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Common colds in Antarctica

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INTRODUCTION

Recent studies have established that the occurrence of common cold epidemics amongst men in Antarctica shows a pattern similar to that seen in other isolated communities such as Tristan da Cunha (Cameron & Moore, 1968; Shibli, Gooch, Lewis & Tyrrell, 1971). Colds occur during relief periods when ships and aircraft call, and disappear during the months of winter isolation, but no statistical analysis of the incidence of such colds is available.

There has been evidence to suggest that during the Antarctic winter men gain increased resistance to colds, so that during the summer relief periods they suffer from fewer and milder colds than do newcomers (Taylor, 1960; Hedblom, 1961). This resistance then appears to be lost when they return to less isolated communities, and their colds then tend to be more severe than those which they experienced while still in Antarctica (Cameron & Moore, 1968). Other workers have noted colds of a severe nature affecting a large proportion of men who had wintered, and who appeared to have little resistance to infection (Siple, 1960; Holmes, Allen, Bradburne & Stott, 1971). Totally different reactions in two groups of Antarctic wintering personnel exposed to the same cold within a few days of each other are recounted by Goldsmith in a personal communication to Wilson (1965). One group at Halley Bay suffered from severe colds, while the other group at Shackleton Base was symptom-free.

To resolve the differences resulting from these observations, and to gain a clearer picture of the epidemiology of viral respiratory disease in Antarctica, based upon detailed and objective observations amongst men at a number of bases, a prospective study was started in 1968, lasting for three years. During this time, men in Antarctica filled in symptom cards whenever respiratory symptoms occurred, both while they were at the bases and during the 6 months after they left to go home.

Logistics

The bases of the British Antarctic Survey are situated on or near the Graham-land Peninsula of Antarctica (Fig. 1). The summer season lasts from late November to late February, and each base is isolated for seven to eleven months, the southern bases having longer periods of isolation than the northern bases, mainly because of their inaccessibility. During the summer seasons 1969–71 the bases were visited by relief ships R.R.S. *John Biscoe*, R.R.S. *Shackleton* and M.V. *Perla Dan*, sometimes by the Royal Naval Vessel H.M.S. *Endurance* and occasionally by foreign

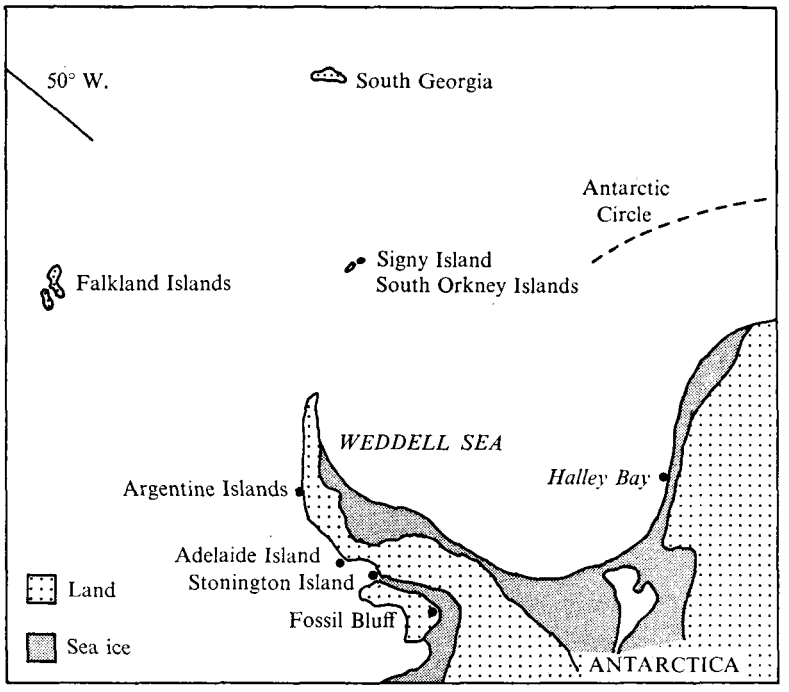


Fig. 1. The Antarctic Peninsula and adjoining sub-Antarctic regions.

ships. Three British bases, Adelaide Island, Stonington Island and Fossil Bluff bases were also served by two Survey aircraft from early December until March, and Halley Bay base was visited by aircraft from McMurdo Sound in addition to its relief ship, the M.V. *Perla Dan*.

