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# Editorials

## Malaria in travellers to Gambia

**Z Bisoffi (zeno.bisoffi@sacrocuore.it)**[1]
1. Centre for Tropical Diseases, S. Cuore Hospital, Negrar, Verona province, Italy

Malaria incidence is reportedly declining steadily in many parts of the world, including in at least several African countries [1-3]. The incidence of imported malaria is also declining in a number of European countries [4-6]. However, incidence rates in travellers, both European tourists and the so called VFR (visiting friends and relatives) are difficult to estimate, due to problems with the numerator (many cases are not reported) and more importantly with the denominator, for which the information is generally lacking. An exception in the European Union is the United Kingdom (UK), where the International Passenger Survey provides a reliable denominator on the number of travellers to the different countries, duration of stay and reason for travel. Using this information and data on malaria notifications, British authors were recently able to show a steady decrease in the incidence rate of imported malaria from West Africa [6]. In their publication the authors comment that this trend is likely to mirror a true reduction in local malaria transmission, and argue that in some years guidelines on malaria prophylaxis might become less strict even in that part of the world, as it has already been proposed for other continents [7,8]. This time, however, has yet to come. The current issue of Eurosurveillance features two rapid communications about an unpredictable cluster of cases of falciparum malaria among European tourists returning from Gambia [9,10]. The first case reported from Denmark in November 2008, triggered a subsequent flow of notifications from other countries in Europe. Interestingly, many of these are northern European countries. Finland alone accounts for almost one quarter of the total cases. The Finnish cases are described and discussed in detail in the paper by K Valve et al. in this same issue [10]. The UK was the only country reporting more cases than Finland, which is not surprising, as many thousands of travellers from this country visit Gambia every year [6].

It is remarkable that as of 18 December, only three weeks after the first case was noted, we are able to discuss this cluster. Clearly, this would not have been possible with surveillance systems based on mandatory notifications. This emphasizes the usefulness of networks of clinicians such as TropNetEurop that can disseminate information among members very quickly; a characteristic feature that has helped to discover local epidemics of malaria and other tropical diseases in tourist resorts [11,12] before they were picked up by local reporting systems.

To date it is not entirely clear if the cluster represents a true increase in local malaria transmission in Gambia, in contrast to a very recent report [3], or rather a coincidence that cheap (last minute or similar) tourist package holidays to Gambia are offered in several European countries. In connection with such travel, the risk of the disease is often clearly underestimated which results in large numbers of people travelling with no or with ineffective prophylaxis. The Finnish paper, however, indicates that the first hypothesis may be true. The authors state that there is only one travel agency organising package trips to Gambia, and that the number of travellers has not increased. However, no information is available on the use of prophylaxis in previous years [10]. Most patients in the cluster were tourists, while in general, in recent years, VFR accounted for the majority of malaria cases in many (albeit not all) European countries [5]. Gambian coastal and tourist area is comparatively small, and therefore a cluster in tourists might represent a local rather than a countrywide increase in transmission, although the latter cannot be ruled out. I assume that this aspect will soon be elucidated after more in depth evaluation of the situation by local authorities.

Apparently, the Finnish travel agency reacted in a very responsible way to the first notice of an increased malaria risk [10]. Unfortunately, the experience of experts in travel medicine shows that this is not always the case. Several patients in this cluster were counselled not to take any prophylaxis [9]. Lack of prophylaxis caused at least two avoidable malaria deaths and several severe cases requiring intensive care, one case is still suffering from neurological sequelae.

The outbreak emphasizes once more the need to maintain adequate awareness of malaria, even for tourist destinations where this risk is considered to be low or very low: I believe that European countries should consider possible legal implications in cases when travel agencies provide misleading messages.

Health professionals dealing with travel medicine should be aware of the fact that local malaria epidemiology may suddenly vary in countries, and unexpected occurrences should be immediately notified. Sources like TropNetEurop, Geo Sentinel, Promed, Eurosurveillance and others provide invaluable and timely information that is freely available and should be regularly consulted by all professionals giving travel advice.

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# Denmark: Botulism in an infant or infant botulism?

**A Pærregaard (anders.paerregaard@hvh.regionh.dk)[1], Ø Angen[2], M Lisby[3], K Mølbak[4], M E Clausen[5], J J Christensen[5]**

1. Department of Paediatrics, Hvidovre, Denmark
2. Section for Bacteriology and Pathology, National Veterinary Institute, Technical University of Denmark, Copenhagen, Denmark
3. Regional Veterinary and Food Control Authority East, Copenhagen, Denmark
4. Department of Epidemiology, Statens Serum Institut, Copenhagen, Denmark
5. Department of Bacteriology, Mycology and Parasitology, Division of Microbiology and Diagnostics, Statens Serum Institut, Copenhagen, Denmark

A 4.5 months old, previously healthy Danish girl was admitted to a paediatric department after six days of passive behaviour and weak suck. Over the next days she became increasingly weak, developed bilateral ptosis, the muscle stretch reflexes were lost, and mydriasis with slow pupillary responses was noted. Botulism was suspected and confirmed by testing of patient serum in a bioassay. The condition of the patient improved following administration of botulism antiserum. The clinical picture was suggestive of intestinal (infant) botulism. However, botulism acquired from consumption of food with preformed neurotoxin could not be excluded. The food history revealed consumption of a commercially produced banana/peach puree which was suspected as a possible source, and based on a precautionary principle this product was recalled. The case description illustrates a risk-management dilemma between suspected foodborne versus intestinal botulism. Taking the potentially very serious consequences of foodborne botulism into consideration, the measures taken were justified.

## Background

There are three forms of botulism:

1) Intestinal botulism: formerly infant botulism, i.e. intestinal germination of spores of *Clostridium botulinum* with subsequent in vivo production and release of neurotoxin – also described in adults;
2) Foodborne botulism: usually seen in adults, caused by ingestion of food contaminated with *C. botulinum* bacteria which have grown and produced neurotoxin; and
3) Wound botulism: wound infection with *C. botulinum* and subsequent release of neurotoxin.

Intestinal botulism has been verified in more than 1,000 cases in North America over the last decades, but is rarely reported in Europe [1,2]. We report a recent case of botulism in a Danish infant; the report illustrates a risk-management dilemma between suspected foodborne versus intestinal botulism.

## Clinical picture

The patient was a 4.5 months old, previously healthy girl. She was admitted to a paediatric department after six days of constipation, passive behaviour and weak suck. She was without fever and did not vomit, but was hypotonic with a weak cry. A plain X-ray of the abdomen revealed signs of paralytic ileus. She was treated symptomatically with intravenous fluids and enteric tube feeding, and screened over the next days for a number of suspected diagnoses (colonic enema for possible intussusception, screening for drug intoxication, metabolic diseases, encephalitis and other infections, cerebral abnormalities, increased intracranial pressure) without any abnormalities detected. Her suck and cry became increasingly weak, she developed bilateral ptosis, the muscle stretch reflexes were lost, and mydriasis with slow pupillary responses was noted. Respiration was not affected and neither respiratory support nor supplementary oxygen were needed. Eight days after admission intestinal (infant) botulism was suspected and blood was drawn for inoculation of serum in a mouse bioassay for detection of neurotoxin of *C. botulinum* and faecal samples were taken for possible detection of *C. botulinum* by culture. Two days later botulism immune globulin was administered. Fourteen days after admission she was found to have improved significantly with decreasing ptosis and increasing muscular tonus, cry, and oral food intake.

## Toxin testing

The presence of toxin was demonstrated by applying patient serum intraperitonally in a mouse model; presence of botulism toxin was suspected within 18 hours. Indicative symptoms in the mice, i.e. wasp-like waist, spiky hair and inactivity could be neutralised by adding *C. botulinum* antitoxin to types A, B, E and F to the serum prior to the intraperitoneal injection. Serum yielded no growth of bacteria, and faecal specimens did not exhibit growth of *C. botulinum*.

## Food history and source investigation

The infant was still breastfed but had started to receive supplementary feeding during the last 3-4 weeks prior to admission. Five days before admission the infant was fed with three spoonfuls of an organic banana/peach puree from a European commercial company. The mother had noticed that the baby food had a very pervading and unusual smell, and the product appeared to be fermented. However, no gas production was noticed from the glass jar and the normal click occurred when opening it. The glass jar was thrown out afterwards.

Other supplementary foods consumed by the infant included gruel made by the mother from organic produced corn, buckwheat flour, whole meal with rice and millet to which grapeseed oil was added.

Based on a precautionary principle, a press release was issued warning about the specific batch of banana/peach puree and the lot (which was marked 'best before December 2008') was recalled by the company. Warnings were issued through the Rapid Alert System for Food and Feed (RASFF) and the European Early Warning and Response System (EWRS).

In total, 11 jars of baby food, four samples of the gruel ingredients and one sample of oil have been investigated for botulinum toxin using a mouse model. No preformed botulinum toxin was detected in these samples. Currently the samples are being investigated for botulinum toxin production after spore germination, as well as detection of botulinum toxin after trypsin activation of the samples.

## Conclusion

The clinical picture in combination with the positive toxin testing confirms the case as botulism in an infant. However, it remains unsettled if it is a case of intestinal (infant) botulism or foodborne botulism. The clinical picture is compatible with infant botulism, and we tend to think this is the most probable diagnosis. However, stool samples have not shown growth of *C. botulinum*. Many cases of intestinal botulism in infants are traditionally ascribed to honey exposure, but there was no such history of exposure. Nonetheless, it is conceivable that the child could have picked up spores from other environmental or food sources. Foodborne botulism cannot be completely ruled out, in particular because the mother described the baby food as foul smelling and fermented and, furthermore, high toxin contents have been detected in products which have looked and smelled acceptable. Taking the potentially very serious consequences into consideration the press statement and the warning of other countries was justified. Additional cases have not occurred

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# Cluster of imported malaria from Gambia in Finland – travellers do not listen to given advice

**K Valve (kirsi.valve@ktl.fi)[1], E Ruotsalainen[1], T Kärki[1], E Pekkanen[1], H Siikamäki[2]**
1. National Public Health Institute, Department of Infectious Disease Epidemiology and Control, Helsinki, Finland
2. Helsinki University Central Hospital, Division of Infectious Diseases, Department of Medicine, Helsinki, Finland

Twelve Finnish tourists contracted falciparum malaria from Gambia in the period between 3 and 27 November 2008. The travellers came from different parts of Finland and all except one had booked the trip from the same travel agency. Ten of them had received information about the risk of malaria in Gambia and protection from mosquito bites but none of them had used adequate malaria chemoprophylaxis.

Twelve Finnish tourists contracted falciparum malaria from Gambia in the period between 3 and 27 November 2008. Three of the patients needed intensive care due to complications. In all these cases there was a delay of at least four days in seeking treatment. All patients recovered.

Usually, between 20 and 30 cases of imported malaria are diagnosed every year in Finland (population 5.3 million); most of them are contracted in Africa. In 2007, three cases were imported from Gambia. The cluster of twelve patients described here raises the total number in 2008 to 36 cases to date.

All twelve patients were thoroughly interviewed. The age distribution was 27-66 years, seven patients were male and five were female. The travellers came from different parts of Finland, and they stayed in different tourist resorts in Gambia, approximately 20 km from the capital city Banjul. One traveller resided in the countryside for one month. The other patients stayed in Gambia for one to two weeks.

All except one had booked the trip from the same travel agency. Five travellers had booked a last-minute trip (booking less than five days before departure). One had bought the trip ten days before, and five more than three weeks before the departure. Booking information for the last case was not available.

Ten of the patients had received information about the risk of malaria in Gambia and knew that prophylaxis using anti-malarial drugs was recommended. Six travellers got the information from the travel agency, two from the internet, one had previous information and one was a healthcare professional. Two travellers had not been informed about the risk of malaria; one of them had booked the trip by telephone, the other one on the internet.

None of the patients had used adequate malaria chemoprophylaxis. Three patients had used chloroquine, which is not recommended prophylaxis for tropical Africa. One of them got the prescription from a physician and two of them used chloroquine - against professional advice - stored from a previous trip. Nine travellers did not use any chemoprophylaxis. One of them was prescribed adequate prophylaxis but did not take it because of warnings about side-effects he had read on the internet.

Ten of the patients had either received information on protection from mosquito bites from the travel agency or had found it on their own from various sources. There was wide variation, however, on how the instructions were followed.

The only travel agency organising package trips to Gambia takes approximately 5,000 Finns yearly to Gambia in the period from mid-October to mid-April. The number of travellers has not increased in the last few years. The National Public Health Institute informed clinical practitioners and sent out a press release about the situation on 14 November 2008, which has had wide media coverage. The travel agency discontinued selling last-minute trips to Gambia immediately and has decided to sell trips no later than two weeks prior to departure and to put extra effort into informing the travellers.

The number of Finnish travellers to this region of Africa has not increased in the last few years. Interestingly, there have been similar clusters of falciparum malaria in travellers returning from Gambia also in other European countries; in total, more than 39 travellers were reported to TropNetEurop and GeoSentinel [1]. It is not clear, if this increase in malaria cases is related to a higher malaria activity in Gambia or to a decrease in compliance with protective measures or in risk awareness among travellers purchasing last-minute package tours. In fact, a recently published analysis showed that the risk to acquire malaria in Gambia seems to have decreased significantly between 1999 and 2007 [2]. But this trend could have been changed in 2008. According to unconfirmed information, the rainy season has been longer than usual this year.

