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JAMDA 21 (2020) 933–936

JAMDA

journal homepage: www.jamda.com

Original Study - Brief Report

Efficacy of a Test-Retest Strategy in Residents and Health Care Personnel of a Nursing Home Facing a COVID-19 Outbreak

Hubert Blain MD, PhD [a,*], Yves Rolland MD, PhD [b], Edouard Tuaillon MD, PhD [c], Nadia Giacosa [a], Mylène Albrand [a], Audrey Jaussent MD, PhD [d], Athanase Benetos MD, PhD [e], Stéphanie Miot MD, PhD [a], Jean Bousquet MD, PhD [f,g,h]

[a] *Department of Geriatrics, Montpellier University Hospital, Montpellier University, France*
[b] *Gérontopôle de Toulouse, INSERM 1027, Toulouse, France*
[c] *Department of Virology, Montpellier University Hospital, INSERM 1058, Montpellier University, France*
[d] *Department of Medical Information, University Hospital of Montpellier, University of Montpellier, France*
[e] *Department of Geriatrics, CHRU de Nancy and Inserm DCAC, Université de Lorraine, Nancy, France*
[f] *Charité, Universitätsmedizin Berlin, Humboldt-Universität Berlin, Berlin, Germany*
[g] *Department of Dermatology and Allergy, Berlin Institute of Health, Comprehensive Allergy Center, Berlin, Germany*
[h] *MACVIA-France, Montpellier, France*

Keywords:
COVID-19
nursing home
rRT-PCR
antibodies against SARS-CoV-2

A B S T R A C T

Objective: To assess the American Testing Guidance for Nursing Homes (NHs)—updated May 19, 2020—with a new COVID-19 case.
Design: Case investigation.
Setting and Subjects: All 79 residents and 34 health care personnel (HCP) of an NH.
Methods: Seven days after identification of a COVID-19 resident, all residents and HCP underwent real-time reverse-transcriptase polymerase chain reaction (rRT-PCR) testing for SARS-CoV-2 with nasopharyngeal swabs. This was repeated weekly in all previously negative subjects until the testing identified no new cases, and in all positive subjects until the testing was negative. COVID-19 infection prevention and control (IPC) measures were implemented in all residents and HCP with positive testing or with COVID-19 symptoms. Standard IPC was also implemented in all HCP. Six weeks after initial testing, all residents underwent testing for enzyme-linked immunosorbent assay–based IgG antibodies directed against the SARS-CoV-2. Symptoms were serially recorded in residents and HCP.
Results: A total of 36 residents had a positive rRT-PCR at baseline and 2 at day 7. Six HCP had a positive rRT-PCR at baseline and 2 at day 7. No new COVID-19 cases were diagnosed later. Among the SARS-CoV-2–positive cases, 6 residents (16%) and 3 HCP (37%) were asymptomatic during the 14 days before testing. Twenty-five residents (92.3%) and all 8 HCP (100%) with a positive rRT-PCR developed IgG antibodies against SARS-CoV-2. Among the residents and HCP always having tested negative, 2 (5%) and 5 (11.5%), respectively, developed IgG antibodies against SARS-CoV-2. These 2 residents had typical COVID-19 symptoms before and after testing and 2/5 HCP were asymptomatic before and after testing.
Conclusions and Implications: This study shows the validity of the updated American Testing Guidance for Nursing Homes (NHs). It suggests implementing COVID-19 IPC in both residents and HCP with positive testing or COVID-19 symptoms and warns that asymptomatic HCP with repeated negative rRT-PCR testing can develop antibodies against SARS-CoV-2.

After identification of a COVID-19 case in a nursing home (NH), residents are at high risk of serious illness and death from COVID-19, with a rapid and widespread transmission of SARS-CoV-2.[1,2] The standard COVID-19 diagnosis is based on SARS-CoV-2 nucleic acid testing by real-time reverse-transcriptase polymerase chain reaction (rRT-PCR).[3] Residents and health care personnel (HCP) with positive rRT-PCR can be asymptomatic at the time of testing and may contribute to transmission.[2] Control strategies focusing only on symptomatic residents are therefore insufficient. This explains why the recent American Testing Guidance for Nursing Homes

The authors declare no conflicts of interest.

* Address correspondence to Hubert Blain, MD, PhD, Centre Antonin Balmes, Pôle de Gérontologie du Centre Hospitalier Universitaire de Montpellier, 39 avenue Charles Flahault, 34295 Montpellier Cedex 5, France.
E-mail address: h-blain@chu-montpellier.fr (H. Blain).

https://doi.org/10.1016/j.jamda.2020.06.013
1525-8610/

recommends (1) testing of all residents and HCP in the NH if there is a confirmed case of COVID-19 and (2) repeated weekly testing of all previously negative residents until no new cases of COVID-19 are detected for at least 14 days since the most recent positive result.[4]

Seroconversion with SARS-CoV-2 antibodies generally occurs rapidly in adult subjects.[5] The immune response to viruses may be influenced by aging, and seroconversion in frail older subjects is uncertain. It is unclear whether residents and HCP with repeated negative testing may develop antibodies against SARS-CoV-2.