METHODS

Symptom cards were completed daily by base members whenever respiratory symptoms appeared. They recorded blocked nose, running nose, sore throat, cough, tight chest, feeling tired, and headache, and the severity of each symptom was denoted by + for a mild symptom and + + for a severe symptom.

Colds were graded according to the types described by Tyrrell (1965). Abortive or doubtful mild colds were excluded.

For comparative purposes the severity of each cold was determined by adding up all the + signs recorded. A mean daily severity could then be derived.

Records obtained

Records were obtained from Halley Bay base of 30 men wintering in 1969, of 26 men wintering in 1970, and of 15 men of the 1969 wintering party during the 6 months after relief.

Records from Adelaide Island base include 12 men who wintered in 1969 and 6-month records of 7 of these who went home in early 1970.

Records from Stonington Island base and Fossil Bluff base, where interchange

of personnel occurred during the winter season, include 18 men who wintered in 1969 and 6-month records of five of these men who came home in early 1970.

Signy Island base members used the cards to produce continuous daily records of respiratory symptoms during 1968, 1969 and the relief periods after these years.

DESCRIPTION OF EPIDEMICS

Marguerite Bay

In early February 1969 the R.R.S. *John Biscoe* arrived in Marguerite Bay to replace stores and personnel at Adelaide Island, Stonington Island and Fossil Bluff bases. An epidemic of moderate to severe colds followed and has been described previously (Holmes *et al.* 1971).

Isolation started on 18 March 1969, and during the next 9 months no cold symptoms were observed in men at Stonington Island and Fossil Bluff bases. However, after 17 weeks of isolation at Adelaide Island base, moderately severe colds appeared in six out of 12 men 3 weeks after midwinter. Specimens taken during this outbreak have since been investigated in the laboratory, but no causative agent has been identified (Allen *et al.* 1973). No further colds occurred until after isolation was broken.

On 7 December 1969, two Survey aircraft arrived at Adelaide Island, introducing four extra men to the base, and two further men were brought into the area on 10 December. None of the incoming men had overt colds when they arrived at the base, nor did they develop colds while they were in Antarctica. One man had a running nose for 1 week after arrival, but this is not unusual in newcomers to Antarctica and was probably a response to unaccustomed cold air. He showed no other respiratory symptoms during his Antarctic stay.

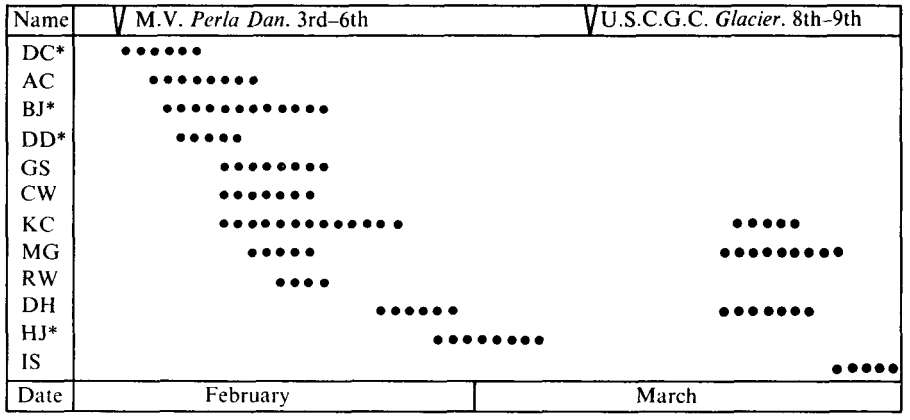
Two men who had wintered at Adelaide Island base developed symptoms of a moderately severe cold on 18 and 22 December 1969, but no other men at this base, or at the other Marguerite Bay bases were overtly affected, although interchange of personnel took place.