Irrespective of what the reasons for this increase in travel-related malaria are, this cluster demonstrates once again the need for adequate chemoprophylaxis and information on protection from mosquito bites for all travellers to West-Africa.

E. Pekkanen has occasionally consulted GlaxoSmithKline and SBL vaccines.

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# European cluster of imported falciparum malaria from Gambia

**T Jelinek (jelinek@bctropen.info)[1], C Schade Larsen[2], H Siikamäki[3], B Myrvang[4], P Chiodini[5], J Gascon[6], L Visser[7], A Kapaun[4,8], G Just-Nübling[9]**

1. Berlin Centre for Travel and Tropical Medicine, Berlin, Germany
2. Department of Infectious Diseases, Aarhus University Hospital, Skejby, Denmark
3. Helsinki University Central Hospital, Division of Infectious Diseases, Department of Medicine, Helsinki, Finland
4. Department of Infectious Diseases, Ullevaal University Hospital, Oslo, Norway
5. Hospital for Tropical Diseases and Health Protection Agency Malaria Reference Laboratory, London School of Hygiene and Tropical Medicine, United Kingdom
6. International Health Centre, Hospital Clinic, Barcelona Centre for International Health Research (CRESIB), Barcelona, Spain
7. Department of Infectious Disease, Section Travel Medicine, Leiden University Medical Centre, Leiden, the Netherlands
8. Section Clinical Tropical Medicine, Heidelberg University Hospital, Heidelberg, Germany
9. Klinik II, Centre for infectious and tropical diseases, J.W. Goethe University, Frankfurt/Main, Germany

A cluster of 56 patients returning from Gambia with falciparum malaria has been noted in several countries of the European Union since September this year. TropNetEurop, the European Network on Imported Infectious Disease Surveillance, collected and reported the cases. Lack of awareness and, consequently, of prophylactic measures against malaria were apparent in the majority of patients.

On 24 November 2008, TropNetEurop, the European Network on Imported Infectious Disease Surveillance (www.tropnet.eu), received information on falciparum malaria cases imported to Denmark. When this information was distributed, further notifications were received from various member sites in the following days. Apparently, the combination of lack of information about their destination and ignorance of potential malaria risks affected travellers throughout Europe.

## Denmark

All Danish travellers bought their journeys at the same travel agency. All stayed at the coast of Gambia at a beach close to the capital Banjul, none of them were travelling around in Gambia.

### Patient 1

A man in his late fifties travelled to Gambia for two weeks and returned home in early November 2008. He did not take malaria prophylaxis. He was admitted to a local hospital ten days later with symptoms suggestive of alcohol withdrawal with tremors, difficulty walking, confusion and fever. Malaria was not suspected until family members mentioned that he had been to Gambia, and the diagnosis was first made two days after admission, when parasitaemia was 5.8%. The patient was transferred to a specialised infectious disease unit and treated for cerebral malaria with artesunate and doxycycline, sedated and put on respiratory support in the intensive care unit. The patient is still closely followed up to date, and neurological deficits still continue.

### Patient 2

A woman in her fifties travelled to Gambia with a friend (patient 3) for one week in early November 2008. She did not take any malaria prophylaxis and was not vaccinated against yellow fever. Onset of symptoms was six days after her return, when she became disorientated and confused. The following days she stayed in bed with fever and headache. Fortunately, a friend visited her at the eight days later and called a doctor who admitted her to a specialised infectious disease unit. She had clinical signs of cerebral malaria and parasitaemia was 2.2%. She was treated with artesunate and doxycycline and discharged on six days after admission with no sequelae.

### Patient 3

A woman in her late forties travelled to Gambia together with patient 2. She did not take any malaria prophylaxis. According to patient 2 she developed fever and diarrhoea about six days after she returned home. Ten days after her return, she was visited in her home by a general practitioner on call and was advised to see her family doctor the next day. The police was notified on the day patient 2 was admitted to hospital, but found patient 3 dead in her home. Autopsy has confirmed that she died from malaria.

### Patient 4

A woman in her late forties travelled with a friend (patient 5) to the Gambia for one week in late October 2008. She did not take malaria prophylaxis. Approximately seven days after she returned home, she got diarrhoea followed by fever and headache. After four days she contacted a local hospital because she suspected she could have malaria. The diagnosis was later confirmed at a specialised infectious disease unit in Copenhagen, with falciparum malaria and <1% parasitaemia. Following treatment, the patient was discharged four days later without sequelae.

**Patient 5**

A woman in her late fifties travelled to Gambia with a friend (patient 4) without taking malaria prophylaxis. She developed fever 6-7 days after she returned home. However, malaria was initially not considered. Two days later she was found in the home with high fever and reduced consciousness. She was admitted on a local hospital and transferred to a department of infectious diseases. Malaria smears showed Plasmodium falciparum with 6% parasitaemia. Insufficient ventilation warranted respiratory support. The patient developed a DIC and necrosis/gangrene of eight fingers and toes.

**Patient 6**

A man in his late sixties travelled to Gambia for one week in November 2008 without any malaria prophylaxis. He was diagnosed with malaria seven days after his return with a parasitaemia of 5%. Following treatment he was discharged seven days later without sequelae.

**Patients 7 and 8**

Two brothers in their late fifties travelled together to Gambia for one week in early November 2008. They did not take malaria prophylaxis, nor were they vaccinated against yellow fever. The first brother was initially treated by his family doctor with penicillin for an upper respiratory tract infection, before he was admitted to a department of infectious diseases and diagnosed with falciparum malaria (3% parasitaemia). Then the police was contacted and a search made for the second brother. He was located in a local hospital to which he had been admitted with cerebral symptoms suggestive of alcohol withdrawal. He was transferred to the same department of infectious diseases and diagnosed with cerebral malaria (5% parasitaemia). Both brothers were treated successfully with parenteral artesunate and oral atovaquone/proguanil.

Following these initial reports from Denmark, further information from other countries was added:

### Finland

Twelve cases were reported between 3 and 27 November 2008, all Finnish travellers returning from Gambia [1]. Five of these patients were female, seven were male. Age distribution was between 27 and 66 years. Their travel destinations were tourist resorts near Banjul. Nine travellers did not take any chemoprophylaxis, three used chloroquine prophylaxis. Ten of the 12 patients had received information about the malaria risk and recommended chemoprophylaxis. The duration of their stay in Gambia was between one and two weeks except for one patient who stayed four weeks. Three had complications that required treatment in intensive care, but all three recovered. For nine patients, the diagnosis was made within three days of onset of symptoms. The three patients with complications had been diagnosed with a delay of up to eight days.

### Norway

Three patients were reported, two men (39 and 71 years-old), and one woman (48 years-old). None of them used chemoprophylaxis during their stay in Gambia. All three patients visited relatives and friends and stayed in and around Banjul. No complications were reported, all patients recovered.

### United Kingdom

Nineteen travellers infected with falciparum malaria in Gambia were reported to the Health Protection Agency's Malaria Reference Laboratory between October and December 2008. Their age was between 21 and 62 years. Six patients were female. The majority of patients travelled as tourists (n=9), two visited friends and relatives in the country, two had migrated from Gambia to the United Kingdom (UK), and the reasons for travel of the remaining six patients were unkown. One traveller used chemoprophylaxis with proguanil, 14 took no chemoprophylaxis, and data for the remaining four were not provided.

### Spain

Two patients with falciparum malaria were noted in Barcelona, Spain. Both were second generation Gambian migrants visiting relatives in Gambia for the first time. They stayed in rural areas in the country for 11 and 13 months, respectively, and did not use chemoprophylaxis. Both were male, one 14 years-old, the other 16 years-old. One of them suffered from uncomplicated malaria and recovered without complications while the other was treated in an intensive care unit due to hypotension, 9.5% parasitaemia, severe anaemia (Hb: 6.5 g/L), low platelet count: 25.000/µl, hyperbilirrubinaemia and somnolence. The infection was treated with quinine and doxycycline, and both recovered without sequelae.

### The Netherlands

In the Netherlands, 10 Dutch tourists were reported with falciparum malaria after returning from Gambia between 21 September and 26 November 2008. The median age was 48 years (range 43-62), six patients were female. Three cases were related (travel companions). The median duration of stay was nine days (range 7-68). Seven travellers did not use malaria chemoprophylaxis, two used homoeopathic drugs (chininum arsenicosum D8) and one tourist stopped atovaquone/proguanil prematurely. The median shortest incubation period was five days (range 0-18). The median interval between the first day of illness and the date of diagnosis was five days (range 0-17). Seven patients were admitted to hospital for treatment. Two patients, aged 45 and 49, died. Both patients had not used chemoprophylaxis. The time to diagnosis was 17 and six days, respectively [3].

### Germany

Two patients were reported in Germany. Both were male, one 15 years-old, the other 54 years-old. They travelled to urban areas in Gambia for one and two weeks, respectively. None of them took chemoprophylaxis. Both recovered after a largely uneventful clinical course. The 54 year-old patient had been returning to Gambia for 10 years, always without prophylaxis. The 15 year-old patient was in Africa for the first time, travelling alone from Turkey, where he was borne.

### Comment

During the comparatively short time period of two months and a half between September and November 2008, TropNetEurop member sites reported 56 patients returning from Gambia with falciparum malaria. Thirty-two of them were male, and 24 female. The age range was 15-71 years.

While the reasons for travel were quite diverse, a striking lack of effective prophylactic measures was apparent in all. Fourty-five patients had not used any malaria chemoprohylaxis. All seven

travellers who indicated that they had taken prophylactic drugs used inadequate or downright wrong ones: two took homeopathic prophylaxis, three used chloroquine only, one used paludrine only, and one stopped taking atovaquone/proguanil too early. No data are available for the remaining four patients.

Thus, despite the documented risk of complicated falciparum malaria from Gambia, virtually all patients chose to use no or inadequate prophylaxis [2]. Several were counselled to take this decision by their travel agency, but in a few cases even by their family doctor.

The cluster underlines the necessity of competent pre-travel information and adequate protection in travellers, in particular at times when malaria appears to be decreasing but still remains a high risk for non-immune travellers [4]. Although there probably is an overuse of chemoprophylaxis against malaria among tourists travelling to Asia and Latin America, chemoprophylaxis is a must for most travellers to African destinations, and in particular to west Africa.

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# Investigations and control measures following a case of inhalation anthrax in East London in a drum maker and drummer, October 2008

**S Anaraki (sudy.anaraki@hpa.org.uk)[1], S Addiman[1], G Nixon[1], D Krahé[2], R Ghosh[2], T Brooks[3], G Lloyd[3], R Spencer[3], A Walsh[4], B McCloskey[5], N Lightfoot[6]**

1. North East and North Central London Health Protection Unit, Health Protection Agency, London, United Kingdom
2. Homerton University Hospital, London, United Kingdom
3. Laboratory for Novel and Dangerous Pathogens, Health Protection Agency, London, United Kingdom
4. Centre for Infections, Health Protection Agency, London, United Kingdom
5. London Regional Director's Office, Health Protection Agency, London, United Kingdom
6. Health Protection Agency, Central Office, London, United Kingdom

We discuss the investigations and control measures undertaken following the notification of a fatal case of inhalation anthrax in East London. The patient is believed to have acquired the infection from making animal hide drums. Environmental investigations identified one drum and two pieces of animal skins contaminated with anthrax spores.

## Introduction

Anthrax is predominantly a disease of livestock. Naturally acquired infection in humans occurs as a result of contact with infected animals or animal products contaminated with spores of *Bacillus anthracis*. The most common form of the disease in man is cutaneous anthrax. Other forms, including inhalation and gastrointestinal anthrax, are less common.

The incubation period for inhalation anthrax is between two and 43 days, but may be up to 60 days or as short as one day [1]. An initial prodromal stage may include symptoms such as fever, malaise, fatigue and anorexia followed by sudden increase in fever, severe respiratory distress, excessive sweating and shock. The case fatality can be as high as 92% in sporadic cases where the diagnosis is usually only made during the fulminant stages [2].

*B. anthracis* spores are considered as one a potential biological weapon [3] and deliberate release of anthrax spores has occurred in the United States (US) in 2001 [4].

Anthrax is now a very rare disease in the United Kingdom (UK). Between 1981 and 2006, 18 possible cases of cutaneous anthrax were notified in England and Wales, with *B. anthracis* isolated in only one case and serological confirmation in another two. The last case of pulmonary anthrax in England and Wales was reported in 1974, and the last case before that was in 1965 [5].

A death from anthrax occurred in Scotland in 2006; this was a case of disseminated anthrax following exposure to imported animal hides in a drummer and drum maker [6]. One case of naturally acquired inhalation anthrax was also reported in the US in 2006 in a drum maker who used imported animal skins [7].

The case reported below is the first case of inhalation anthrax reported in England and Wales in more than 30 years [8].

