplier of meat and vegetables. 

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![Fig. 2 Age distribution of affected children in five nurseries with transient rash illness in England, 2007.](https://academic.oup.com/jpubhealth/article-abstract/32/2/173/1606983/175)
However, further incidents were reported from three nurseries operated by the same management on 13 November 2007. In this instance, the meat component in the same food menu was changed from chicken to turkey and the food suppliers had not been changed yet. No further incidents have been reported to the TVHPU to date.

**Discussion**

**Main finding of this study**

As a result of investigations following a seemingly benign report from a parent, we identified 11 incidents or 'outbreaks' affecting 164 children with transient rash illness across two nursery chains between July and November 2007. Identification of previous similar incidents confirmed low sensitivity of the current system to identify such incidents. Staff working in child-care settings appeared to be unaware of the need to inform public health authorities when there was a clustering of unexplained symptoms among children.

Tight epidemiological clustering of cases in time in a particular nursery chain with strong circumstantial evidence for consumption of the lunch main course as the most likely risk factor suggested that a chemical contamination might have been responsible for the symptoms in children. Overall, the multiple incidents predominantly affected children except for the one adult who consumed the meal and developed symptoms. The transient nature of the skin reaction, lack of systemic symptoms and low attack rates suggested low levels of exposure to the potential causative agent, though information was inadequate for a dose-response assessment.

During the course of this investigation, additional information on similar incidents would have been useful to understand the epidemiology and identify the potential aetiologies. However, our requests to Ofsted directly as well as under the FOIA 2000 were unsuccessful in obtaining the relevant information. The incident highlighted the need for better working arrangements and information sharing between Ofsted and public health authorities to identify and respond to similar incidents in the future.

The need for widening surveillance by cascading information to child-care establishments and related groups was considered. However, this had to be justified against the potential to cause anxiety among parents, especially since the nature of the illness was noted to be trivial and the failure to identify the aetiology of symptoms. Due to the wide geographical dispersion of affected nurseries, it was felt that any subsequent campaign to improve awareness among staff and parents would require significant resources and efforts.

Child-care establishments and school managements do not appear to have a statutory duty of reporting unexplained clusters of illness among children to public health authorities, although this would be ideal. The existing legal requirements on notification of specified infectious diseases under the Public Health (Control of Disease) Act 1984 and the Public Health (Infectious Diseases) Regulations 1988 are applicable to medical practitioners only. Similarly, the managers of food suppliers are required to notify infectious diseases among workers under food regulations. In the absence of legal requirements, it would be helpful to provide child-care establishments and schools with a reliable, working case definition for identification of unexplained illness among children and the criteria for reporting to public health authorities if there was clustering of such illness. However, agreement on policies and procedures for recognition and reporting requires debate and discussion among experts and relevant stakeholders. This investigation was presented at a scientific conference (Five Nations conference 2009) for health protection professionals to share the lessons learned and to highlight the identified issues.

**What is already known on this topic**

Of particular relevance to this incident, a report published in the USA described strikingly similar symptoms among older children attending schools across 27 states over a 9 month period in 2001–2002. Detailed investigations conducted by local and national public health authorities failed to identify a source and the aetiology remains unexplained. The final report acknowledged the difficulties in investigating illnesses of transient duration among children in educational settings.

Biogenic amines such as histamine are known to cause short-lasting symptoms such as an oral burning sensation, hives, itching, red rash, nausea, vomiting, diarrhoea, palpitations and hypotension. However, in this instance, except for the index case, all other children had transient skin reactions only without any accompanying signs or symptoms. In addition, the meat products implicated in the main meal in all the incidents were chicken or turkey or beef, which were thought to be very unlikely sources for histamine-like poisoning. Bleaching agents might cause allergic reactions on the skin due to local irritant effect on contact, similar to what was observed in children in this incident. However, even if bleaching agents were present in the food products due to accidental contamination at the level of the main food supplier, expert opinion confirmed that they would be denatured by cooking prior to consumption.
What this study adds

Our investigations identified 11 incidents or ‘outbreaks’ of multiple children developing transient rash illness across two nursery chains in England in 2007. The incident demonstrated gaps in current surveillance in child-care settings, as none of the 11 incidents were reported by the nurseries directly to public health authorities. No definite cause was found despite extensive investigations. Taking all findings into account, consumption of a lunch time meal prepared on site was the only common risk factor. As the cause for symptoms has not been identified and removed, there is a potential for similar incidents to occur in the future.

This study also highlights the difficulties faced with investigating a cluster of transient illness as delays in reporting and the lack of exposure data hampered the ability to confirm or exclude any of the hypothesized causes. Furthermore, there was some disagreement between the agencies involved (HPA, Local Authorities, FSA) over whether testing of food samples was appropriate and which organization should pay the costs of testing food samples. The costs of testing of the frozen food samples for all the potential chemical agents were quite considerable and given the lack of conclusive evidence for these chemicals agents to cause such transient symptoms, analysis of food samples for selected chemicals was not conducted.

Limitations of this study

A major challenge of the investigation was the difficulty in agreeing a clear case definition due to the transient nature of the rash and varying descriptions given by witnesses. During the course of the investigations, it was recognized that any water-tight case definition would have limited sensitivity and specificity to classify cases and non-cases. The four incidents on 24 October 2007 appeared to be strongly linked in time and place. Further incidents before and after this cluster might have been unrelated to the original cluster and could have had a different aetiology, although there was reasonable evidence to conclude that they were in fact linked.

There was often a delay of several days in reporting these incidents to the relevant public health authorities, resulting in the loss of critical information such as exposure histories for individual children and disposal of food samples. These challenges resulted in the inability to undertake a formal analytical study to assess exposures and outcomes. Consequently, the opportunity to identify any potential chemical agent in the food source was lost and therefore laboratory confirmation of contamination could not be obtained.

Conclusion

The responsibility for, and means of, reporting of incidents with clustering of unexplained symptoms in children needs to be improved by better guidance from public health and regulatory authorities to child-care establishments and schools. Implementation of such a system would be beneficial in identifying potential adverse effects of common exposures that are unique to child-care settings such as new toys, play equipment or hygiene practices. Agreement on the responsibility for covering the costs of any required analysis must be reached among the key agencies. Continued vigilance and thorough investigations of future incidents might lead to successful identification of aetiologies leading to implementation of appropriate control measures to protect the health of children.

Acknowledgements

We would like to thank colleagues in the relevant Health Protection Units, Environmental Health departments and Food Standards Agency for their support during the investigation.

References

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