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COVID-19 on board a cruise ship: medical management

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ABSTRACT

Background: *First, this analysis was conducted to study a coronavirus disease 2019 (COVID-19) cluster dynamic on a cruise ship in order to allow the ship physician to anticipate the duration and importance of the contaminations. Secondly, the author tries to find out if the closed environment on board allows specific conclusions about epidemic dynamics and preventative measures.*

Materials and methods: *From a personal epidemiological compendium done by himself on board the author analysed different epidemic curves identified on board other ships and compared them to the epidemiologic data from the different COVID-19 contamination waves in France since 2020. All crew members were submitted to polymerase chain reaction tests on D2, D5, D8 and D15 and symptomatic cases were tested on on-board devices in the meantime. An excel file called "Log Covid" allowed for daily reporting to the ship-owner on the epidemic dynamics and the prospects on the end of crises in order to anticipate the resumption of the business in the best conditions. The jobs on board, age and geographic origin of the contaminated people were analysed, as well as their vaccination status.*

Results: *Out of a total of 118 crew members, 61 (52%) sailors were contaminated in 8 days. The symptoms were benign (pharyngitis, headaches, feverish state); no serious form of illness were reported. The passengers were repatriated to France at the earliest stage. The epidemic phase occurred in a 15-day window. The first 8 days corresponded to the ascending phase, then a faster phase of epidemic decrease of 7 days. Similarities emerged between the epidemic dynamics of this virus and other contaminations on cruise ships and epidemic phases on land in spite of important differences in numbers.*

Conclusions: *This study can allow a ship's doctor to better understand the viral dynamics in case of a COVID-19 cluster and to anticipate the exit of the crisis. Repeated tests during the active phase of the epidemic are necessary in case of a large cluster to know where to place oneself on a typical epidemic curve. Isolation and barrier measures advised by the ship's doctor remain the only weapons that can limit its magnitude.*

(Int Marit Health 2023; 74, 2: 83–88)

Key words: COVID-19, infection, maritime, boat

INTRODUCTION

Since March 2020, the coronavirus disease 2019 (COVID-19) epidemic has affected the entire planet with 9 epidemic waves identified by the end of December 2022. In marine medicine, few ships have documented and published precisely the dynamics of the contaminations [1–4] since the first one described from the experience of the Diamond Princess immobilized in quarantine in Yokohama, Japan for 15 days [5, 6].

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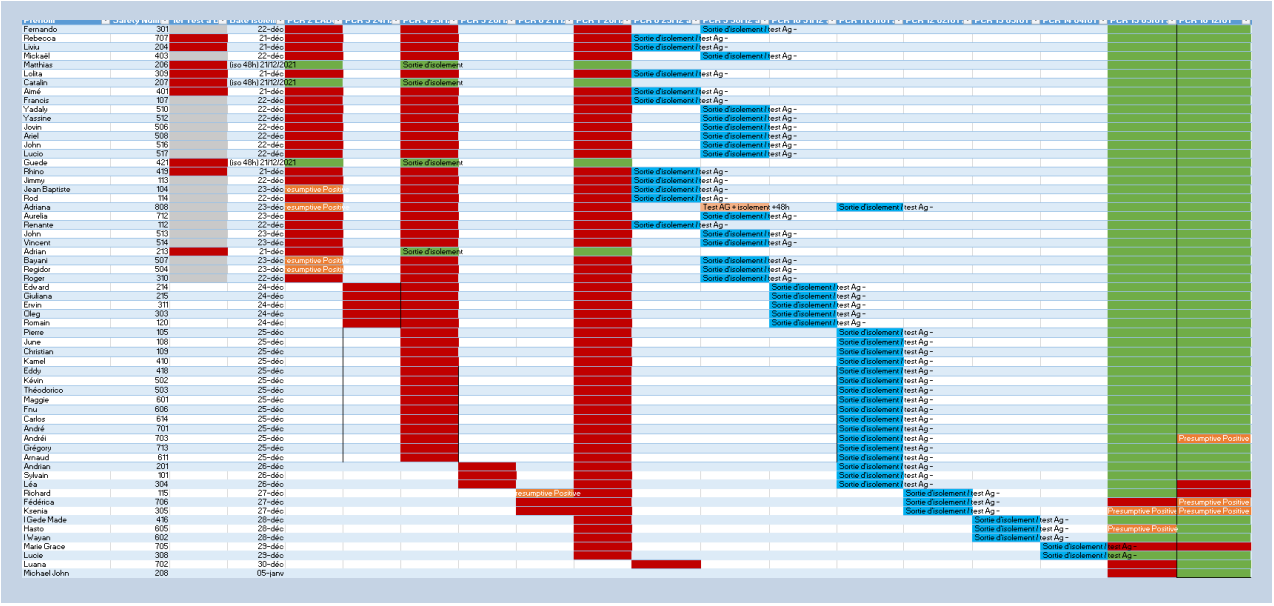