## The case

On 21 October 2008, the patient presented to a London hospital with a two-day history of fever, night sweats and rigors. He rapidly deteriorated during early hours of 23 October and was transferred to the intensive care unit with respiratory failure. Multiple organ failure developed the following day. The admission chest X-ray showed some basal shadowing and a widened mediastinum.

On 22 October, admission blood cultures had become positive and Gram-positive rods were seen on microscopy. On 23 October, the organism produced pure growth on media plates. A preliminary diagnosis of *B. anthracis* was made on 24 October.

The results were reported to North East and North Central London Health Protection Unit on Friday 24 October, and an incident was declared immediately. The sample was couriered to the Health Protection Agency's (HPA) laboratory for Novel and Dangerous Pathogens (NADP) in Porton Down, where the identity of the organism was confirmed on the same day as *B. anthracis*. Further molecular and microbiological investigations on the next day confirmed the identification of the organism and drug sensitivities.

The patient commenced on oral and intravenous antibiotics immediately after admission. Antibiotic treatment was changed to rifampicin, ciprofloxacin and clindamycin following diagnosis of anthrax on 24 October. Following consultation with the US Centers for Disease Control and Prevention (CDC) in Atlanta, anthrax immunoglobulin (Cangene Corporation), was flown in from the US and administered on 27 October. The patient remained in

critical condition requiring multi-organ support until he died on 2 November,

A *post mortem* examination was carried out on 5 November to confirm the diagnosis and to clarify the circumstances of death. The *post mortem* report is awaited after the inquest in March 2009 but the preliminary results confirm the primary cause of death as pulmonary anthrax.

Although cremation is the preferred disposition method [9] the body was buried in a sealed coffin according to the family's wishes.

## Epidemiological investigation

When the diagnosis had been made, the patient was in a critical condition and unable to communicate. Therefore all information about his activities was provided by his family and friends. The family was interviewed in depth in order to identify the potential source of infection. However, they were not able to provide all the required information about his activities during the incubation period. Some of his friends, colleagues and clients were also interviewed.

The patient made and played animal hide drums. All drum making activities in the two months preceding the onset of disease took place in a studio flat in East London, while the family lived at a different address.

A supplier of animal skins, who had been reported to have supplied skins to the patient, was also interviewed and reported importing hides from Gambia; however, it was also reported that the patient made and repaired drums for clients who brought him animal skins from various sources. Based on the available information and evidence from previous cases [6,7,10-12] a working hypothesis was formed that he possibly acquired the infection while making the drums in his studio flat.

## Environmental investigation

The studio flat was investigated and environmental samples were collected by staff from the NADP laboratory. Samples included five drums, animal skins left in the property, drum making equipment, surfaces, and air samples. The remaining skins from the same batch supplied to the patient by the main supplier of animal skins were also tested, as were a further six drums kept at the family's home.

Of the samples taken from the studio flat one drum and two pieces of leftover animal skins proved to be contaminated with *B. anthracis*. All other samples from the studio flat were negative. Neither the animal hides belonging to the main supplier, nor the drums kept at the case's family home showed any evidence of contamination with anthrax spores.

## Control measures

### Prophylaxis

The HPA started a risk assessment as soon as the incident was declared to identify individuals who might have been present when the case was making drums in the 60 days before onset of symptoms. The patient's immediate family, the main supplier of the skins, and a person who assisted him with drum making were offered prophylaxis with ciprofloxacin. A staff member at the hospital was also concerned about potential exposure to aerosolised spores and started prophylaxis on 24 October. No one else had been identified as being at risk.

All contacts started the recommended course of prophylaxis with ciprofloxacin (500 mg oral, twice daily for 60 days) [13] on 24 October or as soon as they were identified. Due to reported minor side effects including gastrointestinal upset, the treatment was switched to doxycycline (100 mg oral, twice daily) in one contact and to amoxicillin (500 mg oral, three times daily) in another. The latter stopped taking antibiotics after three weeks. All other contacts were still taking antibiotics at the time of publication of this report (more than seven weeks after start of prophylaxis).

### Decontamination

None of the surfaces at the studio flat were positive for anthrax. It was therefore decided that extensive decontamination of the flat would not be necessary. However, the contaminated drum was removed and the area surrounding it was decontaminated using 10,000 ppm hypochlorite solution [14]. It was agreed that the skin from this drum should be removed and incinerated but that the base of the drum could be returned to the family following decontamination. Other animal skins found at the property were also incinerated.

### Advice to drummers

During interviews with the case's friends and colleagues they were informed about the possible risks of handling untreated animal skins and were advised to avoid importing skins from uncertified sources. Based on evidence from previous cases they were advised that the risk from playing drums was minimal and the main risk would be during the process of making drums, particularly shaving hair from animal skins as this could result in aerosolised anthrax spores being inhaled [7]. The HPA is now working on information leaflets on anthrax to be distributed to drummers through existing drumming networks and websites. Advice for drum makers on manipulation of animal hides is available on HPA website [15].

## Discussion

Inhalation anthrax continues to be a rare event but this case illustrates the need for rapid diagnosis and treatment. In the anthrax letters in the United States in 2001 the mortality of inhalation of anthrax was reduced from 92% to 45%. This reduction in case fatality rate was associated with factors including rapid instigation of treatment. [12].

Following the identification of one contaminated drum and two animal skins at the patient's workshop we are continuing our investigations about his activities in relation to these objects in more detail. However, we are aware that retrospective information gathering about his exposure may not yield reliable and conclusive information due to several factors including recall bias, vested interest and fear of legal challenges regarding imported animal skins by his clients and work associates.

Inhalation anthrax is very rare. The above case is the first reported in England and Wales in more than 30 years and the second case in the UK after a patient died in Scotland in 2006 [6]. Both of these UK cases, as well as a case reported from US in 2006 [7], were drum makers. The microbiological evidence and epidemiological investigations into the Scottish case concluded that the infection was linked to drumming activities, although the exact nature of the exposure is unknown. It is believed that the most likely source

of infection in the case in London was the imported hides he used to make the drums.

Despite the popularity of African drums and drumming in many countries, there are few documented cases of anthrax associated with these activities. According to an internet search for English and French reports, the case reported here is the sixth case in the literature. In four cases there was a known exposure via manipulating skins in drum making, and for two the exposure was thought to be handling or playing the drums [6,7,10-12].

To prevent future similar cases it is important to raise public awareness, in particular amongst drum makers and drummers about potentially contaminated animal skins, the risks of particular sources of these animal products, and the early signs of anthrax so that they can seek professional advice in a timely manner. This should be available through websites such as the HPA site, and supplied to the drumming community for dissemination.

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# A food-borne outbreak of cryptosporidiosis among guests and staff at a hotel restaurant in Stockholm county, Sweden, September 2008

**M Insulander[1], B de Jong[1], B Svenungsson (bo.svenungsson@sll.se)[1]**
1. Department of Communicable Disease Control and Prevention, Stockholm County Council, Stockholm, Sweden

In September 2008, 21 cases of cryptosporidiosis occurred among guests and staff at a wedding reception in a hotel restaurant in Stockholm county, Sweden. The median incubation period was 7.1 days (range 4-9 days) and 86% of the patients had symptoms for longer than one week. Three patients were hospitalised due to dehydration. The most probable source of the outbreak was béarnaise sauce containing chopped fresh parsley.

On 19 September 2008, the Department of Communicable Disease Control and Prevention in Stockholm was alerted about an outbreak of gastroenteritis among guests who had attended a wedding dinner on 5 September at a hotel restaurant.

Among the 23 guests attending the dinner, 15 developed gastrointestinal symptoms between 9 and 14 September. When contacting the hotel restaurant it emerged that six out of eight members of the restaurant staff, who had eaten leftovers from the dinner menu, also had developed symptoms during the same period, and two of them were hospitalised. However, none of the staff reported any gastrointestinal symptoms around 5 September, when the dinner was served.

In total, 21 cases with gastrointestinal symptoms were identified in the outbreak. The median age of the cases was 34.4 years (range 10-82 years), nine were women and 12 were men.

Stool specimens from 26 individuals, 20 guests and six staff members, were analysed with standard techniques for bacterial pathogens as well as parasites. Sixteen cases were positive for *Cryptosporidium* species, twelve guests and four employees. None were positive for bacterial enteropathogens.

In order to identify the source of the outbreak, a retrospective cohort study was initiated.

## Outbreak investigation

On 22 September, a questionnaire was sent to all guests inquiring about symptoms, as well as foods and drinks consumed. The guests were given the opportunity to answer the questionnaire via an enclosed paper copy or via a web-link. The staff received a similar questionnaire without the web-link. The response rate among guests and staff was 100%. Guests and staff were asked to deliver faecal samples for bacteriological and parasitological analyses.

A confirmed case of cryptosporidiosis was defined as an individual who had attended the dinner on 5 September at the hotel restaurant or at the staff restaurant and developed gastrointestinal symptoms, confirmed by the detection of *Cryptosporidium* oocysts in a stool sample by microscopic examination using the modified Ziehl-Neelsen stain.

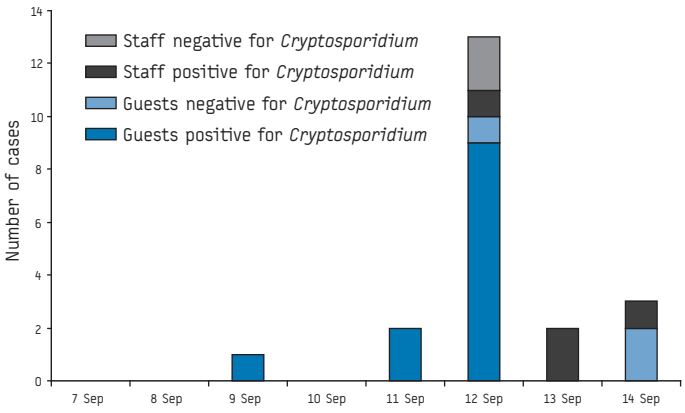
A probable case of cryptosporidiosis was defined as an individual who had attended the dinner on 5 September at the hotel restaurant or at the staff restaurant and developed gastrointestinal symptoms within 2-14 days.

The Figure shows the epidemic curve of the cases, 16 confirmed and five probable. The dates of onset of symptoms were between 9 and 14 September and the median incubation period was 7.1 days (range 4-9 days). The most common symptoms reported by the cases were diarrhoea (100%), abdominal pain (95%), nausea (86%), vomiting (38%), and fever >38°C (38%). Duration of symptoms lasted longer than one week for 18 people (86%). Three individuals were hospitalised due to dehydration.

There were two options for the main dish on the dinner menu. One was beef with béarnaise sauce, served with haricots verts rolled in bacon and baked potatoes, and the other option was salmon

**Figure**

**Date of onset of symptoms among guests and restaurant staff in a cryptosporidiosis outbreak, September 2008, Stockholm County**



served with asparagus, white wine sauce and boiled potatoes. The children were served hamburgers with chips and none of them developed intestinal symptoms. They were also negative for *Cryptosporidium* in faecal samples. A cake, which was eaten by all the guests but not by the staff, was served as dessert. Food and drink histories, based on the menu items consumed, indicated that the béarnaise sauce was the most probable source of the outbreak with a relative risk of 4.00 (95% confidence interval (CI): 1.14-14.09). The sauce had been prepared during the afternoon of the day it was served, and the ingredients were: eggs, butter, onion, vinegar and dried tarragon. The last item added to the sauce, after the heating, was chopped fresh parsley. No other food or drink item was associated with any significant risk. All tap water was obtained from the community network.

The 16 faecal specimens that were positive for *Cryptosporidium* oocysts were further analysed by polymerase chain reaction (PCR). PCR products were obtained from 13 of those samples. The *Cryptosporidium* genotype was determined by PCR-restriction fragment length polymorphism (RFLP) as described previously [1] and showed that all 13 individuals were infected with *Cryptosporidium parvum* (Marianne Lebbad, personal communication).

A project on sub-genotyping of all isolates is ongoing and may provide some information of which subtype that was involved in this outbreak.

The local environmental health office was contacted and an environmental health officer inspected the restaurant kitchen. Only minor errors in food handling were identified. No food items were sampled because too much time had elapsed between the dinner and the time of inspection. The fresh parsley had been imported from Italy in plastic bags and was not rinsed before use.

## Discussion

Cryptosporidiosis has since the 1980s been increasingly recognised as a common cause of gastrointestinal infection in humans worldwide [2,3]. The two most common causes of human cryptosporidiosis are *Cryptosporidium hominis*, which is considered to be pathogenic primarily to humans, and *C. parvum*, which is zoonotic [4]. Humans become infected when they ingest *Cryptosporidium* oocysts. Ingesting as few as 9-100 oocysts can cause an infection [2].

Outbreaks of cryptosporidiosis are mostly associated with water, both drinking water and recreational water use, partly due to the resistance of the oocysts to chlorination at the levels used for water disinfection [1-5]. In Sweden, outbreaks of cryptosporidiosis are rare. However, in August 2002 there was a swimming pool-associated outbreak in Stockholm county, affecting approximately 800-1,000 people and with a secondary attack rate of 8-10% [1].

