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Limited effectiveness of systematic screening by nasopharyngeal RT-PCR of medicalized nursing home staff after a first case of COVID-19 in a resident

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On April 6, 2020, the French Health Ministry issued strong recommendation to intensify COVID-19 testing in residents and staff of medicalized nursing homes (French acronym EHPAD) [1]. This recommendation implied "testing of all residents and staff members upon occurrence of first confirmed case of COVID-19 in a medicalized nursing home". This mandated systematic SARS-CoV-2 testing for all staff members and residents, even asymptomatic ones, in addition to symptomatic individuals. We report our experience and effectiveness of implementation of these guidelines.

On April 9, 2020, a first case of COVID-19 was suspected in an 80-year-old female resident of a medicalized nursing home of Nantes University Hospital, France. The patient presented with unexplained acute fever and shortness of breath. The following day she was transferred to the University Hospital Geriatric Unit; SARS-CoV-2 RT-PCR by nasopharyngeal swab was negative. Chest CT-scan demonstrated pneumonia with a typical pattern of COVID-19 (Fig. 1). The patient died of respiratory failure on April 15, 2020. Following notification of the case, all staff members were immediately offered SARS-CoV-2 testing as part of a point-prevalence survey. Nasopharyngeal RT-PCR tests (Detection kit for 2019 novel coronavirus RNA, PCR Fluorescence Probing, Daan Gene Co.) were performed on April 16 and 17 in the COVID-19 ambulatory clinic. Demographic characteristics, clinical symptoms, and risk factors for severe COVID-19 were collected through a standardized symptom-assessment form.

All 136 staff members, health workers, and administrative personnel (including auxiliary personnel) were tested. A total of 131 individuals were tested during the two screening days and the remaining five 48 hours later (Table 1). At the time of testing, 98 staff members (72%) were asymptomatic. Three of the 136 individuals (2.2%) tested positive for SARS-COV-2. Of these three individuals who tested positive, one reported clinical symptoms highly suggestive of COVID-19 that were present at the time of testing (asthenia, headache, myalgias, rhinitis, dysosmia, dysgeusia), one developed COVID-19 clinical symptoms within 24 hours post-testing, and the last one remained asymptomatic up to 7 days after testing. Implementation of this systematic testing procedure, including administrative organization, nasopharyngeal sampling, symptom-assessment form and follow-up, required the assistance of four nurses, one nursing auxiliary, two medical physicians, and one health executive. Sample processing and RT-PCR assessment in the virology laboratory required two full-time technicians for two days.

We showed that a prompt point-prevalence survey by systematic nasopharyngeal RT-PCR for SARS-CoV-2 in staff members of medicalized nursing homes after identifying the first resident with SARS-CoV-2 infection, has very limited effectiveness. Only 2.2% of the staff had positive RT-PCR, of whom 2/3 would have been isolated because of COVID-19 suggestive symptoms either before testing positive in one individual or 24 hours later for the second one. Overall, only one staff member (0.75% of the tested population) really benefited from this screening, as quarantine would not have been decided without this point-prevalence survey.

Table 1
Characteristics of the 136 staff members of the nursing home.

	N = 136
Age, median [IQR]	39 [27–48.5]
Female	112 (82)
Risk factors for severe COVID-19	33 (24)
Age > 70 years	0 (0)
Cardiovascular disease[a]	11 (8)
BMI > 25 kg/m^2	12 (9)
Chronic respiratory insufficiency	7 (5)
Chronic kidney disease	0 (0)
Cirrhosis ≥ stage B	0 (0)
Diabetes mellitus	1 (0.7)
Immunosuppression[b]	2 (1.4)
Cancer	0 (0)
Pregnancy, 3rd trimester	0 (0)
Asymptomatic	98 (72)
≥ 1 reported symptom	38 (28)
Rhinitis	21/38 (55)
Headache	17/38 (44)
Cough	16/38 (42)
Major fatigue	10/38 (26)
Myalgia	5/38 (13)
Diarrhea	3/38 (8)
Ageusia/dysgeusia	2/38 (5)
Chest pain	2/38 (5)
Abdominal pain	2/38 (5)
Odynophagia	2/38(5)
Dyspnea	1/38 (2)
Anosmia	1/38 (2)
Fever	0/38 (0)
Positive SARS-CoV-2 RT-PCR, nasopharyngeal sample	3 (2.2)
Asymptomatic with positive RT-PCR	2 (1.4)
Symptomatic with positive RT-PCR	1 (0.7)

Data is expressed as *n* (%) unless indicated. IQR: interquartile range

[a] Chronic heart failure, history of hypertension, stroke, coronary artery disease, or heart surgery.