The R.R.S. *John Biscoe* arrived with stores and men in early February 1970, but this time, in contrast to the previous year, none of the men aboard were suffering from clinically apparent colds. The ship had taken 2 weeks to come down from the Argentine Islands because of bad sea-ice, but it is not known whether any men had colds at the start of this journey. No men who had wintered at the Marguerite Bay bases showed any common cold symptoms after the ship's arrival.

Symptoms in men who boarded the R.R.S. John Biscoe

Fourteen men, who had wintered in Antarctica, boarded the ship to go home. No colds occurred among these men until after the ship called at Argentine Islands base, where one man boarded her and showed symptoms of a moderately severe cold within 24 hr. Five men on the ship complained of similar symptoms in the next 3 days. The new man had been in contact with the Chilian ship *Yelcho* 2 weeks previously, but no records of colds at the base following the visit by this ship are available.

The *John Biscoe* later called at Signy Island base, 6 weeks after a call by the M.V. *Perla Dan*. An epidemic of colds had occurred among men at the base after



• = A day of symptoms in one man.
* = Newcomer to Antarctica.

Fig. 2. Respiratory symptoms occurring among 26 men at Halley Bay base in early 1970 in relation to visits by ships.

the M.V. *Perla Dan* left, but no men from the R.R.S. *John Biscoe* showed subsequent symptoms, though they worked with base members for 2 days. One assumes that the cold had died out, or that the conditions necessary for transmission and production of clinical disease were not present.

Among 14 men, in the 6 months following isolation, four recorded no colds, five recorded only one cold and five recorded two or three colds. In these last five men, the occurrence of the first cold did not appear to modify the severity of the second cold. No colds were observed during the 3-week voyage from Montevideo to Southampton, again demonstrating the effect of isolation on a small community.

Halley Bay

During the winter isolation of 1969 no colds occurred among 31 men. Two outbreaks of colds occurred during the relief period of early 1970 (Fig. 2).

The M.V. *Perla Dan* arrived at Halley Bay on 3 February 1970, thus breaking isolation, and stayed for 3 days. Men on the ship had suffered from recent colds (I. Leith, personal communication), and among the men put ashore was one man showing symptoms of a moderately severe cold, and three men who developed mild to moderately severe colds shortly after arrival.

During the next 3 weeks, 23 out of 31 men who had spent the previous winter at the base were sequentially affected with mild to moderately severe colds. Sixteen of these men suffered the colds after boarding the ship to go home, while seven of the men, who were staying a second year, suffered the colds while at base. There was no difference in the symptoms in the two groups. Symptoms in newcomers and men who had wintered in Antarctica were also essentially similar, but 15 out of the 23 men who had wintered and now had colds complained of sore throat, while this symptom was not present among newcomers with colds.

The second outbreak of common colds occurred 9 days after a visit by an American ship, the U.S.C.G.C. *Glacier* on 8 and 9 March, when there was inter-

change of personnel between the base and the ship. These were moderately severe colds, and there was little apparent difference in the symptom-complex between this outbreak and the previous one, but it is interesting to note that of the four men affected, all were men who had already wintered, and three of them had suffered colds in the previous epidemic. This previous experience appears to have had little protective effect in these cases.

After this second outbreak of colds 26 men were totally isolated from the outside world for the rest of 1970. Upper respiratory symptoms during this time were minimal, except in two men, in their second year in Antarctica, who showed symptoms at midwinter. One man complained of a blocked and running nose for 4 days, which on the first day was severe and accompanied by a sore throat. These symptoms started after playing midwinter football outside at low temperatures, and were probably secondary to irritation of the respiratory passages by the rapid inhalation of cold air. The second man complained of running nose for 3 days, severe at first, but becoming mild, associated with bad headache on the second and third day of the illness. These symptoms appeared 3 days after opening midwinter presents, which had been stored unopened since the last ship called. Other than these two men, no base members complained of symptoms resembling a common cold during the isolation period.