Worldwide, food-borne outbreaks of cryptosporidiosis occur less frequently. In a few reports, the source of infection were fruits or vegetables that had been in contact with contaminated water or manure, as well as unpasteurised apple juice [2,3]. Only rarely has an outbreak of cryptosporidiosis been linked to a food handler [6].

We describe the first documented outbreak in Sweden of cryptosporidiosis associated with food, comprising 16 confirmed cases and five probable cases. Even though no food samples were analysed for parasites or bacteria, the epidemiological investigation strongly suggests that the béarnaise sauce, containing chopped fresh parsley which was added after heating, was the source of the outbreak. The sauce was heated to a maximum temperature of 80o C: if a higher temperature is reached there is a risk that the different ingredients will curdle. Since the parsley was added after the heat treatment procedure, we speculate that this fresh ingredient of the sauce was the most probable vehicle. Vegetables have in recent years been associated with several food-borne outbreaks of intestinal infections, which further emphasises the importance of standard recommendations for hygienic control measures to ensure the safety of fresh produce.

It can of course never be excluded that a food handler was the cause of contamination. However, as none of the staff reported any symptoms around the day when the dinner was served, we believe that they were victims, as the guests, rather than vehicles. In addition, faecal samples from asymptomatic staff members were all negative for *Cryptosporidium*.

Cryptosporidiosis has been a notifiable disease in Sweden since 2004 and approximately 50-100 cases are reported each year; in comparison, 7,960 cases were reported in the European Union countries in 2005 [5]. However, the reported data are likely an underestimate of the cryptosporidiosis burden. The infection is fairly unknown among Swedish physicians and most laboratories do not test for *Cryptosporidium* unless specifically requested. Special staining like modified Ziehl-Neelsen is often needed, and therefore many cases are probably undiagnosed.

In Stockholm county, four outbreaks of cryptosporidiosis, involving about 50 individuals, have been identified in the past two years. The number of sporadic cases also seems to increase. Clinicians should therefore be aware of cryptosporidiosis as a possible outbreak aetiology and consider performing routine stool tests for *Cryptosporidium* in patients with watery diarrhoea and abdominal pain.

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# Tuberculosis outbreak associated with a mosque: challenges of large scale contact tracing

**S Duthie (susan.duthie@net.net)[1], C Black[1,2], G Douglas[1], A D Jackson[3], D Webster[1]**
1. Health Protection, NHS Grampian, Aberdeen, United Kingdom
2. University of Aberdeen, Aberdeen, United Kingdom
3. Health Protection Scotland, Glasgow, United Kingdom

In this report, we describe the investigation and management of an outbreak of TB associated with a mosque in Scotland, and consider the implications of large-scale TB contact tracing. In 2005, an Algerian man living in the north-east of Scotland was found to be sputum smear-positive for TB. Initial investigation identified three (18.8%) close contacts with active disease. Due to the high rate of transmission, contact tracing was extended to casual contacts of the index case at a mosque. No sub-group at highest risk of exposure could be defined at the mosque. Screening of mosque attendees identified two cases (0.53%), with a further two identified by review of existing cases and enhanced surveillance. Two additional cases were linked to the outbreak by genetic profile. Response to the screening exercise was initially poor, but after modification of the communication strategy, 438 people were offered screening with 86% attending. The investigation and management of a TB outbreak is challenging and requires a complex message about risk to be communicated. In a mosque setting, there were additional complexities that, to the best of our knowledge, have not been reported previously. It was crucial, in designing the communication strategy, to identify key individuals within the community to assist with tailoring the message to address risk perception and to help to deliver the message. Despite this, approximately 50% of those considered to have the highest exposure (adult males regularly attending Friday lunchtime prayer meetings) did not come forward for screening. The screening of casual contacts in this setting was complex and time-consuming with a low detection rate.

## Introduction

In 2005, an Algerian man, living in the north-east of Scotland was found to be sputum smear-positive for tuberculosis (TB). He had lived in three houses in Aberdeen and was a member of the Aberdeen mosque. Initial investigation identified three (18.8%) close contacts to have active TB disease. Therefore, NHS Grampian undertook a large contact tracing exercise in early 2006, focusing on the mosque community. In this report, we describe the outbreak investigation and management, and consider the implications of large-scale TB contact tracing. As far as we are aware, this is the first reported exercise of its kind associated with a mosque.

### Epidemiology of TB in Scotland

Since the mid 1980s, the incidence of TB has been increasing in many parts of the developed world [1]. In low-incidence European countries, it has long been assumed that reactivation of latent infections was responsible for causing the majority of disease [2]. However, molecular epidemiology studies have shown that the contribution of recent transmission to the overall burden of disease is greater than previously thought [3-6]. The rising incidence of TB in England, Wales and Northern Ireland has been attributed to an increase in cases among those who have recently arrived from high-prevalence countries, with 72% of cases in 2005 occurring in people not born in the United Kingdom (UK) [7]. In contrast, case numbers in Scotland have been relatively stable, with approximately 400 new TB cases annually over the past decade and non-UK born cases representing only 30% of the total number of cases [8].

The outbreak we report here was unusual in Scotland, representing recent transmission of infection rather than reactivation of latent disease. Occurrence within a community where a high proportion of members were not born in the UK is an epidemiological pattern more akin to England and Wales than to Scotland.

### Guidelines for the management of TB

At the time of this outbreak, the National Institute for Health and Clinical Excellence (NICE) guidelines were in draft form and the British Thoracic Society (BTS) guidelines (2000) formed the basis for the actions taken [9,10].

## Investigation of index case

### Setting

Grampian, in the north-east of Scotland, has a population of approximately 524,000 people spread over around 7,700 km2. Approximately half the population live in Aberdeen. In Aberdeen, there is one mosque, although Muslim meetings also occur at other premises. In the 2001 census, 0.82% of people living in Aberdeen City reported that their current religion was Muslim, a figure similar to the Scottish national average of 0.84% [11].

### Index case

The index case was identified in October 2005 after a prolonged illness lasting several months. It was estimated that his symptoms, including a productive cough, had begun around March 2005. A sputum sample was smear-positive for numerous acid- and alcohol-fast bacilli (AAFB) and was confirmed to be fully sensitive *Mycobacterium tuberculosis* by the Scottish Mycobacteriaum Reference Laboratory (Box 1).

### Screening of close contacts

The definition of a close contact (Box 2) was complicated by the index case having been resident at three separate addresses during his illness. The time period of concern also included the start of

**Box 1**

**Details of cases of tuberculosis linked with the outbreak in a mosque, Aberdeen, 2005**

**Index Case**
- adult male
- 7-8 month history of symptoms including productive cough, weight loss and night sweats
- Chest X-ray showed extensive bilateral changes
- Sputum smear-positive 8 October 2005
- Cultured as fully sensitive *Mycobacterium tuberculosis*
- High transmission risk period defined as July to October 2005
- Completed treatment May 2006; no adherence issues

**Close Contacts – Linked Cases**

Linked Case 1
- Child (intermittent household contact over risk period)
- Grade 3 Heaf test, no previous BCG vaccination
- Chest X-ray changes, weight loss, night sweats, slight unproductive cough
- Considered clinically to be non-infectious
- No samples for culture obtained
- Completed treatment May 2006; directly observed treatment

Linked Case 2
- Child (occasional contact at mosque)
- Grade 4 Heaf test, no previous BCG vaccination
- Chest X-ray changes, weight loss, night sweats, slight unproductive cough
- Considered clinically to be non-infectious
- No samples for culture obtained
- Completed treatment May 2006 no adherence issues

Linked Case 3
- Adult male (intermittent household contact over risk period)
- Chest X-ray changes, weight loss, night sweats, no cough
- Considered clinically to be non-infectious
- Bronchoalveolar lavage – smear-negative, culture-positive, fully sensitive *M. tuberculosis*
- Culture specimen genetically identical to index case
- Completed treatment August 2006; no adherence issues

**Review of Grampian Cases and enhanced surveillance**

Linked Case 4
- Adult male (mosque attendee with no known direct contact)
- Grade 1 Heaf test
- Chest X-ray changes, abnormal computer tomography chest scan
- Considered clinically to be non-infectious
- Diagnosed on bronchoalveolar lavage – smear-negative culture positive for fully sensitive *M. tuberculosis*
- Culture specimen genetically identical to index case
- Completed treatment June 2006; no adherence issues

Linked case 5
- Adult male (mosque attendee with no known direct contact)
- New arrival in United Kingdom (UK), September 2005 – no BCG vaccination
- Mantoux 18 mm, minor chest X-ray changes
- Considered clinically to be non-infectious
- No samples for culture obtained
- Incomplete treatment; lost to follow up (left UK) July 2006

**Screening detected cases**

Linked Case 6
- Child (mosque attendee with no known direct contact)
- Mantoux 12 mm, no previous BCG vaccination
- No changes on chest X-ray or symptoms suggestive of tuberculosis
- Completed three-month course of chemoprophylaxsis

Linked Case 7
- Adult male (mosque attendee with no known direct contact)
- Mantoux >15 mm and blistered, minor chest X-ray changes
- Weight loss, night sweats, cervical lymph nodes swollen
- Sputum sent for culture and found to contain fully sensitive *M. tuberculosis*
- Lymph node aspirated and sent for culture; found to be fully sensitive *M. tuberculosis*
- Culture specimens genetically identical to index case
- Completed treatment October 2006; no adherence issues

**Late cases**

Linked Case 8
- Adult female from England, no known links to mosque or Aberdeen
- Culture specimens genetically identical to index case
- No additional information available

Linked Case 9 (Grampian)
- Adult male household contact intermittently over at risk period
- Screened as a close contact but no chest X-ray changes
- Presented in 2007 with productive cough, no changes on chest X-ray
- Sputum sent for culture and found to contain fully sensitive *M. tuberculosis*
- Culture specimens genetically identical to index case
- Completed treatment September 2007; no adherence issues

BCG = Bacillus Calmette Guérin

Ramadan and, as a result, the index case had spent substantial periods of time in close contact of people beyond his residence. Sixteen people were classed as close contacts, although their degree of contact was variable.

From the screening of the 16 close contacts, three cases of TB were identified (18.8%); one adult and two children (see Box 1: linked cases 1, 2 and 3).Screening of the contacts of the three linked cases resulted in a further three people being tested (two children and one adult); all were negative for TB disease.

### Conclusion of initial investigation

To find such a high rate of spread among close contacts (18.8%) was unusual. BTS 2000 guidelines advised that casual contact tracing should be considered if the index case was highly infectious, indicated by transmission to more than 10% of close contacts [10]. Therefore an outbreak was declared and an outbreak control team assembled to consider further investigation and control measures.

The outbreak control team identified two settings where significant casual contact with the case could have occurred:

The index case's work place, a small food outlet (however, all contacts through work had already been screened as part of the close contacts);

The mosque where the index case had attended Friday lunchtime and Friday evening prayer meetings throughout his illness.

## Outbreak investigation and management

### Review of recent TB cases and enhanced surveillance

The outbreak control team decided that a review of recently diagnosed cases, along with enhanced surveillance, of any new cases was appropriate to identify potential association with the index case. Association was considered if there was evidence that the case could have been attending the mosque at the same time as the index case. Through this process, two cases of TB were linked to this outbreak: two adult males (Box 1: linked cases 4 and 5), diagnosed with TB in December 2005 and January 2006.

### Initial microbiological investigation

Where bacteriological specimens were available, genotype testing was requested to establish potential linkage to the index case. The Scottish Mycobacterial Reference Laboratory undertook molecular typing and comparison of genetic profiles using Mycobacterial Interspersed Repetitive Unit-Variable Number Tandem Repeat (MIRU-VNTR), a method introduced in Scotland in August 2005 [12].

Of the three cases detected as part of the close contact investigation only one (linked case 3) had culture-positive specimens available for genotyping. This specimen had a genetically identical profile to the index case.

**Box 2**

**Definition of a close contact (British Thoracic Society guidelines 2000 [10])**

**Close Contacts:**
Someone from the same household (sharing a kitchen), very close associates, or frequent household visitors.

Of the two cases detected as potentially linked to the outbreak from the review of all recent Grampian TB cases, bacteriological specimens were available for genotyping for one case, and this specimen was also found to be genetically identical to the index case. A third possibly linked case, a 33 year-old male with a lymph node biopsy positive for TB, was found to have a different genotype from the index case.

**Environmental investigation**

Members of the health protection team (a TB specialist nurse and a colleague) visited the Aberdeen mosque accompanied by the Imam outwith prayer meeting times. For Friday lunchtime prayer meetings, attended by adult males only, the series of rooms that made up the mosque were reported to be full and found to be poorly ventilated. The Friday evening meetings, though substantially less well attended, also included women and children. Children were considered to be more susceptible to infection due to their potentially immature immune systems [13].

Attempts were made to identify a subgroup considered to have had greatest exposure or to be particularly susceptible to infection. However, there was no list of contact details for the mosque attendees nor was there a regular pattern as to where within the mosque the attendees prayed. It was, therefore, impossible to identify any "high-risk" sub-group within the mosque using the traditional "ripples from a stone in the pond" approach recommended in the BTS guidelines [10].

