# Investigation of a hepatitis A outbreak due to oyster consumption in France in 2007

***Guillois-Bécel Yvonnick*[1], Couturier Elisabeth[2], Le Saux Jean-Claude[3], Roque-Afonso Anne-Marie[4], Le Guyader Soizick[3], Le Goas Annie[5], Pernès Jacques[5], Le Bechec Sylvie [5], Briand Alain[1], Robert Cécile[5], Dussaix Elisabeth[4], Pommepuy Monique[3], Vaillant Véronique[2]***

***[1]Cellule interrégionale d'épidémiologie Ouest, 20 rue d'Isly 35042 Rennes cedex, France * corresponding author: Yvonnick.GUILLOIS-BECEL@sante.gouv.fr***

***[2]Institut de veille sanitaire, Département des maladies infectieuses, 12 rue du Val d'Osne 94415 Saint-Maurice cedex, France***

***[3]Institut français de recherche pour l'exploitation de la mer, Laboratoire de Microbiologie, rue de l'Ile d'Yeu - B.P.21105 - 44311 Nantes cedex 03, France***

***[4]Centre national de référence du virus de l'hépatite A, Hôpital Paul Brousse, 12 avenue Paul Vaillant-Couturier 94804 Villejuif, France***

***[5]Direction départementale des affaires sanitaires et sociales des Côtes d'Armor, 1 rue du parc – B.P. 2152 – 22021 Saint-Brieuc cedex 01, France***

Following the notification of nine hepatitis A cases partly clustered near an oyster growing area in the Côtes d'Armor district (Brittany, France), epidemiological, environmental and microbiological investigations were performed in order to identify the source and vehicle of contamination and devise control measures.

The investigations identified 111 cases, all of whom lived or had stayed in the district. Of these cases, 87% had eaten raw bivalve molluscs and 81% had specifically eaten oysters. The raw molluscs originated from a single shellfish farm located at the north of Paimpol bay.

The shellfish were probably contaminated while being stored in submersible tanks or purified in a land-based tank. They were tainted either by sewage overflows or releases from a polluted storm sewer or effluents from on-site sanitation facilities.

To prevent future food-borne outbreaks due to shellfish consumption, hazards should be analysed for each farm of this area. Sewage collecting and treatment facilities should be up-graded around the bay and timely information on sewage overflows should be provided.

*Keywords: Hepatitis A, Outbreak, Oysters, Epidemiological investigations, Traceback investigations*

# Introduction

Hepatitis A is an acute disease caused by HAV virus which is transmitted either by consumption of tainted water and food or by person-to-person contact. The mean incubation period is 30 days with a range from 15 to 50 days (Heymann, 2004).

The disease is diagnosed by detection of immunoglobulin M antibodies to hepatitis A (IgM anti-HAV) in the serum. In France, surveillance of acute hepatitis A has been based on mandatory notification since November 2005. HAV endemicity is low and the notification rate was 2.2 / 100,000 in 2006 (Couturier *et al*., 2007).

Between 14 and 21 August 2007, nine hepatitis A cases were notified to the district health services of the Côtes d'Armor (Brittany). Seven cases had eaten oysters and four were living or had stayed near Paimpol bay – which is an oyster growing area. Investigations were launched to confirm the outbreak, to identify the source and vehicle of contamination, and to implement appropriate control measures.

# 1. Methods

Epidemiological investigations were performed, supplemented by traceback investigations on suspected contaminated food, as well as by environmental investigations and microbiological examinations (Guillois-Bécel *et al.*, 2008).

## 1.1. Epidemiological investigations

A case was defined as a person with IgM anti-HAV detected in their serum between 1 July and 15 October 2007 and having stayed in the Côtes d'Armor district in the six weeks before the onset of symptoms, either as a resident or a tourist.

The cases were identified through mandatory notification. The people concerned were called and interviewed using a standardised questionnaire about date and symptoms, place of residence or stay in the district and at-risk exposure, defined as food consumption and place of purchase, school or child care centre attendance, travel, household contact with a case and bathing in recreational water.

## 1.2. Traceback investigations

Traceback investigations were made of potentially tainted food when cases had stayed less than 15 days in the Côtes d'Armor district during the assessed at-risk period. Such investigations were also performed for clustered cases that had shared at least one meal.

For the investigated cases, accurate information on the place and on the date of purchase and consumption of the suspected food could be provided.

## 1.3. Microbiological analysis

The staff of the suspected contaminated shellfish farms were tested for the serological markers of HAV and sera of these cases were sent to the National Reference Centre for genotyping and phylogenetic analysis.

## 1.4 Environmental investigations

The functioning of the sewerage systems and wastewater treatment plants located around Paimpol bay during June and July 2007 was described.

HAV analyses were also performed on shellfish and environmental samples (storm sewage, sludge, raw and treated sewage) collected between 24 August and 24 October either around the bay or at the wastewater treatment plant.

# 2. Results

## 2.1. Epidemiological investigation

Of the 111 cases identified, 106 were interviewed between 17 August and 26 November.