Figure 1. Log Covid filled by ship's doctor and daily sent at the company

Shipowners tend not to communicate on these sensitive issues.

The Ponant Company, with 13 cruise ships, has set up internal medical reporting procedures for the doctors on board in order to report contaminations as soon as possible called the daily COVID report.

Having been confronted with an active COVID-19 cluster at the end of December 2021 on one of the company's ships (Le Jacques Cartier) cruising in the Persian Gulf with 150 passengers on board, decisions had to be taken quickly in order to preserve the passengers, who were significantly older than the crew, from serious forms requiring hospitalisation.

The ship was then placed in quarantine, first alongside and then at anchor, and regular testing of the crew was carried out to monitor the epidemic dynamics and anticipate the end of the crisis.

Those decisions were discussed between the ship doctor and the captain.

MATERIALS AND METHODS

The Jacques Cartier's headcount was 118 crew members and 150 passengers.

As the international maritime rules obligate a ship doctor is required up to 100 seamen or passengers on board and for cruising more of 3 days. The ship doctor's duty is to take care of them and also to advise sanitary measures to the captain. In case of a viral epidemic the captain can order diversion of the ship, quarantine measures and all decisions about the safety of the ship that he considers available to decrease the health risks. He can also refer to the Telemedical Advisory Services [7].

This study is the report of the features of the cluster COVID-19 on board the Jacques Cartier with analyses of the epidemiologic data.

On board, the ship's doctor had to diagnose the infection with nasal samples with the reverse transcription-polymerase chain reaction (RT-PCR) method with VITA PCR Credo Diagnostics from Biosynex laboratory. Then he advised the isolation of the infected crew members and the tracing of the contacts cases.

The ship's doctor filled out an Excel spreadsheet Log Covid on a daily basis to report to the shipowner on the progress of the epidemic, and participated with the captain in conferences with the Dubaï Health Authority and the company headquarters in Marseille (Fig. 1).

RESULTS

At D1, several sailors came to the hospital with symptoms suggestive of COVID-19 and were tested on the Biosynex machine on board (VITA PCR Credo Diagnostics). Systematic tests were done on contact cases. In total 9 cases were positive out of 34 tests (26% of tests were positive).

The captain then took the decision to divert the ship to the nearest port to allow a global test of all the passengers and crew (Starmetropolis Dubai Laboratory) done at D2: 29 positive cases (i.e. 3.22 times compared to D1) among the crew members and only one positive passenger out of 150.

The company then decided to repatriate the healthy passengers (the only positive one was placed in a government isolation hotel). The Dubai Health Authority then confined us to quarantine on the ship under the supervision of the ship's doctor.

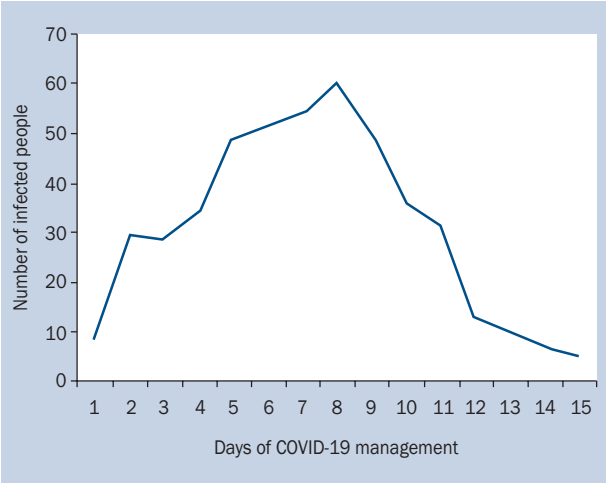

Figure 2. Epidemic curve on-board the Jacques Cartier

Systematic tests were done by the same laboratory at D5 and D8, and then the ship went to anchorage to continue the quarantine until the end of the epidemic at D15 (Fig. 2).