**Risk assessment of potential to spread to casual contacts and definition of casual contacts**

The outbreak control team identified a risk of spread to casual contacts through attendance at the mosque at the same time as the index case. The key factors in reaching that decision were:

- Evidence of high rate of infection among the close contacts (with genotype as evidence of link),
- Long period of symptomatic disease in the index case prior to diagnosis as demonstrated by numerous AAFBs in the sputum samples,
- Evidence linking other Grampian cases with the index case for whom the only opportunity for common exposure appeared to be through attendance at the Friday lunchtime mosque meetings (with genotype as evidence of link),
- Relatively overcrowded conditions and poor ventilation at the mosque,
- Presence of children, with their less mature immune systems, among the contacts.

The outbreak control team therefore established a definition of casual contacts (Box 3) and made the decision that a larger scale contact tracing exercise should be undertaken.

**Box 3**

**Definition of casual contacts of the index case in the tuberculosis outbreak in a mosque, Aberdeen, 2005**

**Casual Contact:**
"Anyone who regularly attended mosque prayer meetings on Friday lunchtimes or Friday evenings between the beginning of July 2005 and the end of October 2005." ('regularly' defined as attending at least three times during the defined time period)

**Large scale contact tracing exercise of casual contacts attending the mosque**

***Organisation and methods***

Communication with the mosque community was via the Imam. Religious beliefs dictated that only male Muslims could attend the Friday lunchtime prayer meetings. As a result, no one from the (all female) health protection team could attend. It was necessary to rely on the Imam communicating our complex message to the mosque attendees requesting casual contacts to come forward for screening. Figure 1 summarises the communication process.

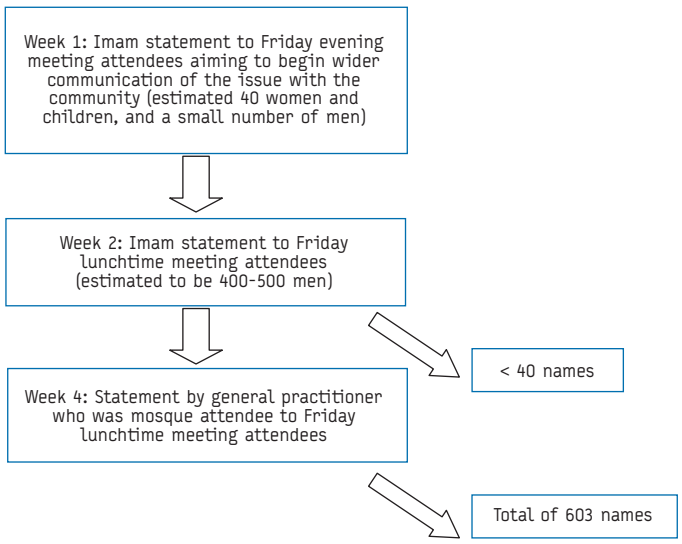
On the advice of the Imam that the mosque community would provide translation as required, standard information letters and leaflets in English were made available for collection. The information provided advice about TB and the risk of transmission, along with advice that anyone who met the definition of a casual contact should call a dedicated National Health Service (NHS) helpline to provide their personal details, so that invitations for screening appointments could be sent out.

The initial response was low, with less than 40 names received. A further meeting was held to discuss approaches to improve the response. The NHS Grampian Equity and Diversity Manager, through a network of contacts within the NHS, identified the chair of the mosque committee and a number of well-respected mosque attendees, including a local general practitioner (GP), to assist with communication. With the help of these individuals, a number of potential barriers were identified:

- Risk perception – the level of anxiety was thought to be low, with many considering TB to be easily treated and not a major cause for concern;
- Misunderstanding of risk – some people believed that if they did not currently have clinical symptoms of TB they could not have the disease, especially since some months had elapsed since the time of exposure;

**Figure 1**

**Summary of the communication process with the mosque, Aberdeen, 2005**



- Protection by Bacillus Calmette Guérin (BCG) vaccine – there was a misconception that previous BCG vaccination would guarantee life-long protection;
- Language barriers – complex messages, provided in English, may not have been translated or passed on effectively; where English was not the first language, having to contact a helpline number was believed to be daunting;
- Confidentiality – some people expressed anxiety about sharing of personal information.

To address these issues, the outbreak control team decided to re-iterate among all regular attendees the message about the importance of contact tracing and the need for them to come forward. The message was modified to address the potential barriers and was delivered by the male GP. In view of the potential difficulties calling the help-line, forms were also made available for attendees to complete and return to the health protection team in a freepost envelope.

Communication with the two universities in Aberdeen, which many international students attend, and local media attention raised general awareness. As the first people began to attend for screening, they were asked to encourage others to come forward.

These actions led to a greatly increased response.

### Screening

All adults (aged 16 years and over) were offered a chest X-ray. Clinics were staffed by X-ray department staff as well as the TB specialist nurse or another member of the health protection team. People who came for a chest X-ray, were also asked to take part in a questionnaire survey of potential symptoms and risk factors.

One respiratory physician reviewed all chest X-rays, together with the relevant questionnaire survey findings. The radiology departments provided a second review of the chest X-ray films. If an abnormality was identified, appropriate follow-up was arranged. All children aged under 16 years were offered a Mantoux test and BCG vaccination as appropriate.

Screened participants, and their GPs, were informed of their test results.

## Results of large scale casual contact screening

Although no formal register of mosque attendees was kept, estimates from various sources suggested that between 400 and 500 adult males (over 15 or 16 years of age) regularly attended Friday lunchtime meetings; a further 40 women and children were thought to regularly attend Friday evening sessions.

A total of 603 mosque attendees contacted the health protection team but, after discussion with a member of the team, only 438 who had had sufficient contact with the index case to qualify as casual contacts were screened; 336 (76.7%) of these 438 were male and 102 (23.3%) were female (Figure 2).

258 adult males (aged 16 years or over) were identified for screening (59% of the total identified for screening). This represented approximately half the number of attendees estimated of the Friday lunchtime prayer meetings.

180 women and children under the age of 16 years were offered appointments for screening; this number was 4.5 times that of the estimated number of attendees to the Friday evening prayer meeting.

Of the 438 individuals identified as casual contacts and eligible for screening, 378 attended the screening (86%). Of the 60 who were offered appointments but did not attend, 57% were adult males.

### Screening findings

Two individuals with TB (one latent, one active) were identified among the 378 who attended screening (a rate of 0.53%) (see Box 1: linked cases 6 and 7).

The screening identified a further three adults with chest X-ray abnormalities, and one with possible clinical symptoms. All required additional follow-up before TB was excluded.

### Additional molecular genotyping information

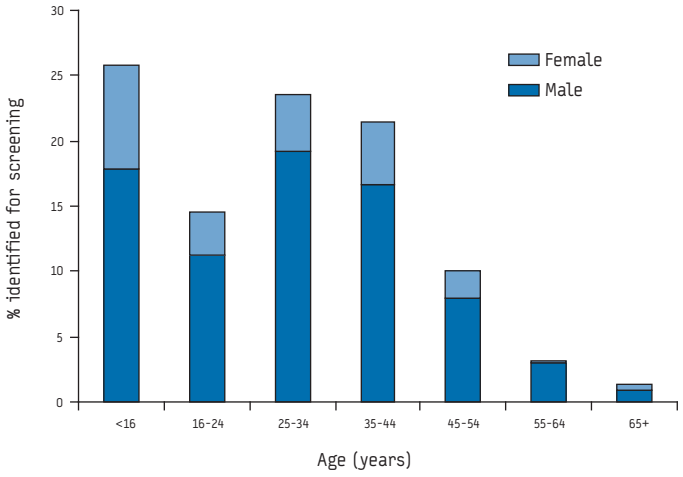
A UK-wide database of MIRU-VNTR profiles, developed by the UK TB Diagnostic and Molecular Epidemiology (DAME) Group, was searched to identify whether the 15 digit profile associated with this outbreak had been detected previously in the UK. It was the first time this particular fully sensitive MIRU-VNTR profile had been observed in the UK. There is no known link of this strain with Algeria nor is there any known pre-deposition for acquiring it. Since the outbreak, this MIRU-VNTR profile has been detected in a UK-born person in England in May 2006, and a further case in a previous household contact in February 2007 (see Box 1: linked cases 8 and 9; personal communication: Dr Ian Laurenson, Oct 2008).

## Discussion

We have described the experience of undertaking a large-scale contact tracing exercise for an outbreak of TB associated with a mosque. Literature searches failed to identify any other such exercises associated with a mosque community, although similar experiences had been reported in other community settings [14-18].

FIGURE 2

**Age and sex distribution of people identified as casual contacts for screening, tuberculosis outbreak, Aberdeen mosque, 2005**



In total, our screening identified five cases of active disease (1.3% of those screened) with a further four cases identified by other means. The detection rate from screening of casual contacts was low, at 0.53%. A review of outbreaks of TB in the UK involving screening of more than 100 contacts reported an estimated mean detection rate of 0.37% [19], raising questions about the effectiveness of large scale screening of contacts [20].

The national Collaborating Centre for Chronic Conditions report, funded by NICE for the development of guidelines on the control and prevention of TB in the UK, suggested the following definition of a significant casual contact:

*"Contacts with a cumulative total exposure to a smear-positive case of TB exceeding eight hours within a restricted area equivalent to a domestic room are equivalent to domestic contacts" [9].*

Faced with a high incidence of active disease found in close contacts, there was an imperative to identify any potentially significant casual contacts. Reviewing the type of contact between the index case and attendees at the mosque, it was considered that at least some of the attendees would have met the NICE criteria. In this instance, no definable subgroup of contacts from the mosque who definitely met the criteria could be identified to enable the traditional "stone in the pond" approach. In addition, the degree of contact with the index case, reported by the linked cases, was variable and did not indicate a minimum level of exposure that could be used to focus screening. To further restrict our definition of a casual contact would have substantially increased the complexity of the message delivered. We were therefore faced with the difficult decision of whether to screen all attendees or no attendees.

We experienced some specific challenges in managing the outbreak that related to the mosque setting. Delivering our message was difficult because, for religious reasons, it was not possible for a member of the health protection team to directly address mosque attendees at a mosque meeting. Identifying all appropriate communication avenues as well as key individuals, who would be seen as respected and influential by their community, to deliver the message, was crucial.

Substantial work was generated for the health protection team because of a lack of clarity in communicating the definition of a casual contact. 603 individuals gave their names and details as casual contacts but closer interview identified that 165 of them had had no, or only minimal, contact with the index case at the mosque. Often the details of entire households were given when only one or two of the male members of the house regularly attended the mosque. Had we been clearer, we might have been able to reduce the number of individuals that were worried or answered the invitation for screening unnecessarily.

Attempts to operate by standard local radiology procedures in the X-ray department identified some language and cultural challenges. For Muslim women, changing into gowns before the X-ray examination was problematic. Cubicles for changing were located in mixed sex waiting areas, so women changed into gowns and then put their outer garments back on over the gowns while waiting for their X-ray. This increased the required appointment time substantially but was unavoidable as many of the women preferred to have their husbands present during interview and X-ray.

The contact tracing exercise was based on the then current BTS guidelines (2000) for the management and control of TB [10]. This guidance recommended that those under 16 years of age should have a tuberculin skin test, irrespective of BCG status, with a follow up chest X-ray for those who had a positive result. This meant that both latent and active TB cases could be identified. Those over 16 years, with a previous BCG vaccination, were recommended to have a chest X-ray, which would only detect those with active TB disease. Linked case 9 was not identified at initial screening because latent TB was not detected. Even when presenting with symptoms approximately 15 months after exposure to the index case, chest X-ray was normal.

However, had the latest NICE guidance (2006) been followed, all those under 35 years would have been offered a tuberculin skin test and, where positive, followed up by interferon gamma blood test and chest X-ray as necessary [9]. The case finding rate, especially for latent TB, might then have been higher. That said, it would still have been impossible to ascertain and report on who had developed latent TB due to recent infection at the mosque. Many of those who were screened were born in countries with a high prevalence of TB (>40 per 100,000) and, therefore, prior latent TB infection could not have been ruled out.

By using the BTS guidelines (2000) for screening adults with a single chest X-ray, we required attendance at only one appointment. We experienced a failure to attend rate of 14%, and a number of attendees required multiple appointments before they finally did attend. Anecdotal evidence suggested that offering screening that required more than one attendance may have led to a higher default rate. Freudenstein *et al.* reported their experience of a large casual contact tracing exercise in a UK village community where screening offered Heaf testing and reading, followed by chest X-ray as required. 20% of the casual contacts failed to complete the screening process [21].

While extensive casual contact tracing was undertaken in this outbreak, we know that a substantial number of individuals who were exposed did not come forward for screening. Standard communication about TB is aimed at reducing anxiety. The message focuses on emphasising the low risk of transmission and treatable nature of TB. It seems that some individuals in the mosque community may have interpreted our initial message as meaning there was no need to come forward for screening. A more direct message, delivered by medical members of the mosque community, and a change in the written information provided, instigated a more active response. However, we continued to have difficulty convincing adult males, who potentially had the highest exposure, to come forward for screening. And yet more children and women attended for screening than were estimated to be at risk. Risk perception contributed to this discrepancy, as it appeared that this community perceived the highest risk to be to women and children, but less concern was given to the risks faced by adult men. Ethnicity and religious beliefs have been reported to influence risk perception of other health issues [22-25].