Fifty-four (51%) cases lived in the Côtes d'Armor district. The places of residence or stay were clustered in the northwestern area near the towns of Paimpol and Lannion (Figure 1). Most of the tourist cases had stayed in the area around mid-July; twenty-six of them were present in the area exclusively during the 7 to 22 July period.

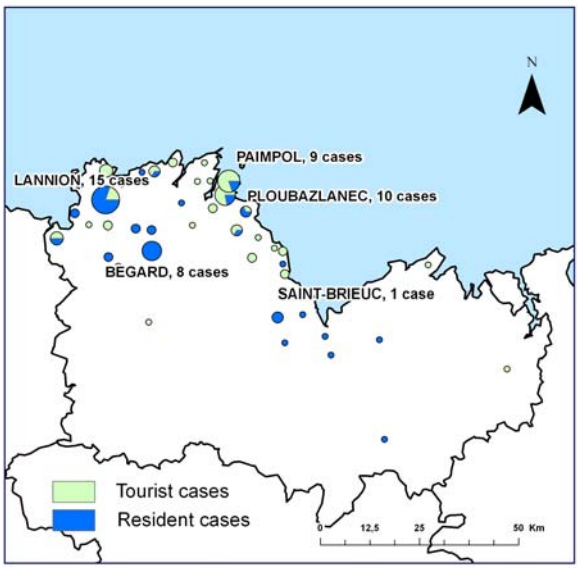


*Figure 1: Places of residence or stay in the Côtes d'Armor district (n=107)*

The symptoms were reported between 25 July and 9 October (weeks 30 to 41), with a peak for weeks 32 and 33 (Figure 2) that was consistent with a common point contamination around mid-July. However, person-to-person transmission was suggested for the few cases occurring from week 36.

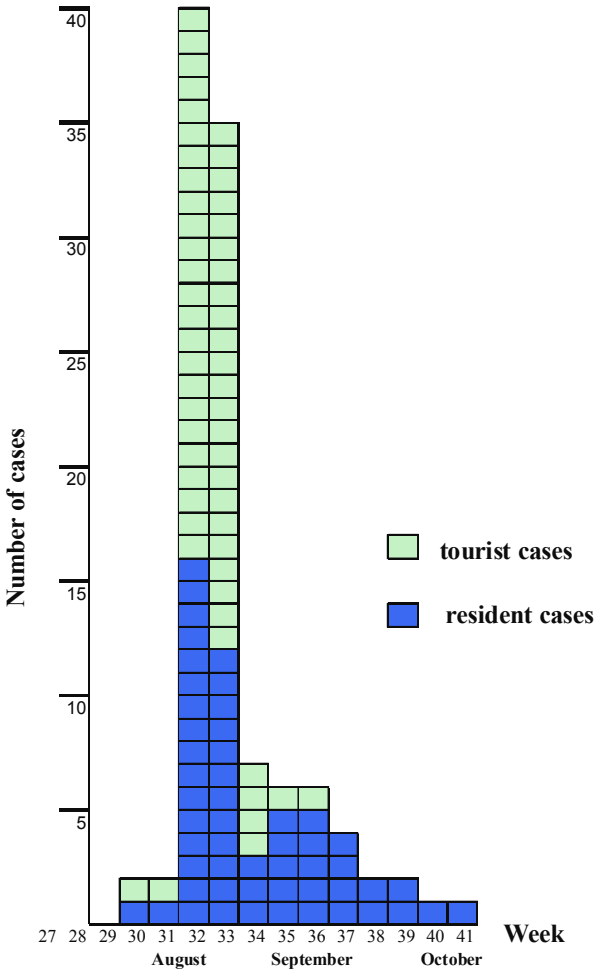


*Figure 2: Cases of hepatitis A by week of onset among resident and tourist populations (n=108)*

Among the interviewed cases, the median age was 40 (range: 4 to 82 years) and the sex ratio M/F 1.04. Eighty-eight cases (83%) had jaundice and 28 (26%) were hospitalised. The median hospitalization duration was 4 days. No deaths were reported.

For the 89 cases that occurred from week 30 to week 35, at-risk exposures were described.

Raw bivalve molluscs (oysters, warty venus, carpet shells, European bittersweets) had been consumed by 77 cases (87 %) and oysters by 72 cases (81%), including the 26 that had a short stay in the district (Table 1). Moreover, three common meals involved 7 cases around mid-July: two cases were linked to a meal on 13 July, two cases to a meal on 15

July and three cases to another meal on 15 July. Six of the seven clustered cases had eaten raw shellfish.

