23. Ohsaki M, Tsutsumi H, Takeuchi R, Seki K, Chiba S. Recent increase in the frequency of infant measles in Japan. Pediatr Int. 2000; 42(3):233-5.
24. Bilkis MD, Barrero PR, Mistchenko AS. Measles resurgence in Argentina: 1997-8 outbreak. Epidemiol Infect. 2000; 124(2):289-293.
25. Gans HA, Arvin AM, Galinus J, Logan L, DeHovitz R, Maldonado Y. Deficiency of the humoral response to measles vaccine in infants inmunized at age 6 months. JAMA. 1998; 280:527-533.
26. Szenborn L, Tischer A, Pejcz J, Rudkowski Z, Wojcik M. Passive acquired immunity against measles in infants born to naturally infected and vaccinated mothers. Med Sci Monit 2003; 9(12):CR541-6.
27. Zanetta RA, Amaku M, Azevedo RS, Zanetta DM, Burattini MN, Massad E. Optimal age for vaccination against measles in the State of Sao Paulo, Brazil, taking into account the mother's serostatus. Vaccine. 2001; 20(1-2):26-234.
28. Morgan OW, Meltzer M, Muir D, Hogan H, Seng C, Hill J et al. Specialist vaccination advice and pockets of resistance to MMR vaccination: lessons from an outbreak of measles. Commun Dis Public Health. 2003; 6(4):330-3.
29. Maldonado YA, Lawrence EC, DeHovitz R, Hartzell H, Albrecht P. Early loss of passive measles antibody in infants of mothers with vaccine-induced immunity. Pediatrics 1995; 96(3 Pt 1):447-50.
30. Cilla G, Basterretxea M, Artieda J, Vicente D, Perez-Trallero E. Interruption of measles transmission in Gipuzkoa (Basque Country), Spain. Euro Surveill. 2004; 9(5):29-31.
31. Lezaun Larumbe ME. Plan de eliminación del sarampión en La Rioja (I). Boletín Epidemiológico de La Rioja 2001;(159):1119-1121.
32. van Treeck U. Measles outbreak in Germany: over 1000 cases now reported in Nordrhein Westfalen. Euro Surveill 2006; 11(5):E060511.1.

ORIGINAL ARTICLES

Outbreak report

OUTBREAK OF *SALMONELLA ENTERICA* SEROTYPE MANHATTAN INFECTION ASSOCIATED WITH MEAT PRODUCTS, FRANCE, 2005

H Noël[1], M Dominguez[1], FX Weill[2], A Brisabois[3], C Duchazeaubeneix[4], A Kerouanton[3], G Delmas[1], N Pihier[4], E Couturier[1]

Between August 2005 and March 2006 in France, 69 cases of *Salmonella enterica* serotype Manhattan (*Salmonella* Manhattan) were reported, 51 (74%) of them from southeastern France.
At the time of the alert (November 2005), 13 cases and 33 controls were interviewed. Cases were more likely than controls to have eaten pork sausages (OR=5.9, confidence interval CI [1.3; 26.9]) and beef (OR=9.3, CI [1.3; 68.6]). At the same time, 19 strains of *Salmonella* Manhattan isolated from meat products in southeastern France, reported to Afssa (the French Food Safety Agency) in September and November 2005, had an indistinguishable PFGE profile to the 7 human isolates of *Salmonella* Manhattan from the outbreak in southeastern France. Trace-back investigations revealed that pork samples came from one wholesaler whose pork products had tested positive for *S.* Manhattan during routine food testing in August 2005. This wholesaler supplied retail outlets in southeastern France. Additionally, a slaughterhouse supplying the wholesaler was inspected and widespread contamination with *Salmonella* spp. and *S.* Manhattan was found. Cooperation between the national agencies in charge of human health (InVS) and food safety (Afssa) allowed us to determine the most probable source of contamination and to take appropriate control measures.

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Key words: *Salmonella enterica* serotype Manhattan, France, outbreak, meat products

Introduction

In France, the National Reference Centre for *Salmonella* (NRC) collects human isolates through a voluntary network of medical laboratories and Afssa (the French Food Safety Agency) also collects salmonella strains isolated from animals, foods or the environment.