In summary, enhanced surveillance and, where possible, the use of molecular genetic techniques to link TB cases to the outbreak was, in our experience, useful in defining the extent of the outbreak [26]. The screening of a large number of casual contacts was a complex and time consuming exercise with a low detection rate.

The following insights were gained in the course of this investigation:

- Screening casual, multi-ethnic contacts in a mosque posed particular challenges;
- Communication of the risk of need for screening must be tailored to meet the specific needs of the community;
- Those at highest risk of TB infection in this setting, adult males, were least likely to attend for screening;
- The detection rate among screened casual contacts was low;
- We describe the first UK case with this particular pan-sensitive TB strain.

### Policy implications

Where the identity of those individuals who form a group of causal contacts cannot be established and the group are asked to self-assess against given criteria and then volunteer for screening, the uptake of screening and the case yield are low.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# Cohort study of an outbreak of viral gastroenteritis in a nursing home for elderly, Majorca, Spain, February 2008

**M A Luque Fernández (fmiguelangel@isciii.es)[1], A Galmés Truyols[2], D Herrera Guibert[1], G Arbona Cerdá[2], F Sancho Gayá[3]**

1. National Centre of Epidemiology (CNE), Programme of applied field epidemiology (Programa de Epidemiología Aplicada de Campo, PEAC), Instituto de Salud Carlos III (ISCIII), Madrid, Spain
2. Epidemiology Service, Council for Health and Consumers, Government of the Balearic Islands, Palma, Spain
3. Group of Assisted and Residential Services (Grupo Servicios Asistenciales y Residenciales, SAR), Medical services, Palma, Spain

An outbreak of acute gastroenteritis occurred in a nursing home for elderly in Majorca between 4 and 23 February 2008. To know its aetiology and mechanism of transmission a retrospective cohort study was conducted with a fixed cohort including 146 people (96 residents and 50 employees). The data were collected from clinical histories and through a survey by questionnaire. In total 71 cases were identified (53 residents, 18 employees), corresponding to an overall attack rate (AR) of 48.6%. The consumption of tap water, adjusted by age, sex and consumption of meals provided at the nursing home, presented a relative risk (RR) of 4.03 (95%CI, 1.4-11.4). The microbiological analyses confirmed the presence of norovirus and/or rotavirus in five of the seven stool samples submitted. The slow appearance of cases at the beginning of the outbreak is characteristic of a person to person transmission, while the sudden peak in the middle of the month suggests a common source such as the tap water. We therefore concluded that the outbreak likely originated from two sources: an infected employee of the nursing home and the tap water. The high number of dependent residents most probably facilitated the spread of the outbreak.

## Introduction

The progressive aging of the Spanish population increases the demand for residential services. The resulting increase of the numbers of nursing homes and their residents has favoured the emergence of acute gastroenteritis outbreaks in these institutions over the past years [1]. Given the risk characteristics of this particular population, these outbreaks are characterised by high morbidity with high attack rates and long duration [2].

Enteropathogenic viruses, including caliciviruses, are the most common causal agents in these outbreaks [3-5]. Rotaviruses are also responsible for severe diarrhoea, but mainly in children [6,7]. Nevertheless, outbreaks of acute gastroenteritis in nursing homes for elderly caused by rotavirus have been described in the literature [8-10].

In Spain, little information is available on morbidity and mortality associated with norovirus infection, its distribution among the population, and many of its epidemiological characteristics. This is primarily due to the fact that sample collection and laboratory screening for noroviruses is not done routinely [11]. Compared to other EU countries, not many studies of gastroenteritis outbreaks caused by norovirus are described in general and in nursing homes in Spain in particular [4, 12-15].

It is estimated that norovirus is the most common cause of acute gastroenteritis in some European Union countries, with 6% and 11% of all intestinal infectious diseases attributed to norovirus in the United Kingdom and the Netherlands, respectively [16,17].

Noroviruses are transmitted primarily through the faecal-oral route, either by direct person-to-person spread or by faecally contaminated food or water. Secondary and tertiary cases appear quickly through a person-to-person transmission. Noroviruses can also spread via a droplet route from vomits [18,19].

In healthcare facilities, transmission can additionally occur through hand transfer of the virus to the oral mucosa via contact with materials, fomites, and environmental surfaces that have been contaminated with either faeces or vomits. These circumstances make it extremely difficult to control outbreaks in institutional settings [20,21].

Between 4 and 23 February an outbreak of acute gastroenteritis occurred in an elderly nursing home in Majorca, Spain. The outbreak was characterised by a slow start followed by an explosive increase in the number of cases which may be linked to a common source. To contain the outbreak, between 9 and 11 February, the nursing home authorities implemented the following control measures: enteric isolation, cleaning of areas contaminated by vomit, restriction of visitors, suspension of the consumption of tap water, distribution of bottled water, cleaning and chlorination of the water cistern, and stool sampling. The notification of a suspected gastroenteritis outbreak was sent to the health authorities of the Balearic Islands on 13 February. In view of the microbiological confirmation of a mixed viral aetiology (norovirus and rotavirus) and the high attack rate, an epidemiological investigation to determine the causes and transmission routes of the outbreak was launched on 5 March.

## Methods

### Study design

A retrospective cohort study was conducted including all residents and employees (health workers, cleaning, laundry and maintenance service and administration) who were present in the nursing home in February. The observation period covered 29 days, from 1 to 29 February 2008. Persons who were admitted to or began employment in the nursing home after 29 February or those who were not present for the entire period of 29 days were excluded from the study.

A case of gastroenteritis was defined as any person working or residing in the nursing home during the month of February 2008 who had an episode of acute diarrhoea (defined as three or more liquid stools in 24 hours) or vomiting, or two or more of the following signs: fever, abdominal pain, malaise and nausea.

### Data source and epidemiological survey

Two data sources were used. The first one was a computerised database with the medical history of all residents of the nursing home. Information on the employees was obtained through an epidemiological self-administered survey. The questionnaire collected data on the employment position, working shifts and location within the nursing home (ground- or first floor, module A, B or C), as well as consumption of meals and drinking of tap water at the workplace during the month of February and on days 8, 9 and 10 of the same month (these dates were chosen taking into consideration the peak in case numbers on 13 February and the 72-hour incubation period). Finally, questions concerning symptoms experienced during the month of February, history of the disease and information on family members affected.

### Microbiological analysis

Stool samples were collected by the medical doctor of the nursing home and sent for routine bacteriological testing to the reference laboratory in the Balearic Islands. Subsequently, as viral origin was suspected in this outbreak, the health authorities of the Balearic Islands sent the available samples to the laboratory of the National Centre of Microbiology in Majadahonda near Madrid where polymerase chain reaction (PCR) was used for identifying norovirus and Elisa test for the identification of rotavirus.

Samples of drinking water could not be taken by the outbreak investigation team because on 26 February cleaning and chlorination of the water cistern of the residence was carried out. Food samples from different meals were collected during the week between 11 and 17 February, i.e. before the arrival of the outbreak investigation team, and were tested for bacteria only.

### Statistical analysis:

Common statistical methods were used for describing the variables related to personal data and place of work or residence within the nursing home. A univariate descriptive analysis was done to study the risk factors of employees and residents. The attack rate, the incidence densities, incidence density ratios (IDR) and the aetiological fractions due to exposure were calculated with their respective 95% confidence interval. The incidence densities were expressed in person-days. The differences of rates were analysed through the Fisher's Exact Test [22]. Finally, multivariate analyses using Cox regression with explanatory purpose were done to test the foodborne and the waterborne hypotheses, adjusted for age and sex. The overall significance of the model was verified through a maximum likelihood ratio test and the individual significance using p value of $\chi 2$ (chi square) by Wald's test. The resulting model relative risks (RR) were expressed with their respective 95% CI. The verification of the hypothesis of proportionality of risks was carried out using the graphic method of logarithmic survival curves: $Ln(-Ln\hat{S}(t))$. The study of outliers and influential values was done through the analysis of the residuals. EPIDAT v.3.1 was used for the data collection and Stata v.10 for the data analysis.

## Results

The study population consisted of 168 persons, 96 of them were residents and 72 employees of the nursing home. Information was obtained from 146 people; 100% (n= 96) of the residents and 69% (n=50) of the employees. Among the 50 employees included in the study, 38 (76%) were health workers. Among the 22 employees who did not respond to the questionnaire, nine worked in administration, management or services (laundry, cleaning and cooking) and 13 were health workers.

### Descriptive analysis of the residents

The sex ratio (males to females) among residents was 0.2 and the median age was 82 years, with an interquartile range (IQR) of 12. Over 60% of the residents needed help to perform activities of daily living. Dementia was present in 54% and 41% were incontinent. Among the residents, 53 (55%) fulfilled the case definition. The most common symptom was diarrhoea, present in 98% of the cases. All residents ate the meals provided by the nursing home and drank the tap water of the nursing home until distribution and consumption of bottled water was ordered by the director on 11 February.

### Descriptive analysis of the employees

Among the employees, the sex ratio (males to females) was 0.06. The median age was 37.7 years (IQR: 17). The median time at workplace was six months. Five (10%) employees drank tap water

**Figure 1**

**Epidemic curve of cases, by date of onset of symptoms, outbreak of gastroenteritis in a nursing home for elderly, Majorca, February 2008 (n=71)**

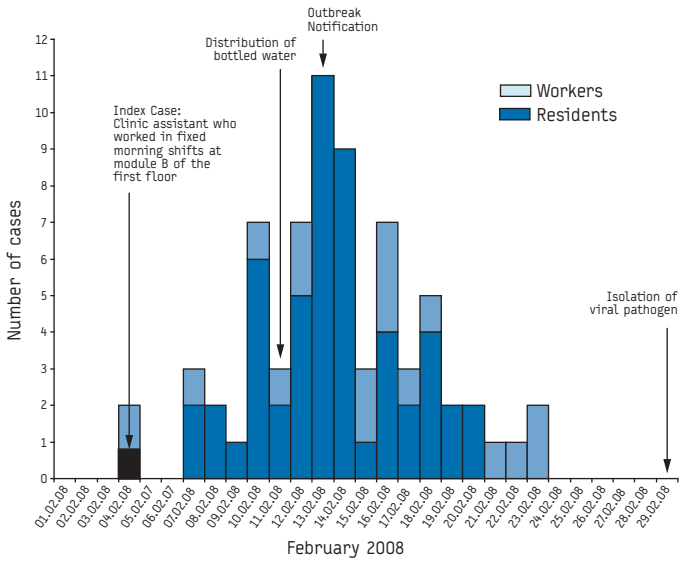

**Table 1**

**Attack rates and incidence densities in the cohort, by residents, employees, consumption of meals and drinking of tap water; outbreak of gastroenteritis in a nursing home for elderly, Majorca, February 2008 (n=146)**

| Variables | Cohort | Cases | Attack rate (%) (95% CI) | Incidence density* (95% CI) | P value** |
|---|---|---|---|---|---|
| | 146 | 71 | 48.6 (38.5-61.3) | 2.3 (1.8-2.8) | |
| **Cohort** | | | | | 0.02 |
| Residents | 96 | 53 | 55.2 (42.1-72.2) | 2.7 (2.1-3.6) | |
| Employees | 50 | 18 | 36.0 (22.6-57.1) | 1.5 (0.9-2.4) | |
| **Employees** | | | | | 0.13 |
| Health workers | 37 | 16 | 42.1 (25.7-68.7) | 1.8 (1.1-2.9) | |
| Others*** | 13 | 2 | 16.6 (4.2-66.6) | 0.6 (0.1-2.5) | |
| **Sex** | | | | | 0.39 |
| Male | 23 | 13 | 48.7 (37.5-63.2) | 2.2 (1.7-2.9) | |
| Female | 123 | 58 | 56.5 (32.3-97.3) | 2.8 (1.6-4.8) | |
| **Drinking of the nursing home tap water** | | | | | < 0.05 |
| Yes | 102 | 58 | 56.8 (43.9-73.5) | 2.8 (2.2-3.7) | |
| No | 44 | 13 | 29.5 (17.1-50.8) | 1.1 (0.6-1.9) | |
| **Diet** | | | | | 0.09 |
| Standard | 59 | 32 | 54.2 (38.3-76.7) | 2.6 (1.9-3.7) | |
| Diabetic | 19 | 12 | 63.1 (35.8-111.2) | 3.3 (1.8-5.7) | |
| Soft | 13 | 8 | 61.5 (30.7-123.0) | 3.5 (1.7-6.9) | |
| Pureed | 14 | 4 | 28.5 (10.7-76.1) | 1.2 (0.4-3.1) | |
| Do not eat meals at the nursing home | 41 | 15 | 36.5 (22.0-60.6) | 1.5 (0.9-2.5) | |

* Incidence density per 100 people and day
** P value of $\chi^2$ of Fisher's exact test
*** Cleaning, laundry and maintenance service and administration