*Table 1: Molluscan shellfish consumptions by Hepatitis A cases in the Côtes d'Armor district during the 6 weeks before symptom onset (n=80)*

| | **Cases that stayed in the district exclusively during the at-risk period** n *(%)* | **Other cases** n *(%)* | **All cases** n *(%)* |
|---|---|---|---|
| **Raw bivalve molluscs:** | 26 *(100)* | 51 *(81)* | 77 *(87)* |
| Pacific oysters *(Crassostrea gigas)* | 26 *(100)* | 46 *(73)* | 72 *(81)* |
| Warty venus *(Venus verrucosa)* | 8 *(31)* | 17 *(27)* | 25 *(28)* |
| Grooved carpet shells *(Ruditapes decussates)* | 9 *(35)* | 13 *(21)* | 22 *(25)* |
| Japanese carpet shells *(Ruditapes philippinarum)* | | | |
| Common European bittersweets *(Glycymeris glycymeris)* | 4 *(15)* | 8 *(13)* | 12 *(13)* |
| **Gastropod and other bivalve molluscs** | | | |
| Mussels *(Mytilus edulis)* | 11 *(42)* | 42 *(67)* | 53 *(60)* |
| Periwinkles (*Littorina littorea)* | 9 *(35)* | 25 *(40)* | 34 *(38)* |
| Whelks (*Buccinum undatum)* | 10 *(38)* | 22 *(35)* | 32 *(36)* |
| Common scallops (*Pecten maximus)* | 6 *(23)* | 14 *(22)* | 20 *(22)* |
| Limpets *(Patella vulgata)* | 0 *(0)* | 2 *(3)* | 2 *(2)* |
| Common cockles *(Cerastoderma edule)* | 2 *(8)* | 7 *(11)* | 9 *(10)* |
| Hard shell clams *(Merceneria merceneria)* | 1 *(4)* | 0 *(0)* | 1 *(1)* |
| **All gastropod and bivalve molluscs** | 26 *(100)* | 63 *(100)* | 89 *(100)* |

Raw vegetable consumption was documented for 80 cases. Tomatoes and lettuce were consumed by 74 (92%) and 72 (90%) cases respectively. No other common at-risk exposure was noticed.

## 2.2. Traceback investigations

Twenty of the twenty-six cases that stayed in the district exclusively during the at-risk period consumed raw shellfish either originating from one farm located in the north of Paimpol bay or, in one case, picked up near this farm.

The raw shellfish consumed by six of the cases linked to the three clusters exclusively originated from this same particular farm.

## 2.3. Microbiological analysis

Viral RNA was detected for 68 cases and all the sequences belonged to HAV genotype IIIA. Anti-HAV IgM tests were negative among the staff of the suspected shellfish farm.

## 2.4. Environmental investigations

The farm and its tanks where contamination was suspected were located near a storm sewer outlet at the north of the bay. Their oysters originated from different oyster bed areas and had been stored on the foreshore in submersible storage tanks or up to 10 days and then purified for 48 hours in a land-based tank before being sold.

At the north of the bay, a separate sewerage system collects the wastewaters from Paimpol, Ploubazlanec and Plourivo.

The wastewater treatment plant is an activated sludge plant (22 000 inhabitant equivalents), its disposal is located at the inner end of the bay and local streams disperse the treated effluents towards the north shore of the bay. Heavy rains caused sewage overflows twice in June and July: the buffer tank discharged 300 $m^3$ of diluted raw sewage on 24 June which was a neap tide day, and there were overflows from eight pumping stations on 23 July. HAV analyses performed on shellfish and environmental samples, onetheless, remained negative.

# 4. Discussion

This was the largest hepatitis A outbreak reported in France since the beginning of mandatory notification in November 2005. It was a common point source for outbreaks attributable to the consumption of raw shellfish between 7 and 22 July 2007. The traceback investigations revealed that the raw shellfish originated from one farm located at the north of the bay.

Although over 90% of the cases had consumed lettuce and tomatoes, the variety of purchasing places, together with the ban on sewage sludge and wastewater reuse in French market gardening, ruled out the hypothesis of raw vegetables being the vehicle for HAV in the investigated outbreak.

The shellfish were probably contaminated on the farm either in the depuration tank or in the submersible tanks where they had been stored temporarily. They could have been tainted by sewage overflows or by wastewater releases from polluted storm sewers or from on-site sanitation facilities. Being located near a storm sewer outlet increased the vulnerability of the farm's facilities, especially its storage tanks and the water supply to the depuration tank. The prevention of effluent dispersion by downpours and neap tides may also have contributed to the shellfish contamination.

To prevent another food-borne outbreak due to the shellfish from Paimpol bay, the sewage collection and treatment installations around the bay should be up-graded. Their monitoring should allow to timely alerts for shellfish farmers and local authorities about sewage overflows. On each farm in the bay, risk assessments should be performed in order to identify specific hazards and possible control measures.

This outbreak investigation underlines that consumption of raw shellfish can still cause a large outbreak in a country with low HAV endemicity like France.

# References

Couturier E., Letort M. J., Roque A. M., Dussaix E., Delarocque-Astagneau E., 2007, Hépatite aiguë A en France en 2006. Première année de surveillance par la déclaration obligatoire. *Bull Epidemiol Hebd.* 29-30, p. 253-255.

Guillois-Bécel Y., Briand A., Couturier E., Le Saux J. C., Roque-Afonso A. M., Le Guyader S., et al., 2008, Epidémie d'hépatite A dans le département des Côtes d'Armor. 1-43 Saint-Maurice, Institut de veille sanitaire.

Heymann D. L., 2004, Control of Communicable Diseases Manual, 18th Edition. American Public Health Association. Washington DC.