[b] Chemotherapy, immunosuppressive therapy including steroids, biological agents, uncontrolled HIV or with CD4 count < 200/mm^3, solid organ or stem-cell transplantation, advanced cancer.

The very low positivity rate of systematic screening of nursing home staff after identification of a COVID-19 case in a resident might be explained by various factors. First, the mean incubation period of COVID-19 is 5 days, and transmission of the virus can occur in the 48 hours before symptom onset [2,3]. There is therefore a theoretical window period of 3 days during which nasopharyngeal RT-PCR will be negative during the early incubation period, assuming that the transmission risk is correlated with positive SARS-CoV-2 RT-PCR [3]. Second, viral transmission during the incubation period varies between 6% and 44% of cases, which would diminish performances of one-time testing of asymptomatic individuals, even more so if such transmission rate is in the lower range [3–5]. Third, the survey was conducted four weeks after lockdown and strong decrease of new viral infections in our area, which could also explain the very low positivity rate of RT-PCR. Finally, nasopharyngeal RT-PCR has poor sensitivity, around 70% in symptomatic individuals. Sensitivity is unknown but probably even lower in asymptomatic infected individuals, especially during the incubation period [6–8]. On the other hand, in our hospital during March-mid-April 2020, targeting symptomatic health care workers on suggestive COVID-19 symptoms led to a positive rate of SARS-Cov-2 RT-PCR of around 30%. Such results reinforce the policy of enhanced screening measures for minor symptoms in health care personnel, with immediate isolation and quarantine in case of RT-PCR positivity.

Our study has limitations. The index case was diagnosed on chest CT-scan with a negative nasopharyngeal RT-PCR. One could argue that this resident did not have COVID-19, although CT-scan was typical, with no alternative diagnosis, and sensitivity of nasopharyngeal RT-PCR in the elderly with isolated pneumonia is

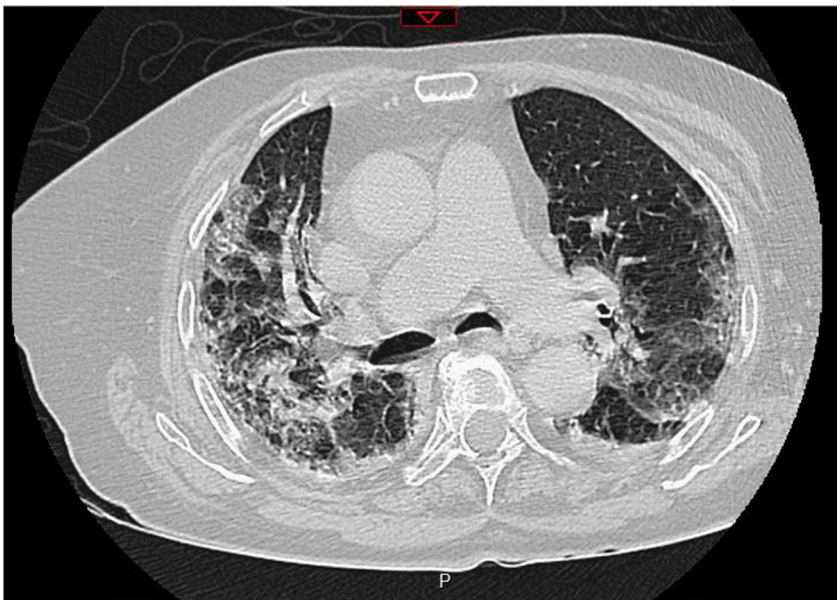

Fig. 1. Thoracic computed tomography (CT) scanner (transverse computed axial) of index resident case. An 80-year-old woman with fever and shortness of breath. CT scan showed ground glass opacities with septal thickening representing a "crazy paving" pattern that predominates in peripheral lung fields (degree of lung involvement between 25% and 50%) highly suggestive of COVID-19.
Tomodensitométrie du thorax (coupe transversale, fenêtre parenchymateuse). Patiente de 80 ans avec dyspnée fébrile et désaturation. Interprétation : plages de verre dépoli associées à des lignes septales apicales et du crazy paving à prédominance périphérique et lobaire évoquant en première intention une pneumopathie à Covid-19 (degré d'atteinte évalué entre 25 et 50 %).

low. In the current pandemic context associated with the critical situation in medicalized nursing homes and implementation of national guidelines, it would have been impossible not to perform the prompt and massive one-shot systematic testing of all staff members, even if entirely asymptomatic, following one case of high suspicion of COVID-19.

