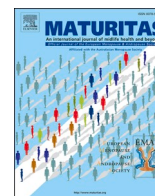




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## Lessons learnt from a nosocomial COVID-19 outbreak in a geriatric acute care ward with a high attack rate

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### ABSTRACT

Nosocomial COVID-19 in older patients has a high mortality rate. We describe an outbreak of COVID-19 in a geriatric acute care unit (GACU) in March/April 2020 and the lessons learnt regarding prevention. Thirty-six patients were diagnosed with COVID-19 during that 2-month period, in France's "first wave" of SARS-CoV-2 infections. Thirty (83.3%) were considered nosocomial. Attributable mortality reached 33.3% in these patients. Healthcare workers (HCW) were not spared, with an overall attack rate of 36.8%, but the rate was especially high among nurse assistants (68.2%). Repeated testing, single rooms, hand hygiene, and good use of personal protective equipment are paramount in GACUs to prevent in-hospital COVID-19 outbreaks.

### Introduction

In older adults, diagnostic of COVID-19 can be tricky, and asymptomatic carriage is not infrequent [1, 2]. Older age and comorbidities are important risk factors for severe COVID-19 and mortality [3]. Moreover, places of care for frail older adults are at risk of chain contamination involving patients and healthcare workers (HCWs) [4]. We report a SARS-CoV-2 epidemic in a hospital geriatric acute care unit (GACU). We aim i) to describe the characteristics of the spread to both patients and HCWs, and ii) to provide guidance regarding prevention.

### Methods

#### Geriatric acute care unit (GACU)

The GACU is a 40-bed ward separated into 2 corridors of 17 and 20 rooms respectively. All visits were banned from March 11, 2020. On March 18, the ward was split into a geriatric "COVID-19 unit" (CU) and a geriatric < non-COVID-19 unit > (NCU) with 20 beds each. HCWs were separated except for medical staff. The NCU had 3 double rooms and 2 showers.

The NCU welcomed patients for which COVID-19 diagnosis was either unsuspected or deemed unlikely after a negative RT-PCR.

There was no specific air treatment and every room was independent from the other regarding airflow. Air renewal is provided by Controlled Mechanical Extract Ventilation and compensating air inlets. In situ measures carried out in April 2020 showed that the premises were at zero pressure. Air flows were not assessed.

#### Healthcare workers (HCW)

The whole staff comprised 114 HCW, including: 25 nurses, 22 assistant nurses, 21 medical doctors or residents, 20 medical students, and 26 support staff.

#### Infection control and prevention (ICP)

Since early March 2020, all HCWs working in the GACU wear surgical masks continuously. In the CU, HCWs wore gowns, aprons, gloves, headgear, and eye protection. In the NCU, aprons and gloves were used according to care provided.

Daily cleaning with a virucidal detergent/disinfectant was done in

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the CU and NCU.

### Virological diagnosis

Nasopharyngeal swabs were performed for SARS CoV-2 detection. Extraction step was done on EMAG® (bioMérieux, Marcy l'Etoile, France) followed by amplification step performed on ABI 7500 FAST Real-Time PCR System (Applied Biosystems, Foster City, CA, USA). Primers used for RT-PCR targeted two regions on RNA-dependent RNA polymerase (RdRp).

### Statistical methods

Continuous variables were recorded as means  $\pm$  standard deviations (SD), as appropriate. Categorical variables were described as n (proportion) and compared by Fisher's exact test. A p-value  $< 0.05$  was considered significant.

### Ethics

The study was conducted in accordance with the Helsinki Declaration (1983). No participant objected to the use of anonymized clinical and biological data for research purposes. Ethics approval was obtained from the Ethics Board of the University Hospital of Angers, France (2020/100). The study protocol was also declared to the National Commission for Information Technology and civil Liberties (CNIL; ar20-0087v0).

### Results

From March 1 to May 1, 36 out of 149 patients (24.2%) were diagnosed with COVID-19 in the NCU (83.3% considered as nosocomial). Twenty (55.6%) were female, mean age was 89.2 (SD 4.5 years). Main risk factors for severe COVID-19 were cardiovascular condition (47.2%), diabetes mellitus (30.6%) and obesity (22.2%). Fever (47.2%), cough (42.1%) and dyspnea (41.7%), were frequent symptoms (11.1% asymptomatic). COVID-19 related mortality was 33.3%. Double rooms (17.6% of all rooms) resulted in 36% of contaminations. Average delay between admission and positive RT-PCR in nosocomial cases was 10.9 days.

At the same period, 42 professionals (both CU and NCU) presented with clinical symptoms compatible with COVID-19 (attack rate = 36.8%) and 73.8% of them had either a positive RT-PCR and/or serology. Assistant nurses were significantly more affected than other HCWs (68.2%,  $p < 0.001$ ).