On 25 November 2005, the NRC for Salmonella identified an unusual increase of isolates of *Salmonella enterica* serotype Manhattan (*Salmonella* Manhattan). Thirty cases had been reported since August 2005, of which 26 were from several districts in southeastern France.

Although salmonellosis is the largest documented cause of foodborne infections [1], *S.* Manhattan is rarely isolated from humans, foods or animal*S.* The NRC identified an annual average of 7 cases in the previous five years and no isolate of *S.* Manhattan was reported in 2004 in food (A. Brisabois, personal communication, 2005).

An investigation was conducted to determine the extent of the outbreak, the source of infection and to implement control and prevention measures.

Methods

Epidemiological investigation

Basic epidemiological data (age, sex, district of residence, address of the medical laboratory) for all isolates of *S.* Manhattan identified through the NRC were transmitted for investigation. A case was defined as a person living in France, with diarrhoea (at least 3 watery stools a day) or fever, and *S.* Manhattan isolated from a stool or blood specimen, since August 2005. At the time of the alert, the most recently identified cases were retrospectively interviewed by telephone using a trawling questionnaire that collected food consumption and purchase in the 7 days before onset of symptoms. The questionnaire also enquired about symptoms, other possible exposures such as contact with other cases of diarrhoea in the household, pets or wild animals, recent travel, etc. A case-control study was carried out. Three controls per case were matched by district and by age group (child, adult if older than 15 years). Controls were sourced from the medical laboratory or general practitioner that had identified the case, from among the cases' family or friends, or at random from the telephone directory. Controls had no reported gastrointestinal illness in the two weeks before the interview.

1. Institut de Veille Sanitaire, Saint-Maurice, France
2. Centre National de Référence des Salmonella, Paris, France
3. Afssa-LERQAP, Maisons-Alfort, France
4. Direction générale de l'alimentation, Paris, France

They were asked detailed questions about food consumption and purchase in the 7 days before the interview. For analysis, meat products were grouped according to type and preparation (e.g. dried sausages, cooked sausages, raw sausages, cooked pork pieces). Analysis was performed using EpiData®, and frequencies were compared using Pearson's χ^2 or 2-tailed Fisher's exact test. Confidence intervals of the odds ratios were calculated using the Mantel-Haenszel method, stratified by district of exposure.

European investigation

Enter-net (the international network for surveillance of human gastrointestinal infections) was informed of the ongoing French outbreak and its members were requested to report any increase in number of cases of *S.* Manhattan or any cases possibly linked to the French outbreak.

Veterinary investigation

Food isolates of *S.* Manhattan recorded by Afssa since August 2005 were traced back by the district veterinary services.

Microbiological investigation

Human and food isolates of *S.* Manhattan linked to the outbreak and unrelated *S.* Manhattan isolates were characterised by pulsed field gel electrophoresis (PFGE) [2]. DNA was digested by the enzyme *Xba*1. Each profile that differed by at least one clear band >100 kbp was considered as a distinct profile. The software BioNumerics® was used to analyse and compare the genomic profiles obtained.

Results

Epidemiological investigation

Between August 2005 and March 2006, 69 cases were reported, 51 (74%) of which were from 10 districts located in southeastern France [FIGURE 1, FIGURE 2]. Among the 69 cases, 38 were female. All age groups were affected; 74% were adults and among them, 27 (55 %) were aged 65 years or older.

At the time of the alert (week 47/48), 13 cases were interviewed. Twelve lived or had spent a few days in one of the districts in southeastern France during the week before the onset of symptoms. Among the 13 cases, 9 were adults (3 more than 65 years old). The dates of onset of symptoms were from 2 September to 11 November 2005. The most frequently reported symptoms were diarrhoea (12/13, of which 4 cases reported bloody diarrhoea) and abdominal pain (10/13). Three patients were admitted to hospital, and there were no deaths.