In conclusion, our study suggests that human resources and cost for systematic screening of all staff members of a medicalized nursing home after diagnosing a first case of COVID-19 in a resident are totally disproportionate according to the limited effectiveness of such point-prevalence survey. Our large screening had limited or even no impact on viral transmission reduction. Whether testing of asymptomatic staff members in medicalized nursing homes should be proposed to better organize COVID-positive and COVID-free dedicated units, in case of large outbreaks, remains to be investigated [9]. A national policy for systematic point testing for SARS-CoV-2 by nasopharyngeal RT-PCR of all staff members of medicalized nursing homes after identifying COVID-19 in a resident should be put on hold. It should be newly debated when reliable serological tests are available. For the present time, priority should be given to prevention and control recommendations (for all care activities, including during work breaks) and to generalizing the use of face masks (and N95 respirators for invasive acts), as well as rapid testing of all staff members of medicalized nursing homes in case of minor symptoms with immediate isolation and quarantine [10].

Human and animal rights

The authors declare that the work described has been carried out in accordance with the Declaration of Helsinki of the World Medical Association revised in 2013 for experiments involving humans as well as in accordance with the EU Directive 2010/63/EU for animal experiments.

Informed consent and patient details

The authors declare that this report does not contain any personal information that could lead to the identification of the patient(s) and/or volunteers.

Disclosure of interest

The authors declare that they have no competing interest.

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Serratia marcescens outbreak in the intensive care unit during the COVID-19 pandemic: A paradoxical risk?

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As coronavirus disease 2019 (COVID-19) patient management requires personal protective equipment (PPE) and rigorous environment cleansing and disinfection, strengthened hospital infection control was expected.

Surprisingly, between mid-February and mid-April 2020, five patients including four out of the 95 COVID-19 patients managed in our intensive care unit (ICU) presented blood and respiratory specimen cultures positive for *Serratia marcescens*, resistant to amoxicillin, amoxiclav, 1st and 2nd generation cephalosporins (inducible AmpC β-lactamase) and with low-level resistance to amikacin (chromosome-borne *aac(6')-Ic*). Isolates were clonal based on whole genome sequencing using Illumina™ procedures. Noteworthy, *S. marcescens*, a saprophytic environmental Enterobacteriaceae transitory found in human microbiota [1], was commonly implicated in nosocomial infections, especially in neonatal ICUs [2].

After the Infection Prevention and Control Team (IPCT) investigation, an environmental reservoir was suspected as the five patients stayed for at least one day in the same double room (Fig. 1). The source patient had been admitted to this room for septic shock due to community-acquired *S. marcescens* infection from his dialysis catheter, a few days before the COVID-19 outbreak started. Thereafter, *S. marcescens* acquisition by the COVID-19 patients was likely promoted from the environment due to invasive procedures, high antimicrobial selective pressure and immunomodulatory therapy administration [1–3]. Additionally, difficulties in applying optimal bio-cleaning procedures during the COVID-19 outbreak may have contributed to facilitating the bacterial reservoir [3]. Transmission between caregivers and patients was facilitated by increased patient density and severity, enhanced workload, and reduced space (e.g., two mechanically ventilated patients managed in rooms routinely dedicated to single patients).

Due to the severity of COVID-19 pneumonia, our patients extensively received cefotaxime (82%) to treat a possible bacterial coinfection. They also extensively received azithromycin (93%) as empirical antibiotic treatment in addition to its alleged antiviral and immunomodulatory properties, especially combined with hydroxychloroquine [4]. However, despite these almost systematic antibiotic prescriptions in our COVID-19 patients, we suspected an additional condition that had promoted the *S. marcescens* outbreak, by contrast to the multidrug-resistant bacteria outbreaks usually attributed to the density of antimicrobial prescriptions in the ICU.

In our ICU, PPE included FFP2 masks, long-sleeved disposable gowns, aprons, goggles, and gloves, as recommended [5]. Care-