**Table 2**

**Univariate analyses of gastroenteritis cases in residents of the nursing home, outbreak in Majorca, February 2008 (n=96)**

| Variables | Cohort of residents | Cases | Attack rate (%) (95%CI) | Incidence density* (95%CI) | Incidence density ratio (95%CI) | Attributable fraction (exposed) (95%CI) |
|---|---|---|---|---|---|---|
| **Sex** | | | | | | ** |
| Female | 76 | 41 | 53.9 (39.7-73.2) | 2.6 (1.9-3.5) | 1 | |
| Male | 20 | 12 | 60.0 (34.0-105.6) | 3.1 (1.7-5.4) | 1.2 (0.5-2.2) | 15.2 ([-7.7]-5.6) |
| **Age in years** | | | | | | ** |
| ≤ 80 years | 43 | 25 | 58.1 (39.2-86.0) | 2.9 (2.0-4.4) | 1.2 (0.6-2.1) | 15.6 ([-5.1]-52.6) |
| ≥ 81 years | 53 | 28 | 52.8 (36.4-76.5) | 2.5 (1.7-3.6) | 1 | |
| **Independent in the activities of daily living** | | | | | | ** |
| Yes | 38 | 21 | 55.1 (39.2-78.0) | 2.6 (1.7-4.0) | 1 | |
| No | 58 | 32 | 55.2 (36.0-84.7) | 2.8 (1.9-3.9) | 1.1 (0.6-1.9) | 5.7 ([-6.8]-48.3) |
| **Physical disability*** ** | | | | | | ** |
| Yes | 36 | 18 | 50.0 (31.5-79.3) | 2.4 (1.5-3.8) | 1 | |
| No | 59 | 35 | 59.3 (42.5-82.6) | 2.9 (2.1-4.1) | 1.22 (0.7-2.3) | 18.2 ([-48.2]-56.4) |
| **Dementia** | | | | | | ** |
| Yes | 52 | 26 | 50.0 (34.0-73.4) | 2.4 (1.6-3.6) | 1 | |
| No | 44 | 27 | 61.3 (47.1-89.4) | 3.0 (2.1-4.5) | 1.2 (0.7-2.2) | 21.0 ([-40.5]-55.7) |
| **Control sphincters** | | | | | | ** |
| Yes | 56 | 28 | 50.0 (34.5-72.4) | 2.4 (1.7-3.6) | 1 | |
| No | 40 | 25 | 62.5 (42.2-92.4) | 3.1 (2.1-4.6) | 1.3 (0.7-2.2) | 20.0 ([-43.0]-55.0) |
| **Diet** | | | | | | ** |
| Standard | 50 | 29 | 58.0 (40.3-83.4) | 28.8 (20.0-41.5) | 2.4 (0.8-9.5) | 59.1 ([-16.3]-89.5) |
| Diabetic | 19 | 12 | 63.1 (35.8-1112) | 32.6 (18.5-57.4) | 2.7 (0.8-11.7) | 63.8 ([-19.3]-91.4) |
| Soft | 13 | 8 | 61.5 (30.7-123.0) | 34.6 (17.3-69.2) | 2.9 (0.8-13.3) | 65.9 ([-27.1]-92.5) |
| Pureed | 14 | 4 | 28.5 (10.7-76.1) | 11.8 (4.4-31.4) | 1 | |
| **Type of room** | | | | | | ** |
| Simple | 46 | 23 | 50.0 (36.1-63.8) | 2.3 (1.5-3.5) | 1 | |
| Double | 50 | 30 | 60.0 (46.1-72.4) | 3.1(2.1-4.4) | 1.3 (0.7-2.7) | 24.1 ([-30.6]-55.9) |
| **Floor** | | | | | | ** |
| Ground floor | 24 | 11 | 45.8 (25.3-82.7) | 1.9 (1.0-3.5) | 1 | |
| Second floor | 72 | 42 | 58.3 (43.1-48.0) | 3.0 (2.2-4.1) | 1.5 (0.8-3.3) | 35.8 ([-26.7]-70.2) |

* Incidence density per 100 people and day
** P value > 0.05 of $\chi^2$ of Fisher's exact test
*** Information on physical disability was available for 95 of the 96 residents in the cohort (one missing)

**Figure 2**

**Survival function of the tap water adjusted by age, sex and consumption of meals at the nursing home, outbreak of gastroenteritis in Majorca, February 2008 (n=146, 48.6% cases)**

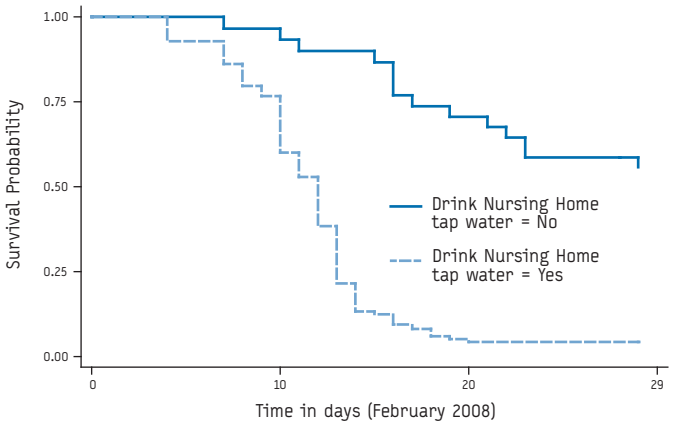


**Figure 3**

**Verification of the hypothesis of proportional risks assumption, logarithmic survival curves, Ln(-LnŜ (t)), outbreak of gastroenteritis in a nursing home for elderly, Majorca, February 2008**

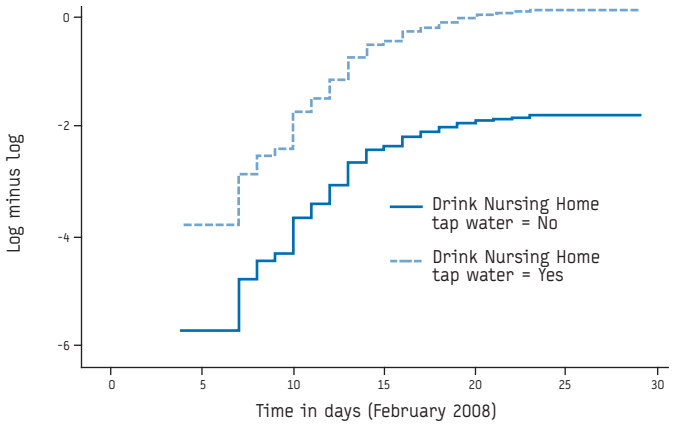


**Table 3**

**Univariate analyses of gastroenteritis cases in employees of the nursing home, outbreak in Majorca, February 2008 (n=50)**

| Variables | Cohort of employees | Cases | Attack rate (%) (95% CI) | Incidence density* (95% CI) | Incidence density ratio (95% CI) | Attributable fraction (exposed) (95% CI) |
|---|---|---|---|---|---|---|
| **Sex** | | | | | | ** |
| Female | 47 | 17 | 36.1 (22.4-58.1) | 1.5 (0.9-2.3) | 1.1 (0.2-48.5) | 13.9 ([-4.5]-97.9) |
| Male | 3 | 1 | 33.3 (4.7-23.6) | 1.2 (0.2-9.2) | 1 | |
| **Age in years*** ** | | | | | | |
| ≤ 24 | 8 | 3 | 37.5 (12.116.2) | 1.5 (0.5-4.8) | 1.5 (0.2-1.7) | 36.3 ([-37.5]-91.4) |
| 25-34 | 12 | 3 | 25.0 (8.0-77.5) | 0.9 (0.3-3.0) | 1 | |
| 35-44 | 12 | 6 | 50.0 (22.4-111.2) | 2.1 (0.9-4.8) | 2.1 (0.4-13.5) | 54.2 ([-11.4]-92.6) |
| ≥ 45 | 15 | 6 | 40.0 (17.9-89.0) | 1.7 (0.7-3.8) | 1.7 (0.4-6.9) | 43.2 ([-12.2]-85.5) |
| **Job position** | | | | | | |
| Health workers | 38 | 16 | 42.1 (25.7-68.7) | 1.8 (1.1-2.9) | 2.9 (0.7-2.6) | 65.7 ([-45.6]-96.1) |
| Others**** | 12 | 2 | 16.6 (4.1-66.6) | 0.6 (0.1-2.4) | 1 | |
| **Working hours** | | | | | | |
| Day shift | 16 | 8 | 50.0 (25.0-99.9) | 2.2 (1.1-4.4) | 2.3 (0.5-13.4) | 56.5 ([-81.2]-92.5) |
| Afternoon shift | 8 | 3 | 37.5 (12.0-116.2) | 1.6 (0.5-5.0) | 1.6 (0.2-12.5) | 40.5 ([-34.3]-92.0) |
| All shifts | 3 | 1 | 33.3 (4.6-23.6) | 1.4 (0.2-10.1) | 1.5 (0.1-18.6) | 33.0 ([-342.2]-94.6) |
| Day/night shift | 11 | 3 | 27.2 (8.7-84.5) | 1.1 (0.3-3.4) | 1.1 (0.1-8.6) | 13.1 ([-54.8]-88.3) |
| Day/Afternoon shift | 12 | 3 | 25.0 (8.0-77.5) | 0.9 (0.3-2.9) | 1 | |
| **Length of employment in months** | | | | | | ** |
| 11-14 months | 10 | 5 | 50.0 (20.8-120.1) | 2.3 (9.9-57.4) | 2.6 (0.5-13.2) | 61.2 ([-76.9]-92.4) |
| 7-10 months | 11 | 5 | 45.4 (18.9-109.2) | 2.0 (8.5-49.4) | 2.2 (0.5-11.3) | 55.7 ([-105.7]-91.2) |
| 4-6 months | 12 | 4 | 33.3 (12.5-88.8) | 1.2 (4.8-34.0) | 1.4 (0.3-7.35) | 28.7 ([-282.7]-86.7) |
| 0-3 months | 17 | 4 | 23.5 (8.8-62.6) | 0.9 (3.4-24.2) | 1 | |
| **Location at the workplace (floor and module) in February** | | | | | | ** |
| Ground floor | 10 | 3 | 30.0 (9.6-93.0) | 1.1 (0.3-3.5) | 1.4 (0.2-8.2) | 28.0 ([-391.7]-87.8) |
| Second floor, module A | 7 | 2 | 28.5 (7.1-114.2) | 1.1 (0.2-4.3) | 1.3 (0.1-9.1) | 23.7 ([-743.3]-89.0) |
| Second floor, module B | 6 | 4 | 66.6 (25.0-117.6) | 4.5 (1.7-12.1) | 5.5 (1.0-29.6) | 81.8 (2.5-96.6) |
| Second floor, module C | 8 | 5 | 62.5 (26.0-150.1) | 2.7 (1.1-6.5) | 3.3 (0.7-16.6) | 69.6 ([-41.0]-93.9) |
| Both floors | 19 | 4 | 21.0 (7.9-56.0) | 0.8 (0.3-2.1) | 1 | |
| **Consumption of the nursing home meals in February** | | | | | | ** |
| Yes | 9 | 3 | 33.3 (10.7-103.3) | 1.4 (0.4-4.3) | 1 | |
| No | 41 | 15 | 36.5 (22.0-60.6) | 1.5 (0.9-2.5) | 1.1 (0.3-5.8) | 7.4 ([-227.0]-82.8) |
| **Drinking of the nursing home tap water in February** | | | | | | **0.01** |
| Yes | 5 | 4 | 80.0 (30.0-213.1) | 6.5 (2.4-17.4) | **5.3 (1.2-17.0)** | **81.3 (0.2-94.1)** |
| No | 45 | 14 | 31.1 (18.4-52.5) | 1.2 (7.2-20.7) | 1 | |

*Incidence density per 100 people and day
** P value > 0.05 of $\chi^2$ of Fisher's exact test
*** Information on age was available for 47 of the 50 employees in the cohort (three missing)
**** Cleaning, laundry and maintenance service and administration; (working in administration was not reported by any case)

from the cistern of the nursing home during the month of February, and nine (18%) ate the standard menu during the same time. 18 cases (36%) were identified among the employees. The most common symptom reported by employees was diarrhoea, followed by abdominal discomfort.

### Descriptive temporal analysis

The outbreak began on 4 February and lasted until 23 February. The first two cases with onset of symptoms on 4 February were employees of the centre. Both were included in the study but only one provided detailed answers to all questions in the questionnaire. This index case was a nursing assistant who during the month of February worked in fixed morning shifts in the module B on the first floor. This person was diagnosed with acute gastroenteritis by a physician. The relatives of the index case were also affected and began to show symptoms on 6 February (Figure 1).

The outbreak peaked on 13 and 14 February (11 and 9 cases, respectively). The latest reported date of onset of symptoms was 23 February (two cases).

### Attack rates, incidence densities

The overall attack rate (AR) was 48.6% (95% confidence interval, CI, 38.5-61.3). The AR among the employees (n=50) was 36% (95%CI, 22.6-57.1). The AR among the residents (n= 96) was 55.2% (95%CI, 42.1-72.2).