FIGURE 1

Cases of *Salmonella* Manhattan infection by district, August 2005-March 2006, France

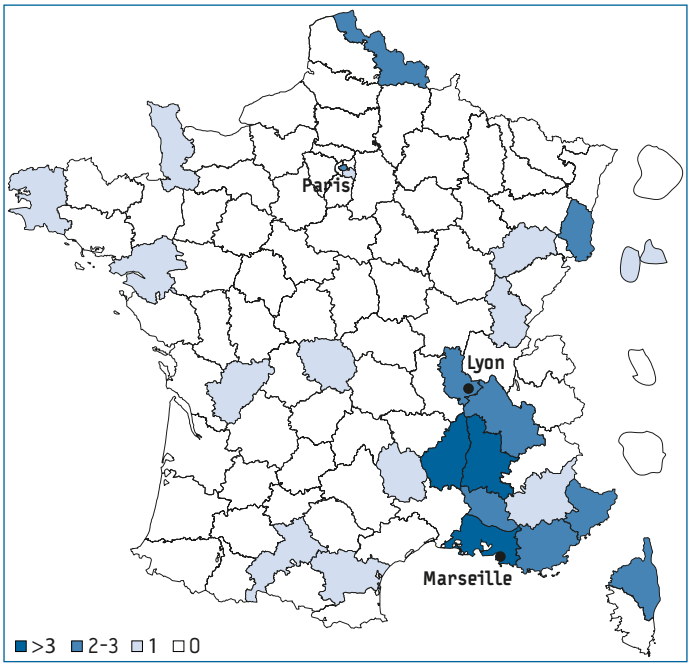
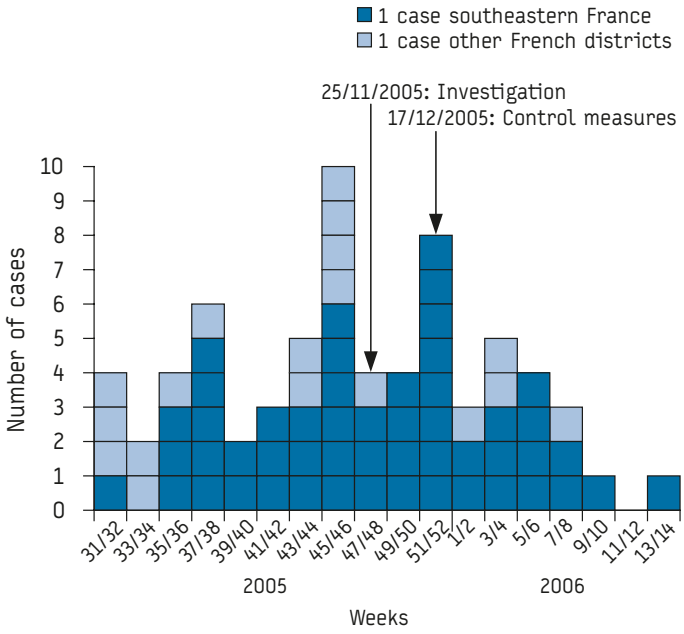


FIGURE 2

Epidemic curve by fortnight of isolation, *Salmonella* Manhattan, France, 2005-2006



The most frequently reported food products were cooked pork (boiled ham, 12/13), beef (12/13), dried pork sausages (11/13) and pork sausages (9/13), goat cheese (11/13), minced beef (10/13) and surimi (10/13) (minced, processed fish used in the preparation of imitation shellfish) [TABLE].

TABLE

Food consumption among cases and controls, *Salmonella* Manhattan, southeastern France, 2005

Food consumption	Cases N=13 n[1] exposed (%)	Controls N=33 n[1] exposed (%)	OR[2] CI 95%	p value
Beef	12 (92)	16 (48)	9.3 [1.3-68.6]	0.02
Pork sausages	9 (69)	10 (30)	5.9 [1.3-26.9]	0.05
Goat cheese	11 (85)	18 (55)	5.4 [0.9-32.0]	0.14
Cooked pork pieces	12 (92)	29 (88)	1.8 [0.2-19.2]	0.93
Dried sausages	11 (85)	21 (64)	5.8 [0.5-30.0]	0.20
Rare minced beef	6 (46)	11 (33)	1.4 [0.3-6.0]	0.65
Minced beef	10 (77)	21 (64)	1.7 [0.4-7.2]	0.47
Surimi[3]	10 (77)	5 (15)	9.5 [2.0-45.1]	0.001

1. Number exposed
2. Mantel-Haentzel estimate controlling for district
3. Minced, processed fish used in the preparation of imitation shellfish

Cases were more likely than controls to have eaten pork sausages (OR=5.9, confidence interval CI [1.3; 26.9]), beef (OR=9.3, CI [1.3; 68.6]) and surimi (OR=9.5, CI [2.0; 45.1]) [TABLE]. Because of the small number of cases, no multivariable analysis could be performed.