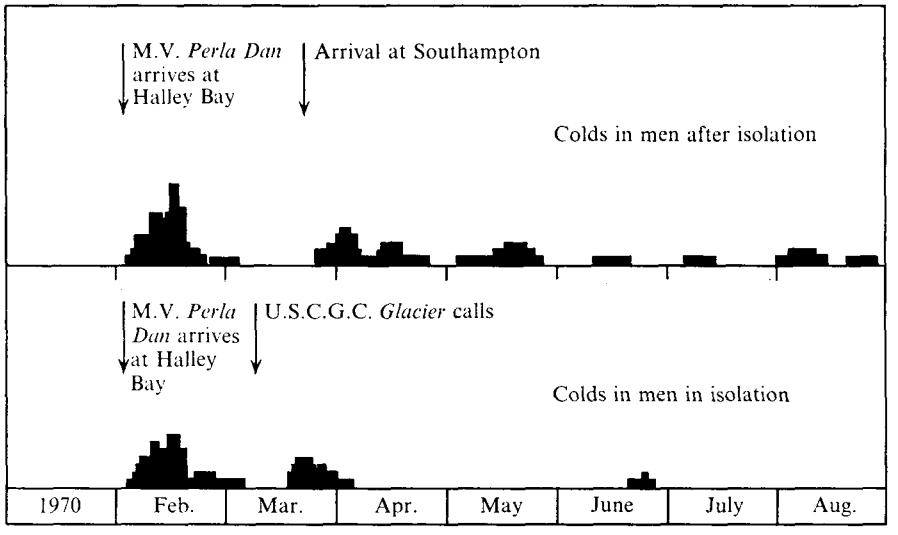
The occurrence of respiratory symptoms in these two men is the second example in this study of possible colds occurring during a long period of isolation. The appearance of symptoms in one man 3 days after opening midwinter presents, bears resemblance to reports of colds occurring among early Antarctic explorers after opening frozen blankets, and to the occurrence of colds in men at isolated camps, where virulent organisms in fur clothing are alleged to have been responsible for an outbreak of upper respiratory infection (Hedblom, 1961).

Colds among men leaving Halley Bay

Twenty-one men boarded the M.V. *Perla Dan* between 3 and 6 February 1970, all having spent at least one winter in Antarctica. Mild to moderately severe colds occurred in 16 of these men over a 2-week period starting 24 hr. after arrival of the ship at Halley Bay. Men were affected sequentially.

Colds were still occurring when the ship called at Signy Island base on 13 February 1970. No men at this base were suffering from colds when the ship called, but an outbreak of heavy colds occurred at the base within 2 weeks of this visit, without further ships calling.

On 19 February 1970, the ship arrived at Portstanley, Falkland Islands, and within 48 hr two men had developed colds, their second since relief, one mild and one moderately severe. During the 3-week voyage to Southampton no colds were recorded, reflecting the isolation of the men during the journey. Colds started to appear among the men 3 days after arrival at Southampton, and occurred throughout the summer months. Meanwhile, in Antarctica, colds had died out, leaving the majority of the men symptom-free for the rest of the isolation period (Fig. 3).



▮ = A day of symptoms in one man.

Fig. 3. Colds occurring among 21 men upon leaving the Antarctic and in 26 men who spent the winter in isolation in Antarctica. After isolation colds continued to appear among the men, while in Antarctica colds died out after the last ship had called.

Signy Island

In the two 7-month periods of isolation in 1968 and 1969 no colds occurred in 14 and 13 men respectively.