There were no significant differences between attack rates and the incidence densities according to sex and consumption of the menu. However, the risk of illness following consumption of tap water from the nursing home was significantly higher among those who drank it compared to those who did not (Table 1).

### Univariate analysis

Among residents, women of any age and people of both sexes below 80 years of age were most affected. Being resident of the first floor in a double room, incontinent and dependent on the staff to handle the basic activities of daily living, posed a greater risk of infection. The risk of residents of double rooms was 30% higher (IDR: 1.3 CI95% [0.7-2.2]) than those of single rooms. There were no significant differences between risks related to different diets (i.e. standard, diabetic, pureed, etc.) within the meals consumed in the nursing home (chi square of Fisher's exact test for unequal rates, p= 0.098) (Table 2).

Among employees, health workers between 34 to 44 years of age, with fixed morning shifts attached to the module B of the first floor and more than 10 months at the workplace had a higher risk of acute gastroenteritis. The consumption of tap water during the month of February is the highest risk factor associated with the acute gastroenteritis (Table 3).

### Multivariate analysis

The consumption of tap water during the month of February is a clear risk factor for gastroenteritis within employees and residents. The unadjusted risk ratio for drinking tap water was 2.5 95% CI (1.3-4.5). Regardless of age, sex and consumption of the menu, individuals from the cohort, who drank water, were four times more at risk of acute gastroenteritis than those that did not consume (Table 4, Figures 2 and 3).

### Laboratory results

On 29 February the results of laboratory analysis of samples taken during the outbreak confirmed the isolation of viral enteropathogenic agents in five of the seven samples submitted: norovirus in three of them, rotavirus in one and both norovirus and rotavirus in the fifth one. The food samples tested during the outbreak were negative for bacteria.

## Discussion

The description and the epidemiological analysis of the outbreak allow us to reconstruct the possible source and subsequent transmission of infection in the nursing home. The index case of 4 February was a clinic assistant who worked in fixed morning shifts at module B of the first floor. In this module, where the outbreak began among residents, it is likely that the index case introduced the virus into the residence. This hypothesis is also supported by the fact that the washing and changing clothes of residents is done during the morning shift, the workload is bigger than in the other shifts and the contact between employees and residents is closer.

Regarding the transmission of the outbreak, the epidemic curve with mild start and slow spread until 9 February would support the hypothesis of introduction of rotavirus from outside through the index case. However, on 13 and 14 February an explosive peak, lasting two-days, occurred affecting only residents. Knowing the pathogenesis of norovirus, its epidemiological characteristics and the fact that calicivirus outbreaks have been associated with a common water source [23-27], it is likely that this peak was due to consumption of tap water from the nursing home. All residents and five (10%) of employees in the centre drank tap water until 11 February, when distribution of bottled water was imposed due to the suspicion of an acute gastroenteritis outbreak. Within 72 hours after the closure of the cistern the highest case load per day were reported. In addition, all these cases had drunk tap water before. If we take into consideration the incubation period of these viral agents, the epidemic peak of day 14 and 15 corresponds well to the prohibition to consume tap water and the provision of bottled drinking water. This assumption is further supported by the results of the statistical analysis. The risk of gastroenteritis was four times higher in those individuals of the cohort who had consumed tap water regardless of age, sex and consumption of the nursing home meals. From the qualitative information obtained from staff interviews, we understood that days before the start of the outbreak there were complaints from residents of a bad taste of the tap water.

**Table 4**

**Multivariate analyses by Cox regression model of gastroenteritis cases categorised by age, sex and consumption of meals and tap water at the nursing home, outbreak in Majorca, February 2008 (n=146)**

| Variables | Beta coefficient | Standard error | Relative risk (95%CI) | P value* |
|---|---|---|---|---|
| Age (in years) | -0.01 | 0.01 | 0.99 (0.97-1.01) | 0.17 |
| Sex (female vs male) | -0.03 | 0.31 | 1.03 (0.53-1.79) | 0.93 |
| Drinking of tap water (yes vs no) | 1.39 | 0.53 | **4.03 (1.42-11.38)** | **0.01** |
| Consumption of meals (yes vs no) | -0.05 | 0.25 | 0.96 (0.58-1.56) | 0.85 |

* P value of $\chi^2$ Wald's test

There were no differences between the risks related to different diets, so the alimentary hypothesis was rejected. The risk of acute gastroenteritis was similar for those who usually ate at the residence as for those who did not, and multivariate analysis confirmed the absence of association between the outbreak and having meals at the nursing home.

Therefore, disregarding the hypothesis of food source, we consider as very likely the coexistence of two routes the outbreak was introduced into the nursing home. The first was infection imported from outside, most likely by the index case we identified, which progressed by a person to person transmission. The second was a common source, most likely the tap water.

The outbreak took place in a closed setting which usually results in high attack rates. However, in this outbreak, the double source could also explain the high virulence and high transmissibility of infection, that affected half of the cohort and a density incidence of 2.3 (95%CI: 1.8-2.8) cases per 100 person-days. The unique dynamics in the transmission of this outbreak makes it markedly different from other outbreaks in nursing homes studied in Spain [4, 10-13].

After the peak on 13 and 14 February, the outbreak adopted a person to person transmission pattern affecting employees and residents. This hypothesis is supported by the high attack rates in both incontinent and dependent residents and health workers in fixed morning shifts of module B of the first floor. In addition, the risk of becoming ill among health workers was greater for those with fixed morning shifts, when as previously commented workers usually have more contact with residents. This phenomenon of spreading the disease by person to person is recurrent in different outbreaks described in nursing homes in Spain and in health care settings in other European countries [4,12-15, 28].

The greatest risk of becoming ill in the group of dependent residents and those with incontinent sphincter may be related to the special care they required. In this group of residents, the health worker per resident ratio is one per 12. As 60.4% of the residents needed assistance in performing activities of daily living, and 41% were incontinent, this might be a factor to take into account when trying to understand the difficulty of controlling the mechanism of person to person transmission in an outbreak in such setting.

Considering the limitations of this study, we must be prudent in interpreting the results where statistically significant associations were not found, since there is a possibility of false negative results in the statistical analyses. We should not overlook the possibility of a classification bias due to the memory at the time of completing the epidemiological questionnaire. Another limitation includes the selection bias introduced with the loss of selective information in the subgroup of employees in our cohort, linked to the non-response of the epidemiological questionnaire. This represents a 21.6% rate of non-response among employees. Therefore, apart from being cautious in extrapolating the results to the subgroup of employees, we should bear in mind that when we report the relative risks in the bivariate analysis of this group, the statistical power of our results is 22%. And finally, the impossibility to confirm by laboratory the presence of viruses in the drinking water of the cistern of the residence can subtract the attribution force of water as the causal hypothesis.

We can conclude that the studied outbreak showed a high attack rate and affected both residents and employees. The aetiology of the outbreak was mixed, with the involvement of norovirus and rotavirus. It is likely, that the high level of dependence of the residents had been a facilitating factor of the spread of the outbreak.

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# Letters

## Influenza vaccination coverage in England, 2000-2008

**R G Pebody (richard.pebody@hpa.org.uk)[1], F Begum[1,2], P Gates[2], K Noakes[2], D Salisbury[2]**
1. Health Protection Agency, Centre for Infections, London, United Kingdom
2. Immunisation Branch, Department of Health, London, United Kingdom

Dear Editor,

We read with interest the article by P Blank and colleagues on "Trends in influenza vaccination coverage rates in the United Kingdom over six seasons" published on 23 October 2008 [1].

The authors' study sets out to measure vaccine uptake over six seasons, with a secondary objective to ascertain motivations to be vaccinated. Between 2001 and 2007, they undertook annual household surveys by telephone interview in the UK. In their results, the authors describe a significant decline in vaccine uptake in those 65 years and more in age from 78.1% to 65.3% with evidence of year to year variation.

For several years, the Health Protection Agency on behalf of Department of Health has undertaken routine annual uptake monitoring of the seasonal influenza vaccination programme in England in order to provide an annual estimate of uptake in targeted groups. Data are now collected on registered patients in all general practices in England using a web-based reporting system. Many practices use automated extraction procedures based on standard queries. A detailed description of the methods used to collect the data is available [2].

In 2007-8, 95% of 8,375 GP practices in England took part in data collection. The sample size (registered patients, aged 65 and over) was 8,071,671). The national mean uptake in those 65 years and above in England was 74%, approaching the WHO target of 75%. Uptake levels have reached a plateau after the steady increase from 65% when the over-65-year-old programme was introduced in 2000 (Table 1). Data are published [3].

What might be the explanation for the discordance in the trend findings? As Blank et al discuss, their telephone study did have a large number of non-respondents (6% response rate), with the consequent potential for selection bias. In addition, the approach of self-reporting vaccination status can result in misclassification bias. Finally, the relatively small annual sample for the 65+ subgroup (<400 persons) will result in power limitations.

Telephone survey data can be a useful study tool. Our direct data allows the authors to validate the accuracy of their findings. There are discrepancies, indicating care needs to be taken when interpreting these results.

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**Table**

**Influenza vaccine uptake for 65 years and over by survey year, England, 2000-2008**

| Survey year | Number of participating GPs/total GPs | Total number of persons aged 65 years and over vaccinated | Total number of persons aged 65 years and over in registered population | Vaccine uptake (%) |
|---|---|---|---|---|
| 2000-1 | N/A | 4,820,239 | 7,373,157 | 65% |
| 2001-2 | N/A | 5,232,826 | 7,726,992 | 68% |
| 2002-3 | N/A | 5,487,645 | 8,008,299 | 69% |
| 2003-4 | 8,484/8,611 (99%) | 5,788,875 | 8,157,671 | 71% |
| 2004-5 | 8,147/ 8,675 (94%) | 5,621,381 | 7,870,212 | 71% |
| 2005-6 | 8,318/8,527 (98%) | 6,122,744 | 8,131,513 | 75% |
| 2006-7 | 7,860/8,464 (93%) | 5,779,145 | 7,815,298 | 74% |
| 2007-8 | 7,988/8,375 (95%) | 5,934,370 | 8,071,672 | 74% |

Note: Uptake figures include only those GP practices who have returned confirmation to the survey and reflect data for individuals vaccinated at these premises
Data Source: Influenza Immunisation Uptake Monitoring Programme HPA/DH

# Authors' reply: Influenza vaccination coverage in the United Kingdom

**P R Blank (patricia.blank@ifspm.uzh.ch)[1], M Schwenkglenks[2], T D Szucs[1]**
1. Institute of Social- and Preventive Medicine, University of Zurich, Zurich, Switzerland
2. European Center of Pharmaceutical Medicine, University of Basel, Basel, Switzerland

Dear Editor,

In response to our study investigating influenza vaccination coverage rates in the United Kingdom over six seasons with a telephone-based methodology [1], Pebody and colleagues note differences between our results and those reported by the Health Protection Agency (HPA) on behalf of Department of Health for registered patients in general practices in England. In their letter, Pebody and colleagues focus on our finding of a decline in coverage from 78.1% to 65.3% in the population aged 65 or over between 2005-6 and 2006-7.

At a closer look, our coverage results for this age group and those reported by the HPA are quite similar for 2003-4 (70% vs. 71%, respectively) and 2005-6 (78% vs. 75%, respectively) while our coverage results for 2004-5 and 2006-7 are indeed substantially lower. Given confidence interval widths, as shown in Figure 2 of our report, chance alone does not appear to be a likely explanation for this discrepancy.

With respect to selection effects, it should be noted that our survey methodology was designed to capture a representative sample of the population, even in the presence of low response rates. We are aware, however, that the increasing use of answering machines, voicemail systems, caller IDs and mobile phones creates an emerging challenge for telephone surveys [2,3]. Given that, we clearly cannot exclude selection bias as a partial explanation. However, as our methodology remained the same during the entire time period covered, it is unclear why selection bias should have occurred in two of the influenza seasons covered, but not in the other two.

The interviews were generally conducted between December and February as most individuals get (typically) vaccinated between September and November. The time lag between the vaccination and the fieldwork period was kept small in order to minimise incorrect recall of vaccination status. However, if the time distribution of vaccination episodes is atypical, as may have been the case in the 2006-7 influenza season due to delayed availability of the vaccine, this approach to survey timing may potentially lead to underreporting.

It should also be noted that our household surveys do not study the same population as the HPA. While our methodology covers the entire population that can be reached by a (landline) telephone connection, the HPA approach is restricted to those persons who are registered with a general practitioner and hence will, on average, differ in health status and perhaps other respects. Our knowledge of the British health system is not detailed enough to make a judgement on the potential implications of this difference.

In order to avoid double counting, we primarily studied only those persons aged 65 or over who did not have a chronic illness and were not working as health care professionals, i.e. we did not include all persons aged 65 or over, as was the case in the HPA analyses. Lower coverage rates would be expected for the resulting lower risk group, while in those aged 65 or over and with a chronic disease, whom we analysed separatly , distinctly higher coverage rates were indeed seen.

In conclusion, it is not obvious, in our opinion, what gave rise to the differences noted by Pebody and colleagues. There are several possible explanations which are not mutually exclusive. The different approaches to studying influenza coverage rates may be complementary rather than contradictory.

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