A study was carried out on all residents and HCP of a NH facing a COVID-19 outbreak. The aim was to assess clinical and serologic parameters for the efficacy of infection prevention and control (IPC) measures adapted to (1) symptoms and (2) results of repeated testing.

Methods

Setting

The study was performed in a single NH.

Participants

From March 3 to 6, 2020, in our NH, 3 residents were hospitalized for severe nonrespiratory COVID-19 symptoms. All 3 developed respiratory symptoms (cough with fever and dyspnea) 7-10 days after admission, and rRT-PCR following nasopharyngeal swab test confirmed COVID-19. Seven days after the first diagnosis, all residents or HCP were enrolled in the study.

No ethics committee approval was required as this is an observational study.

Outcomes

COVID-19 symptoms were examined for 14 days before the first test and then followed daily for 6 weeks. Nasopharyngeal testing for SARS-CoV-2 using rRT-PCR was performed in all residents and HCP. It was repeated weekly in all previously negative subjects until no new cases were identified and in all positive subjects until testing was negative.

COVID-19 IPC measures were applied in all residents and HCP with positive testing or with new COVID-19 symptoms, including diarrhea, delirium, or falls. Six weeks after initial testing, all residents and HCP underwent blood testing for IgG antibodies directed against the SARS-CoV-2 nucleocapsid protein using an enzyme-linked immunosorbent assay CE-IVD marked kit (ID screen SARS-CoV-2-N IgG indirect ID. Vet, Montpellier, France) (Figure 1).[5]

Results

Residents

Among the 79 residents, 38 (48%) had a positive rRT-PCR (Table 1). Thirty-six were diagnosed at baseline and 2 at day 7. The residents who tested positive were distributed throughout the 4 floors of the NH (10, 9, 10, 9).

The mean age of residents was similar in the positive and negative rRT-PCR groups. Diabetes and renal disease were more common in rRT-PCR–positive residents.

Thirteen residents died 2 to 7 days after testing as a result of respiratory symptoms. Twelve (7 men) had a positive rRT-PCR. Six rRT-PCR–positive residents (16%) were asymptomatic before testing.

Six weeks after initial testing, 7 residents still had at least 1 typical COVID-19 symptom (particularly fever or cough) or a significant functional impairment. Among them, 5 (83%) were rRT-PCR–positive.

The rRT-PCR test became negative 14, 21, or 28 days after initial positive testing in 2 (14%), 7 (27%), and 12 (46%) residents, respectively. In the 5 (19%) who still had positive rRT-PCR 28 days after initial testing, 1 recovered completely and 4 had long-lasting symptoms (fever and hypothermia, shortness of breath, dry cough, impaired health status).

