

## **An epidemic of influenza on Tristan da Cunha**

BY JOHN MANTLE

*Medical Officer, Tristan da Cunha*

AND D. A. J. TYRRELL\*

*Clinical Research Centre, Harrow, Middlesex HA1 3UJ*

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### SUMMARY

Respiratory disease on Tristan da Cunha has been observed since the islanders returned in 1962. An epidemic of unprecedented severity occurred in the winter of 1971 and involved 273 (96 %) of 284 islanders, 92 of whom had two attacks.

The epidemic was apparently introduced by the *Tristania*.

The illness of both first and second attacks ranged from mild to severe but there were some differences. There were two deaths, both in elderly persons with chronic chest disease and heart failure. Serological evidence suggests that this was due to influenza A2 of the Hong Kong serotype H<sub>3</sub>N<sub>2</sub>.

### INTRODUCTION

Tristan da Cunha is a remote volcanic island in the South Atlantic. The isolated population has for many years been subject to epidemics of common colds which follow the arrival of supply ships from Cape Town (Woolley, 1946; Shibli, Gooch, Lewis & Tyrrell, 1971). It is many years since an epidemic of influenza-like illness occurred there, but one occurred in the winter of 1971 and is reported here because of some unusual features.

### MATERIALS AND METHODS

The clinical records were drawn from the notes taken during the regular work of the practice, since the previous regular respiratory disease survey had been discontinued. All but three houses were visited and this gave opportunities to record milder illnesses as well as those requiring medical attention; further enquiries were made through two island nurses. As has been found before, it was possible to obtain almost complete records of illness on Tristan. The practice population consisted of 284 islanders and 20 expatriates, but the figures presented are for the islanders only.

#### *Laboratory studies*

Sera were collected and separated on the island, and sent by sea in refrigeration to Cape Town and thence by air to Britain. They were tested by haemagglutination-inhibition tests as described previously (Tyrrell, Peto & King, 1967) and by complement fixation tests against standard respiratory virus antigens.

\* Requests for reprints to Dr D. A. J. Tyrrell.

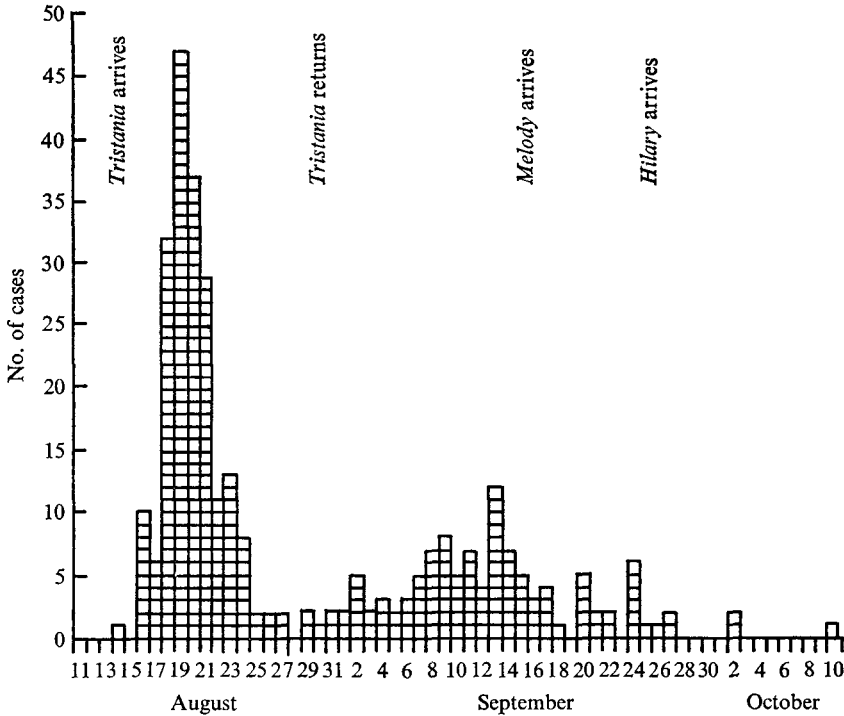


Fig. 1. The course of the epidemic. Each square indicates the day of onset of a separate case of illness. I or II in the 312 cases in which it was known for certain. *Tristania* arrives 13 August, disembarks five islanders and embarks JY. *Tristania* returns (from local fishing) 30 August, and lands JY and MR. *Melody*, fishing vessel ex-Cape Town, lands mail 16 September. *Hilary*, fishing vessel ex-Cape Town, lands mail 26 September.