The resumption of cruises authorized by the Dubai Health Authority required an additional 10 days of quarantine after the last case, and a new global test at the end of these 10 days.

A total of 61 crew members were isolated in the cabin (the last contamination at D15), all of whom were released from isolation at D7 after a negative antigenic test (except for one positive who spent two more days in isolation).

The distribution of contaminated positions is unsurprising: the largest number of employees per sector are the most frequently affected (galley 27%, deck 20%, engine 16%) (Fig. 3).

The most frequent symptoms were like the ones ashore, pharyngeal pain (32%), followed by headache (25%) and flu-like symptoms (25%). It should be noted that 2/3 of the contaminated people were symptomatic and 1/3 asymptomatic detected by the tests of the whole crew (Fig. 4).

The extent of pharyngeal pain and headache and the complete absence of respiratory forms were in favour of an Omicron variant, which at that time was beginning to supplant the Delta variant, but it was not possible to perform viral sequencing in Dubai.

There was no predominance of infection by country of origin or by type of vaccine received (all crew members were vaccinated, those who received the Chinese vaccine, the Russian vaccine, or a dose of Janssen vaccine had all received a dose of RNA booster before the cluster).

The epidemic curve of the Jacques Cartier is comparable to the one from the Diamond Princess in March 2020 (712 cases out of 3711 passengers) and that of the Champlain in January 2022 (70 cases out of 113 crew members) (Figs. 5, 6).