During the 1968/69 summer period of 5 months, when vessels called frequently, daily records showed only two colds in 23 men, both occurring in newcomers.

The records for the 1969/70 summer relief period are incomplete, but the base diary records the occurrence of heavy colds among the majority of the base personnel in the 3 weeks following the visit of the M.V. *Perla Dan*, on its way back from Halley Bay. As described already, men on the ship were at this time suffering from common colds.

ANALYSIS OF RECORDS

The study covered 110 man-years in Antarctica, during which time there were 69 colds recorded, an overall rate of 0·6 colds/man year.

During isolation periods, 112 men between them spent 898 months in groups of 4 to 31 men, not including the first month of each isolation period to allow for colds occurring after the visit of the last vessel. Eight colds were recorded, giving a rate of 0·1 colds/man year in isolation in Antarctica.

During the summer relief periods 140 men between them spent 348 months in Antarctica and recorded 61 colds a rate of 2·1 colds/man year.

Insufficient numbers were available for valid comparison of symptoms in newcomers and men who had wintered but generally the duration and severity of colds in the two groups were similar and there was no evidence of newcomers being particularly susceptible to colds.

Table 1. *Clinical features of colds in men who had wintered in Antarctica*

	Colds in Antarctica	Colds after contact with less-isolated communities
Total no. colds	45	34
Percentage of total with:		
Nose blocked	91	88
Nose running	87	94
Throat sore	78	86
Cough	38	65 ($P = < 0{\cdot}02$)
Tight chest	18	41 ($P = < 0{\cdot}05$)
Feeling tired	73	79
Headache	58	68
Median duration (days)	7·5	10·4 ($P = < 0{\cdot}05$)
Median severity of colds	21·4	35·3 ($P = < 0{\cdot}05$)
Median severity/day	2·9	3·6 ($P = > 0{\cdot}05$)

Symptoms in the two groups were compared using Yates's modification of the Chi-squared test, and duration and severity in the two groups were compared by analysis of variance (Holman, 1962).

The severity of colds suffered after return to less-isolated communities was significantly greater than that suffered in Antarctica when considered in terms of the total number of plus signs recorded during a cold, but comparison of colds in relation to the average number of pluses recorded each day showed no significant difference in severity.

In men who had wintered in Antarctica colds suffered after contact with less-isolated communities were generally similar in daily severity to those suffered while the men were still in Antarctica, but showed a greater incidence of cough and tight chest, and a longer duration (Table 1).

DISCUSSION

This study of acute respiratory infections among small groups of men during and after isolation in Antarctica has provided fairly clear evidence that in such an environment the common cold usually behaves as an infectious disease introduced from the outside. Occasionally, however, outbreaks of cold occur after many weeks of isolation, and presumably in such cases the responsible agents are preserved in some form in the environment, or in the respiratory tract cells of the isolated men.

The occurrence of colds on breaking isolation has been very variable. Colds of a moderate to severe nature have demonstrated the epidemic pattern most clearly, with colds starting soon after initial contact with newcomers and affecting a high proportion of men exposed. The epidemic pattern of mild colds has not been so clearly visible, with a long interval between initial contact and onset of the first cold, and only a few men affected. This could either mean that such mild colds do not transmit well under Antarctic conditions, or that men become infected without showing symptoms.

The high proportion of men involved in epidemics of moderately severe colds after wintering in Antarctica suggests that isolation predisposes to susceptibility

The longer duration of colds occurring after contact with less-isolated communities and the increased incidence of cough and tight chest may indicate a greater rate of secondary infection.

The overall rate for the occurrence of colds in men in Antarctica of less than one cold per man per year is similar to that seen in other isolated communities such as Tristan da Cunha (Shibli *et al.* 1971). The rate during long periods of isolation falls to 0·1 colds per man per year, and during the summer relief periods when communications are established, the rate of 2·1 colds per man per year approaches that seen in the less-isolated rural and urban communities from which the Antarctic personnel originate.

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