Veterinary investigation

Between September and November 2005, *S.* Manhattan was isolated from 19 food samples from 2 districts in southeastern France: 12 from pork, 6 from minced beef and 1 from veal [FIGURE 3].

Trace-back investigations revealed that 8 out the 12 pork samples originated from one wholesaler (establishment Y) [FIGURE 4]. It was noted that in August 2005, routine food controls on merguez sausages, Italian sausages and chipolatas manufactured in establishment Y were positive for *S.* Manhattan. Establishment Y supplied retail outlets in southeastern France. Slaughterhouse X, producing mainly pork (80%) but also beef (20%), was the supplier for establishment Y. The

Figure 3

Number of food strains of *Salmonella* Manhattan isolated by month, southeastern France, 2005

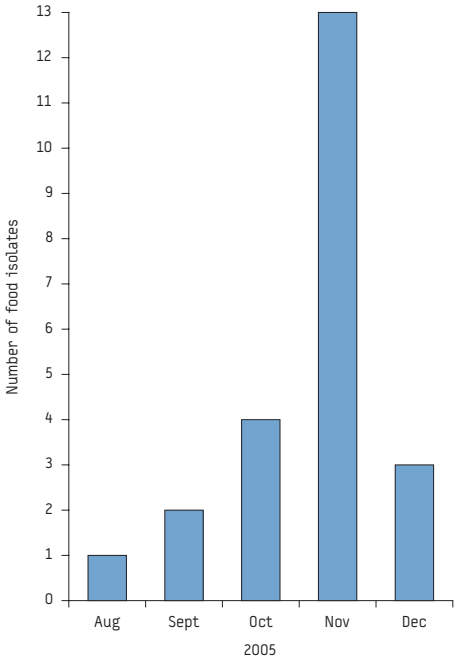
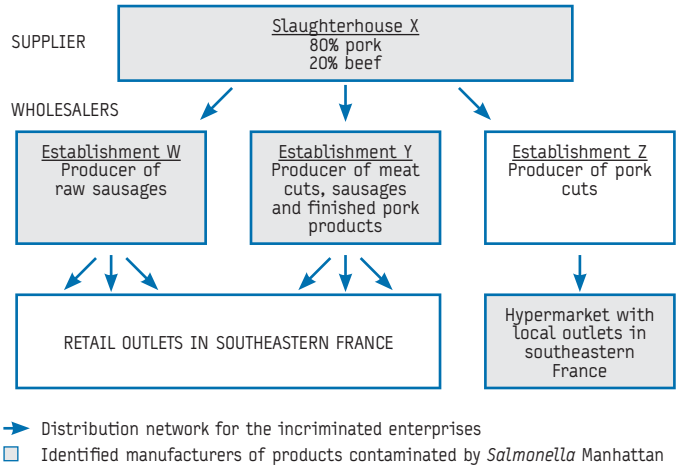


Figure 4

Traceback investigation, *Salmonella* Manhattan, southeastern France, 2005



slaughterhouse's facilities were inspected and revealed a widespread contamination with *Salmonella* spp. and *S.* Manhattan, as well as poor operational hygiene control practices.

Slaughterhouse X also supplied two other wholesalers (establishment W and establishment Z) and further investigations showed that since October 2005, pork products purchased by these wholesalers had been contaminated with *Salmonella* spp. Furthermore, 9 *S.* Manhattan isolates were obtained in slaughterhouse X products distributed in retail outlet*S.* These four establishments (X, W, Y and Z) distributed their products in the districts where 75% of the interviewed patients lived.

Microbiological investigation

Seven human isolates of *S.* Manhattan received by the NRC in October and November 2005 from southeastern France had an indistinguishable PFGE profile to the 19 strains of *S.* Manhattan isolated from meat products reported in September and November 2005. The PFGE profile of 2 human isolates received in March and September 2005, and not linked to the outbreak, was different.

European investigation

In European countries, *S.* Manhattan is a rare serotype and only five European countries (Austria, Belgium, Denmark, Finland and Scotland) had reported human, animal or food isolates of *S.* Manhattan in the previous two years. However none of these cases could be epidemiologically related to the French outbreak. Moreover, distribution of products from the incriminated slaughterhouse X was restricted to France.