On April 1, after 10 nosocomial cases occurring in double rooms (first case on March 22), these were closed. Source of contamination was either undetermined or undetected COVID-19 case due to false negative RT-PCR. It was decided to test patients every 5 days and screen all HCW. On April 9, screening of all 14 hospitalized patients on the ward resulted in 7 additional positive results. The ward was closed, and 6 of the remaining 7 patients became positive 5 days later. The ward reopened on April 17 (only single rooms) after thorough cleaning of the premises with quaternary ammonium. All admitted patients were screened upon admission and 7 days later. Since flaws in care organization, hand hygiene, use in personal protective equipment (PPE) (lack of apron for close care, and misuse of gloves), cleaning premises were identified, training to standard precautions was provided to 100% of the staff within 2 weeks. ICP team conducted daily audits on the ward from April 1 to April 14 (including night shifts) and fluorescent markings to assess cleaning. Poorly tolerated hydro-alcoholic products were replaced with better tolerated ones.

No other nosocomial cases were detected for more than 6 months in NCU following these interventions.

Lessons learnt from this outbreak are summarized in [Table 1](#).

**Table 1**

Experience gained during the first wave of COVID-19 pandemic and lessons learnt from COVID-19 outbreak in a geriatric acute care ward not dedicated to COVID-19.

Questions to address	Risk assessment	Prevention advices
Multiple rooms	Major risk of cross contamination, independent of time spent	Consider closing multiple rooms unless all patients can wear correctly a mask
Organization of care	Limiting the risk of super-spreading event through HCW* entering many rooms	Consider dedicating healthcare workers to a limited number of rooms, always the same
Undetected COVID-19 case admitted on the ward	High incidence in general population increases the risk of admitting undetected COVID-19 patients without contact and droplet precautions	Consider screening patients upon admission by RT-PCR test, and repeat testing on day 3 and day 7 following admission (RT-PCR or antigenic depending on availability)
Healthcare workers	Asymptomatic HCW can contaminate patients and colleagues	Universal masking. Education to hand hygiene with hydroalcoholic products. Regular audit of standard precautions. Consider regular testing of HCW (RT-PCR or antigenic).
Patients with dementia	Patients with dementia may walk throughout the ward and interact with other patients. They pose a high risk of getting contaminated and contaminating others	Consider installation of barriers at mid-height of room entrance to allow patients to see movements on the ward without going out of the room. Setting up a dedicated support to allow the patient to individually go out of the room in dedicated premises free from any other patients. We do not advice to sedate these patients
Visitors	Asymptomatic HCW can contaminate patients	Virtual visits should be encouraged. Visits should be limited to specific situation with major benefits for the patient. Visitors should be educated to hand hygiene and provided with a surgical mask correctly adjusted
Ward cleanliness	SARS-CoV-2 may be transmitted through contaminated fomites	Cleaning of premises should be done twice a day. Circulating devices must be clean between 2 patients. Frequently touched objects (door handle, keyboard, phone, etc.) must be cleaned as often as possible and at least once per hour.
Shared premises dedicated to patients' hygiene	Shared showers, or toilets, often poorly ventilated can facilitate cross-contamination	Access to shared premises should be organized according to a planning to permit sufficient air renewal and cleaning between 2 patients
Personal protective equipment	Access to effective PPE can reduce contamination	Universal masking for HCW. Patients are masked when a HCW enters the room.
Healthcare workers' meal	Eating in the same room is a high-risk situation for HCW transmission	Premises dedicated to HCW meals must be large enough to allow enough ( $> 2$ m) social distancing between people. Limit number of people by staggering the length of lunch break. Natural air renewal through window after each meal.

## Discussion

We underline the rapid spread of SARS-CoV-2 in a GACU during the first COVID-19 wave, both in patients and HCWs. Double rooms, inadequacies in infection prevention, patients with dementia (inappropriate behaviours and poor understanding of instructions), and false negative PCR participated in this outbreak.

We identified an important attack rate in HCWs, especially in assistant nurses. Good use of PPE, and hand hygiene are paramount in preventing SARS-CoV-2 infection. Most HCW to HCW transmission is suspected to occur during breaks or meals, social distancing should be emphasized.

As underlined in several previous studies, we found that RT-PCR testing may provide false negative results [5]. COVID-19 status in older adults should thus not be removed with a single negative test.

This study has several limitations. We did not assess potential airborne transmission, which may have played a role in double rooms or shared premises (showers, toilets). Frequent aeration of premises is now recommended.

It should also be underlined that some of the COVID-19 prevention strategies can have adverse effects on hospitalized older patients. These measures may be re-evaluated considering the balance between vaccination rates and the emergence of immune escape variants.

## Contributors

Hélène Cormier participated in the collection and analysis of data and review and editing of the manuscript.

Antoine Brangier participated in the collection and analysis of data and review and editing of the manuscript.

Caroline Lefevre participated in review and editing of the manuscript.

Marine Asfar participated in review and editing of the manuscript.

Cédric Annweiler participated in the analysis of data and review and editing of the manuscript.

Clément Legeay participated in the collection and analysis of data and review and editing of the manuscript.

All authors saw and approved the final version.

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## Ethical approval

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## Provenance and peer review

This article was not commissioned. Peer review was directed by Leon Flicker independently of Cédric Annweiler, an author and *Maturitas* editor, who was blinded to the process.

Research data (data sharing and collaboration)

There are no linked research data sets for this paper. Data will be made available on request.

## Declaration of competing interest

The authors declare that they have no conflict of interest.

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