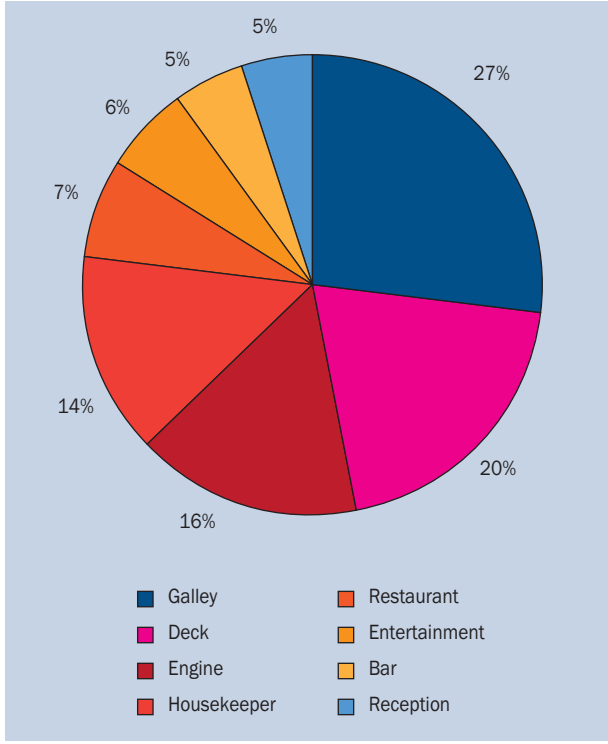

Figure 3. Work-places of the contaminated crew members on the Jacques Cartier

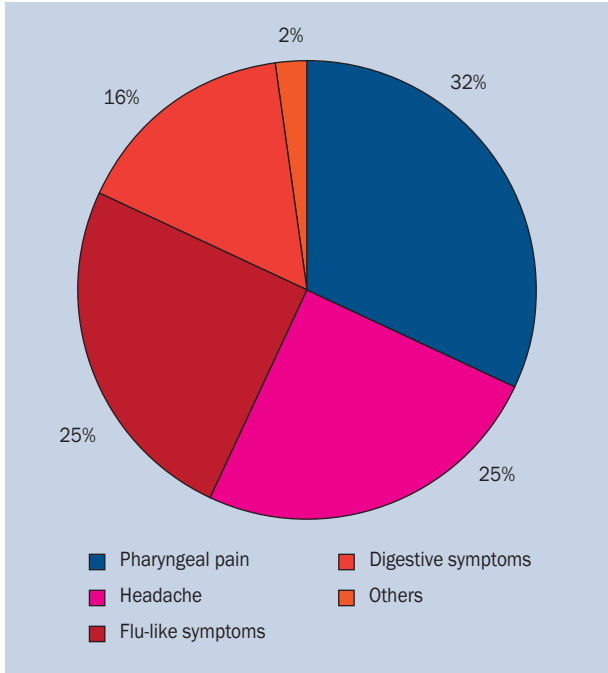

Figure 4. Symptoms of the contaminated crew members on the Jacques Cartier

The analysis of these curves shows:

— A duration of the active ascending phase of the epidemic of 14 days for the Diamond Princess and 8 days for the Jacques Cartier and Champlain. This longer duration

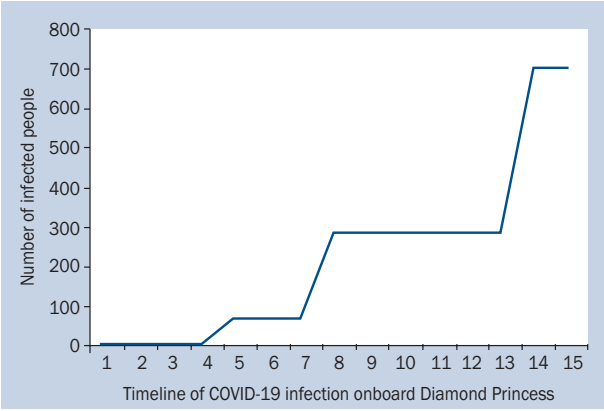

Figure 5. Curves of the Diamond Princess

is related to the larger number of participants, which delayed herd immunity;

— The duration of the descending phase was significantly shorter than the ascending phase (6 to 7 days);

— An initial phase lasting 3 to 4 days of slow viral replication followed by an exponential increase in the epidemic dynamics until herd immunity.

The epidemic plateau is brief, one can even speak of an epidemic peak.

If we compare these curves to the epidemic curves on land in France in 2020 and in Brittany in 2022, we find more or less the same dynamics with an initial phase of slow linear replication, then a brief plateau before the exponential phase, followed by a peak with rapid decay (Figs. 7, 8).

On land, the decrease in the dynamics is less clear-cut, either towards a high plateau (left-hand curve France 2020) or even with an active epidemic resumption (right-hand curve in Brittany 2022). This notable difference compared to the curves on board ships is certainly linked to the fact that the isolation of patients is less well respected than on board.

The amplitude of the curves on land is more marked due to the larger number of people.

DISCUSSION

Viral dynamics curves are typically exponentials of the type $y2 = x3 + x + 1$ [8].

The faster decay phase than the ascending phase and the sharp break at the epidemic peak have led to a preference for the term epidemic waves.

The ascending phase can be divided into two distinct parts separated by a short plateau: a linear phase and then an exponential phase, which can be explained by a weak diffusion of the virus at the very beginning of the cluster and then a more important contagiousness of the aerosols after a few days due to an increase of the viral replication [9].

It should be noted that on the Jacques Cartier this slow initial phase was absent probably due to a delay in consulting the first patients, especially Asians who were afraid of being disembarked.

The plateau phase or the epidemic peak is preceded by a slowing down of the epidemic dynamics which can be explained by the beneficial effect of the isolation of the patients.

The epidemic peak typically corresponds to the collective immunity reached between 50 and 65% of infected persons