#### RESULTS

On 13 August 1971, the fishing vessel *Tristania* landed five islanders after an 8-day voyage from Cape Town. The islanders had either been receiving medical treatment or had been on holiday in Cape Town. Three of them developed acute respiratory disease (ARD) in the course of the voyage and two had a similar illness immediately after landing. Various family gatherings welcomed their disembarkation. In the next few days all those who had been in contact with the returning islanders developed ARD which spread rapidly throughout the whole island population. The illness was similar in both expatriates and islanders, except that it tended to be milder in the former, particularly in those who had recently arrived.

At the beginning of the fourth week of the epidemic it became clear that some islanders were developing second attacks of respiratory disease and a second peak of new cases was recorded. The last new case was recorded on 10 October.

#### *The origin and course of the epidemic*

Fig. 1 shows the number of new cases beginning on each day and the dates of arrival of ships. Only those cases of which the date of onset was known precisely were included, i.e. 312 of the total of 365.

On arriving the *Tristania* disembarked five islanders and, for 2 days only, an English marine biologist (MR). During these 2 days there was some superficial contact between the ship's crew and islanders while supplies were unloaded. After 2 days the *Tristania* departed to fish in local waters, taking on board the expatriate manager of the crawfish freezing plant (JY) and MR. During the 15 days between the first and second arrival of the *Tristania* the ship had no outside contact. There was no respiratory disease on board the ship during this period – indeed the only ascertainable illness whatsoever among the crew on board was a mild cold which the captain suffered during the first 2 days out from Cape Town on the original voyage. Therefore, from the departure of the *Tristania* from Cape Town on 5 August until the arrival of the fishing vessel *Melody* on 16 September, the island and the *Tristania* together constituted a closed epidemiological group. On 30 August the *Tristania* called briefly to disembark JY and MR and take on water. Four days later JY developed a mild cold.

Ninety-six per cent of the Tristan islanders (273 out of 284) developed one episode of respiratory disease; 33 % (92) developed a second episode of respiratory disease. It is difficult to analyse the data without making epidemiological assumptions, but the least objectionable method seems to be to classify the illness according to whether

(a) it was the only episode, or the first of two episodes (illness I);

(b) it was the second of two episodes (illness II).

A few patients classified as having illness I developed it after other patients developed illness II. The first case of a second episode of respiratory disease occurred at the end of the third week of the epidemic, by which time 215 islanders had been infected with what is by definition illness I. This figure (215) represents 76 % of the island population at risk and 97 % of those who suffered from at least one illness.

#### *Clinical features of the illnesses*

In the majority of cases (85 % of those affected) illness I consisted of a typical influenza-like illness of at least moderate severity. The onset was sudden, with fever ranging from 100–104° F. presaged by shivering attacks or, in a few cases, actual rigors, and generalized aching pains in the back and legs. There was often prostrating headache with vomiting for 24 hr. and this occurred more often in women than in men. Cough was marked after the first day and tended to persist, even in the absence of secondary infection, for up to 3 weeks. Fever and malaise lasted an average of 3 days. In younger children (aged below 10 years) and babies the illness was usually comparatively mild, lasting only 2 days and without respiratory sequelae. In some adult islanders also the illness was quite mild, with fever not exceeding 100° F. and only transient cough and malaise. Coryza was not prominent. Sore throats were common, usually after the acute stage had passed.

Table 1 shows the extent and severity of illness I amongst the Tristan islanders. In mild illness the patient was not confined to the house or to bed for more than a day. Moderate describes what would be accepted by both lay and medical people as a typical case of influenza-like illness without major complications. Severe

Table 1. *The clinical features of the illnesses seen*

	Observations on	
	Illness I	Illness II
Grade of illness in islanders		
None	11 (4)	192 (67)
Mild	41 (14)	42 (15)
Moderate	189 (67)	36 (13)
Severe	43 (15)	14 (5)
Total	284 (100)	284 (100)
Complications in patients		
Chest infection	36 (13)	21 (23)
Bronchospasm	23 (8)	11 (12)
Pleural pain	12 (4)	6 (6)
Haemoptysis	4 (1.5)	3 (3)
Cardiovascular	1 (0.3)	0 (0)
Otitis media	7 (2.6)	2 (2)
Total	273 (100)	92 (100)

N.B. Figures in brackets are percentages.

illness was characterized by severe secondary infection, or other complications such as persistent pleuritic pain, severe bronchospasm, cardiovascular involvement, or by an unusual degree of prostration and fever.