Preventive and control measures

Production was suspended in establishment Y and its supplier, slaughterhouse X (on 6 and 15 December 2005, respectively) and X's facilities were cleaned and disinfected on 17 and 18 December. After those control measures were taken, products were routinely analysed for *Salmonella* spp. before being released for sale or used in the manufacture of other product*S.* No more *S.* Manhattan positive isolates in meat products occurred after implementation of these measures.

Discussion

From August 2005 to February 2006, a community-wide outbreak of *S.* Manhattan infections occurred in France. The investigation incriminated pork products from slaughterhouse X as being the most likely source of this outbreak. There is a concordance between the temporal (October-December 2005) and the geographical (southeastern France) occurrence of the majority of cases and the distribution of products from the slaughterhouse X. Furthermore, *S.* Manhattan, a rare serotype, was isolated from cases and from pork products, and seven human cases had the same PFGE profile as isolates from the pork products. Additionally, the consumption of pork sausages was associated with illness in the case-control study, and could explain the majority of cases.

There was no sampling frame for cases or controls. At the time of the alert, the most recently identified cases were retrospectively interviewed in order to lessen recall bias on food consumption and purchase. Controls were selected from different sources in order to recruit adequate numbers within a short timeframe. This enabled us to identify the incriminated food item(s) and rapidly implement control and prevention measures.

Decreasing numbers of cases and the absence of positive food isolates in early 2006 indicate the efficacy of the control measure*S.* However, cases were reported from mid-December 2005 to March 2006, and could be explained by the shelf life of pork products (at least 2 months) distributed before implementation of control measures.

The main production of slaughterhouse X was pork, but beef was also produced (20% of production). The outbreak could be due in part to the distribution of contaminated beef. In the case-control study, there was an association between beef consumption and illness. Although beef and pork production were carried out in different units, cross-contamination of the beef unit could not be ruled out. Therefore, the beef production unit was cleaned and disinfected as well as the pork unit.

Among the cases, 77% reported surimi consumption, and its consumption was associated with illness. However, the hypothesis of surimi as a source of contamination was highly unlikely. First, surimi consumption by case was from a wide range of brands. Second, these brands had no raw material or processing plants in common. In addition, the production process includes a double pasteurisation, so surimi contamination by *Salmonella* spp. was considered unlikely. As far as we know, no salmonella outbreak due to contaminated surimi has been reported in the scientific literature.

Despite the wide contamination of products from slaughterhouse X, relatively few cases were identified. Consumption of food contaminated with salmonella that has been properly cooked does not imply disease. Furthermore, it is likely that not all cases were reported through the surveillance system. In France in 2003, there were only 2 *S.* Manhattan food isolates, accounting for 0.2% of the salmonella isolates from pork and 0.1% from poultry. A recent British study showed that *S.* Manhattan accounted for 51.9% of all salmonella isolates in slurry in a commercial pig farm [3]. However, few human outbreaks due to

S. Manhattan have been described in Europe [4]. To our knowledge, the most recent *S.* Manhattan outbreak before this one occurred in France in 1982 in a hospital nursery, but the source of contamination was not identified [5].

In France, cooperation between the national agencies in charge of human health and food safety allowed us to determine the most probable source of contamination and to take appropriate control measures. To prevent community acquired salmonella infections, the greatest care should be taken in animal husbandry, to prevent contamination, and in slaughterhouses, to prevent cross contamination. Cooking meat and dairy products thoroughly before consumption should be recommended. This advice may prevent not only salmonellosis but also other potentially serious foodborne infections.

References

1. Vaillant V, De Valk H, Baron E, Ancelle T, Colin P and al. Foodborne Infections in France. Foodborne Pathog Dis. 2005;2(3):221-32.
2. Ribot EM, Fair MA, Gautom R, Cameron DN, Hunter SB, Swaminathan B, Barett TJ. Standardization of pulsed-field gel electrophoresis protocols for the subtyping of Escherichia coli O157:H7, Salmonella, and Shigella for PulseNet. Foodborne Pathog Dis. 2006;3(1):59-67.
3. Watabe M, Rao JR, Stewart TA, Xu J, Millar BC and al. Prevalence of bacterial faecal pathogens in separated and unseparated stored pig slurry. Lett Appl Microbiol. 2003;36(4):208-12 .
4. Fisher I, Hald T, Mølbak K, Riewerts Eriksen N. Outbreak of *Salmonella* manhattan infection in Denmark with international implications . Eurosurveillance Weekly. 1998;2(9) 980226. Available from: http://www.eurosurveillance.org/ew/1998/980226.asp#2 .
5. Sarlangue J, Billeaud C, Mégraud F, Martin C. [Neonatal epidemic caused by *Salmonella* Manhattan. Protective role of maternal milk]. Pediatrie. 1982;37(6):461-6. [In French]