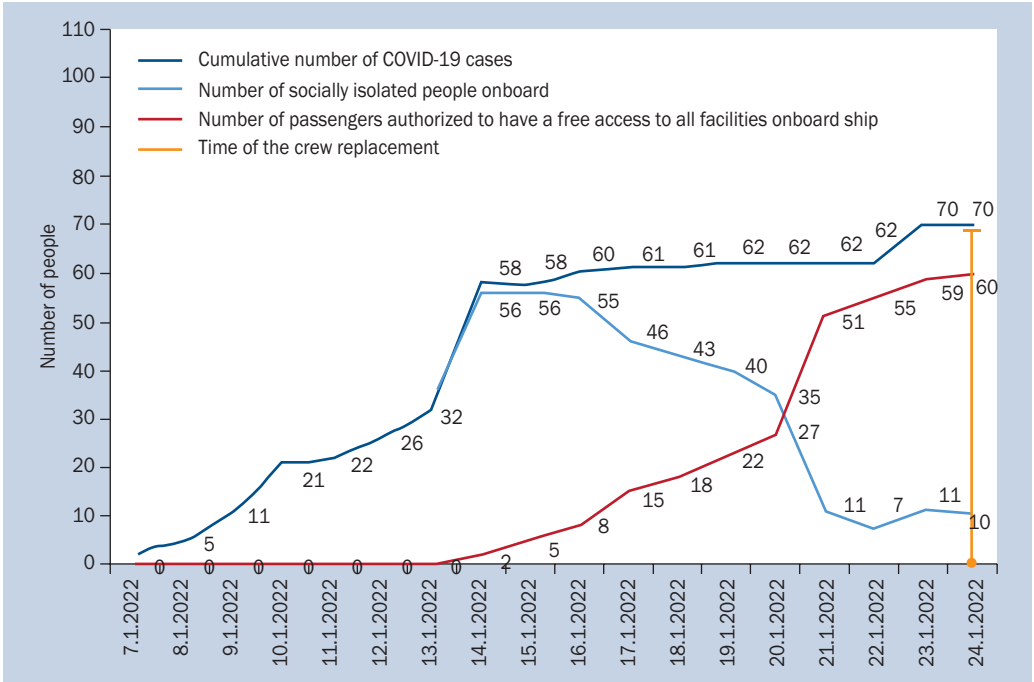

Figure 6. Curves of the Champlain

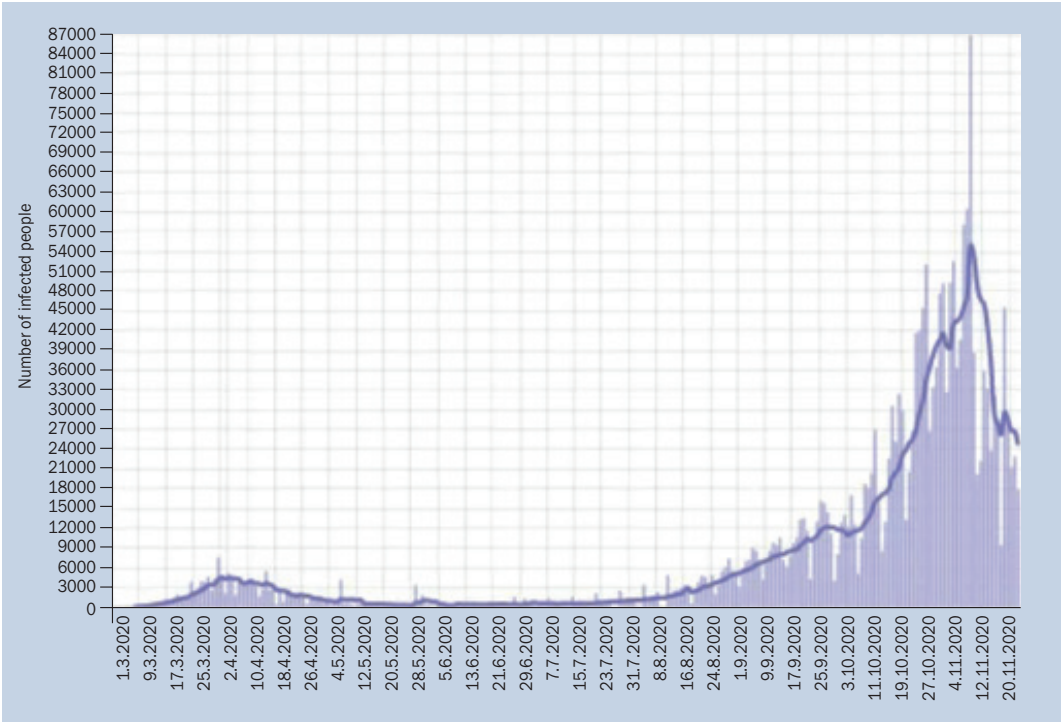

Figure 7. Incidence of COVID-19 cases in France

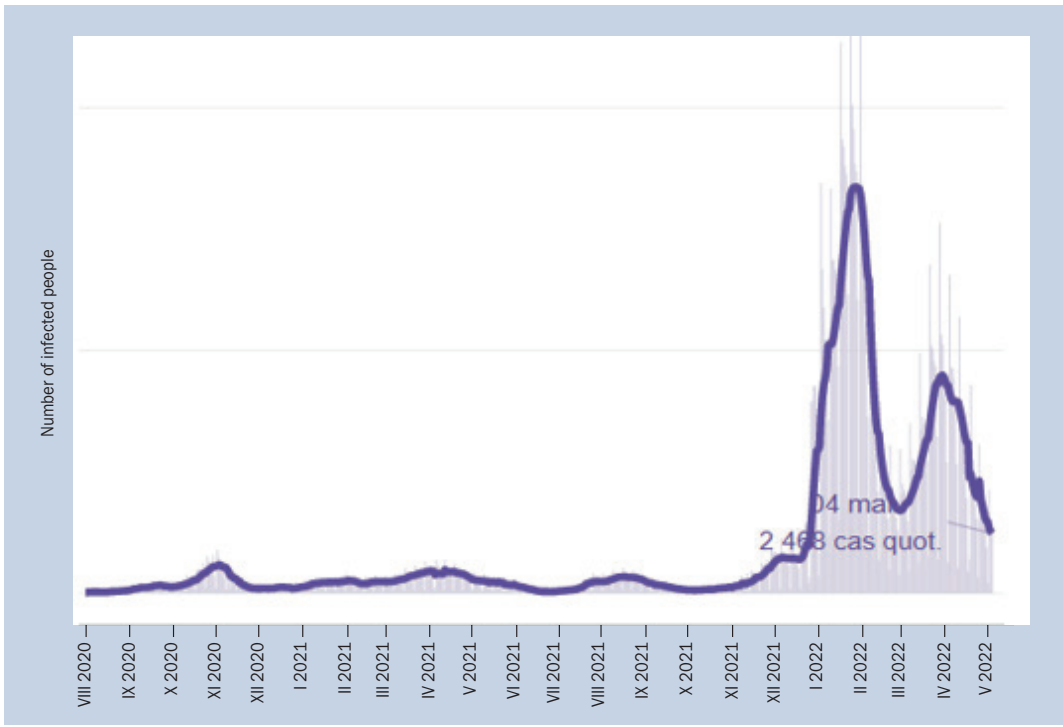

Figure 8. Incidence of COVID-19 cases in Brittany

in a stable workforce (no new entrants due to quarantine) [1–6].

The decay phase is rapid if the isolation of patients is respected. This is what made it possible to drastically limit the number of infected people during the SARS-COV1 and MERS-COV epidemics in 2002 and 2013 respectively, as well as during the influenza A pandemic in 2011, even though it was not a coronavirus but an influenza virus [9].

On board a ship, the isolation of patients remains the main weapon of the ship's doctor. It must be strict and as early as possible. Comfort facilities for the infected crew allow them to better tolerate this introspective phase (unlimited internet, internal telephone communications, use of a terrace or a reserved outdoor space) [10]. Psychological support and daily medical surveillance also help to cope with this phase. This is the role of the doctor or nurse on board, but also of the captain.

CONCLUSIONS

The role of the shipboard physician in the event of a COVID-19 cluster is paramount. Remote health care practice such as prescribed by a Telemedical Advisory Service cannot replace the effectiveness of a medical doctor practicing diagnosis, treatment and health survey on board.

The identification of the cluster must be done as early as possible in order for the isolation of the patients to be effective [1–6]. Repeated tests at an interval of 3 to 4 days maximum allow to know where to place oneself on a typical epidemic curve and to envisage the outcome of the epidemic phase.

The doctor must also provide his or her knowledge and forecasts to the shipowner and be absolutely transparent with the captain with whom important decisions are taken.

He or she must also relay sensitive information to the local health authorities, while taking care not to violate medical confidentiality.

Finally, he or she has an informative role and a psychological dimension of support for the crew, never forgetting that some of them have been on board and away from their families for many months.

Conflict of interest: None declared

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