The incidence of complications in illness I is also shown. Secondary bacterial chest infection was diagnosed by persistent fever in association with the expectoration of purulent sputum and clinical or radiological signs in the chest.

Only 54% of the 92 islanders who developed a second illness, illness II, had typical influenza-like moderate illness and less than half of the whole population was affected at all by it (Table 1). Nevertheless, no less than 21 islanders developed two episodes of influenza-like illness.

The second episode of viral respiratory disease was readily distinguished from relapse due to secondary infection. It was usually associated with a blocked or running nose. Fever was less and of more gradual onset than in first episodes. There were invariably coryzal symptoms (which indeed were the only symptoms in about one-third of those affected); involvement of the lower respiratory tract followed later.

Table 1 shows the incidence of complications in illness II, which is similar to that after the first illness, but relatively more secondary chest infections followed illness II. There was one death attributable to illness I and one to the effects of illness II; both were in elderly islanders with chronic respiratory disability and heart failure.

### *Serological results*

The sera were not obtained until the epidemic was almost over and the details of the patients and the timing of the specimens are shown in Table 2. In spite of the small numbers several points are clear. First, the islanders' sera contained significant levels of antibody against Hong Kong influenza A2 haemagglutinin. The last known exposure to influenza A2 was by vaccination in England in 1961

Table 2. Results of antibody titrations on sera from islanders with moderate or severe illnesses

Patient	Date of illness		Date of serum	Titre of serum against influenza			
	A	B		Influenza A		Influenza B	
				CFT	A2/HK HI	CFT	B/1970 HI
82	20. viii. 71	10. ix. 71	10. ix. 71	0	1280	0	0
			9. x. 71	0	1280	0	0
9	17. viii. 71	—	8. x. 71	320	320	0	10
111	17. viii. 71	—	8. x. 71	80	1280	0	10
248	19. viii. 71	—	8. x. 71	> 320	> 5120	0	20
10	20. viii. 71	—	8. x. 71	320	640	0	0
112	20. viii. 71	—	8. x. 71	> 320	1280	0	5
241	20. viii. 71	—	8. x. 71	0	1280	0	0
194	22. viii. 71	—	9. x. 71	320	320	0	0
183	24. viii. 71	9. ix. 71	8. x. 71	0	320	0	5
37	2. ix. 71	—	8. x. 71	> 320	320	0	0
JPM	10. ix. 71	—	10. ix. 71	0	320	20	0
Expatriate			8. x. 71	20	640	20	0

0 = <5 in HI, <10 in CFT.

and during a subsequent epidemic, long before the Hong Kong variant appeared. There were titres of HI antibodies against A2/Eng/12/64 some of which were higher than those against A2/HK, but these were presumably recalled. Recent infection with influenza A is suggested strongly by the presence of high titres of antibody against the soluble (nucleoprotein) antigen (Table 2) and by a rising titre (from <10 to 20) in JPM, the one expatriate who was bled. Furthermore, there was evidence of influenza A2 infection in those who became ill for the first time both in the first and the second wave of infection. The only CFT antibodies against influenza B were found in the serum of the expatriate and these did not change, and there were only occasional low titres in complement-fixation tests against measles, respiratory syncytial virus, herpes simplex and parainfluenza 3.

#### DISCUSSION

It is difficult to understand why there were two distinct waves of illness and why one third of the islanders developed two separate illnesses, both obviously viral in origin, in the course of one epidemic. This is the first epidemic in which islanders have been observed to be ill twice, although some anomalies in the epidemic curves have been interpreted as being possibly due to epidemics caused by two agents (Hammond & Tyrrell, 1971). There are three possible explanations for this.

The first is that two separate viral agents were introduced onto the island when the *Tristania* first arrived on 13 August. Each pursued its course through the community at a different rate and produced, therefore, two waves of illness. Each agent must have been capable of causing respiratory disease of varying severity, since some islanders had two mild illnesses and some two episodes of typical or

even severe influenza-like illness. If this explanation is correct, then it is only possible to say that 96 % of the population was infected by one or the other virus, and 33 % by both. In other words, illness I could have been due in some cases to either virus (i) or (ii) and conversely illness II could have been due either to virus (ii) or (i). However, the time factor, the necessarily different infectivity rates and the explosive spread of the first outbreak of ARD suggest that the degree of overlap is small. Even accepting this explanation, it is probable that the patients classified as having illness I are a fairly homogeneous group, epidemiologically speaking.