ORIGINAL ARTICLES

Outbreak report

INVESTIGATION OF A TUBERCULOSIS CLUSTER AT A JOB CENTRE IN MANCHESTER, UK

A Kirkpatrick[1], C Bell[2], M Petrovic[1], M Woodhead[1], A Barrett[3], E Duffel[1], A Verma[4], F Reynolds[1]

During the summer of 2005, four cases of active tuberculosis from the same occupational setting were investigated in Manchester, UK. The index case had been diagnosed in December of the previous year. At that stage the closest occupational contacts had been screened, all of whom were assessed as being free from active disease, and none had met nationally recommended criteria for chemoprophylaxis for latent tuberculosis infection (LTBI).

In June 2005, two work contacts developed progressive primary extrapulmonary (pleural) TB. Following a detailed risk assessment, the screening programme was widened to include 137 staff who worked at the job centre (employment agency) where the first four cases had been found. This screening programme was based on tuberculin Mantoux testing, CXR and gamma-interferon testing. Of these 137 contacts screened, one additional person was found to have active disease and six others were offered chemoprophylaxis for LTBI. The isolates from the index case and the first two secondary cases were indistinguishable on VNTR-MIRU (variable number tandem repeat - mycobacterial interspersed repetitive unit) typing at 15 loci. No samples were available for testing from the fourth case of active disease.

Management of this incident has benefited from the evolving fields of both genotyping and diagnostic testing for LTBI. However, further research into the epidemiological inferences made through genotyping, as well as the significance of a positive gamma-interferon test in assessing the risk of development of active disease, is still required.

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Key Words: Tuberculosis, cluster, epidemiology, latent infection, gamma-interferon testing, genotyping

1. Greater Manchester Health Protection Unit, Manchester, United Kingdom
2. Central Manchester and Manchester Children's University Hospitals NHS Trust, Manchester, United Kingdom
3. HPA Regional Centres for Mycobacteriology, Newcastle, United Kingdom
4. Evidence for Population Health Unit, University of Manchester, Manchester, United Kingdom

Introduction

In December 2004 a case of sputum smear positive tuberculosis (TB) was diagnosed in an employee of a job centre (a branch of the United Kingdom government funded employment agency) in North Manchester. The isolate was confirmed to be fully sensitive *Mycobacterium tuberculosis*. In accordance with pre-existing national guidance [1] all household and close occupational contacts were screened. None of the three household contacts had active disease but two were offered chemoprophylaxis on the basis of their tuberculin Heaf test result, age and BCG status [1]. Ten close occupational contacts were all assessed as being free from active disease and none of them met the recommended criteria [1] for chemoprophylaxis for latent tuberculosis infection (LTBI).

In June 2005, however, two of these occupational contacts developed progressive primary extrapulmonary (pleural) TB. Initial screening had revealed Grade II and IV Heaf tests (neither had had BCG vaccination) and normal chest x rays (CXRs). Gamma interferon (GIF) testing was not performed, since at this time it was not available for routine use within Greater Manchester. Given the ages of these contacts, both of whom were adults in their late fifties and early sixties, neither were offered chemoprophylaxis: this was in accordance with national guidance. An incident management team (IMT) was subsequently convened to assess the need to expand screening in the workplace setting.

Methods

In order to guide the extent of further screening, a risk assessment was undertaken. This took into account the presumed infectious period of the index case, the duration of exposure for both staff and clients, the layout of the job centre, social activities, and use of canteens and smoking rooms. The two new cases were carefully assessed and were judged to be at low risk of being infectious, on the basis of their clinical presentation and the absence of any evidence that they were smear positive on sputum microscopy.

The centre was divided into three floors. The index case worked almost exclusively on the ground floor. The exact onset of symptoms