The second possible explanation is that one virus was introduced when the *Tristania* first arrived and a second virus was introduced when JY and MR disembarked from the *Tristania* on her second call on 30 August, after 15 days at sea. JY developed a mild cold 4 days after coming ashore (3 September). Against this, previous records on Tristan suggest that ships more than 3 weeks out of port are unlikely to initiate epidemics of respiratory disease (Shibli *et al.* 1971). There had been no respiratory disease among the crew on board the *Tristania* since 10 August. There was time for JY to acquire a cold on the island rather than on the ship.

The third possible explanation is that one virus introduced on 13 August was responsible for the whole epidemic. Antigenic change in the virus may have occurred, allowing second infections, or some patients may not have become fully immune and have suffered a recrudescence of infection or been reinfected from another patient. The epidemiological and laboratory findings lead us to accept the third explanation.

There is clinical and serological evidence that almost all the islanders were infected with influenza A in 1954 (Taylor-Robinson & Tyrrell, 1963). The very high incidence on both occasions may have been due to some lack of immunity and the close-knit society which facilitated transmission. Double illnesses, some apparently due to virus infection, were reported by many in the 1918–19 pandemic, but on Tristan in 1971 other aspects, such as the mortality of about 1 % in the elderly, were more like recent experience, though the frequency of chest complications was high.

It is notable that only 8 % of those affected by illness I and 12 % of those affected by illness II developed bronchospasm. The incidence of asthma was previously 45 % or 48.5 % (Woolley, 1963; Black, Thacker & Lewis, 1963) and occurred mostly after respiratory infections, while Samuels (1963) found it about 10 % with a much higher proportion of chronic sufferers who went about wheezing without requesting medical attention. Although this epidemic was said to be the worst 'sick' for between 10 and 20 years, and affected virtually all the islanders, some islanders who had bronchospasm said this was their first wheezing attack for years. This suggests that the incidence of bronchospasm is declining on the island. It is certain that there has been a great reduction in the incidence of parasitic infection, and improvement in living conditions generally, over the last 10 years. A longitudinal study on the present incidence of asthma on the island is in progress and may shed more light on the problem.

An epidemic of influenza affecting virtually the whole of a closed society in a

short space of time is a striking, even an awesome, phenomenon. A normally active community comes to a standstill. Agriculture and fishing cease. Few people are seen out and about. Whole houses and families are laid low, so that even in a closely knit society like Tristan it was sometimes difficult to find a fit person to care for the sick. At first there is a 'blitz' atmosphere in the face of adversity, but as morbidity continues morale falters. We must remember that influenza can still be a dangerous disease.

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## REFERENCES

- BLACK, J. A., THACKER, C. K. M. & LEWIS, H. E. (1963). Tristan da Cunha: general medical investigations. *British Medical Journal* *ii*, 1018.
- HAMMOND, B. J. & TYRRELL, D. A. J. (1971). A mathematical model of common-cold epidemics on Tristan da Cunha. *Journal of Hygiene* **69**, 423.
- SAMUELS, N. (1963). Experiences of a Medical Officer on Tristan da Cunha, June–Oct. 1961. *British Medical Journal* *ii*, 1013.
- SHIBLI, M., GOOCH, S., LEWIS, H. E. & TYRRELL, D. A. J. (1971). Common colds on Tristan da Cunha. *Journal of Hygiene* **69**, 255.
- TAYLOR-ROBINSON, D. & TYRRELL, D. A. J. (1963). Symposium on medical problems presented by the Tristan da Cunha community. IV. Virus disease on Tristan da Cunha. *Transactions of the Royal Society for Tropical Medicine and Hygiene* **57**, 19.
- TYRRELL, D. A. J., PETO, M. & KING, N. (1967). Serological studies on infections by respiratory viruses of the inhabitants of Tristan da Cunha. *Journal of Hygiene* **65**, 327.
- WOOLLEY, E. J. S. (1946). Health of civilian population of Tristan da Cunha. *Journal of the Royal Naval Medical Service* **32**, 3.
- WOOLLEY, E. J. S. (1963). Symposium on medical problems presented by the Tristan da Cunha community. Discussion. *Transactions of the Royal Society for Tropical Medicine and Hygiene* **57**, 24.