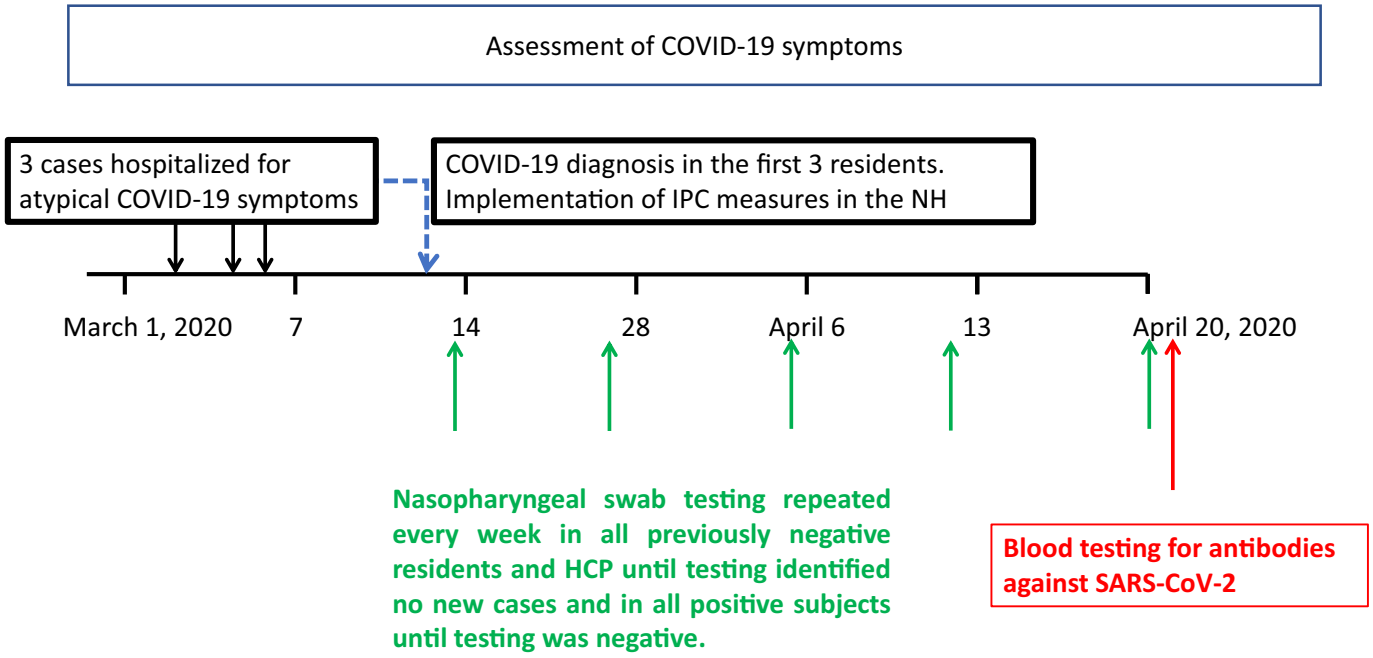

Fig. 1. Flowchart for assessment of COVID-19 symptoms and testing.

Table 1
Demographic Characteristics, Reported Symptoms at the Time of Initial Testing, and Occurrence of Antibodies Against SARS-CoV-2 in Residents

Characteristics	SARS CoV-2 Test Results		*P* value*
	Positive (n = 38)	Negative (n = 41)	
Overall			
Age, y, mean (SD)	86 (15.5)	87 (9.8)	.95
Length of stay at facility <90 d before testing, n (%)	4 (10)	5 (12)	>.99
Coexisting conditions, n (%)			
Any coexisting condition	38 (100)	36 (88)	.06
Chronic lung disease	9 (23)	9 (21)	.85
Diabetes	9 (24)	3 (7)	.04
Cardiovascular disease	32 (84)	32 (78)	.49
Cerebrovascular accident	10 (26)	9 (22)	.65
Renal disease	26 (68)	7 (17)	<.001
Received hemodialysis	0	1 (2)	>.99
Cognitive impairment			
Moderate	18 (47)	20 (49)	.90
Severe	14 (37)	3 (7)	.001
Denutrition	12 (32)	14 (34)	.80
Obesity	10 (26)	9 (22)	.65
Symptoms during the past 14 d, n (%)			
In symptomatic residents	32 (84)	22 (54)	<.01
At least 1 typical COVID-19 symptom	28 (74)	19 (46)	.01
Temperature	27 (71)	14 (34)	.001
Cough	14 (37)	10 (24)	.23
Shortness of breath	24 (63)	6 (15)	<.001
Saturation rate less than 90%	21 (55)	5 (12)	<.001
Respiratory rate more than 24	21 (55)	4 (10)	<.001
Only atypical COVID-19 symptoms	3 (8)	3 (7)	>.99
Asymptomatic residents	6 (16)	19 (46)	<.01
Deaths	12 (32)	1 (2)	<.001
Antibodies against SARS CoV-2	25 (96)	2 (5)	<.001

*P for chi-square test or Fisher exact test if chi-square was not a valid test for categoric variables, and Student *t* test for continuous variables.

Health Care Personnel

Among the 34 HCP, 6 had positive rRT-PCR at baseline and 2 at day 7 (23.5%). No new COVID-19 diagnosis was made later. Two-thirds of the positive rRT-PCR HCP had COVID-19 symptoms, often mild.

Seroconversion

Six weeks after nasopharyngeal testing, 25 residents (92.3%) and all 8 HCP (100%) with positive rRT-PCR developed SARS-CoV-2 IgG antibodies. Two (5%) rRT-PCR–negative residents and 5 (11.5%) rRT-PCR–negative HCP developed antibodies. All 2 residents and 3/5 HCP had typical COVID-19 symptoms.

Discussion

The present study shows the clinical efficacy of a symptom- and repeated testing–based strategy in an NH facing a COVID-19 outbreak. This experience validates the American Testing Guidance for Nursing Homes updated in May 2020.[4]

All residents and HCP were tested, and there was no selection bias. This study was conducted before any other COVID-19 cases had been detected in the county. The presence of antibodies in residents and HCP is therefore almost certainly linked with the COVID-19 outbreak in that NH.

In the present study, 16% of residents and one-third of HCP with positive rRT-PCR were asymptomatic in the 14 days before testing. This confirms that all residents and HCP should be tested if there is a confirmed case of COVID-19, whatever the symptoms.[4] Two residents and 2 HCP who tested negative at baseline were tested positive for COVID-19 7 days after baseline. This suggests that a repeated weekly testing of all previously negative residents and HCP until no new COVID-19 cases are identified is also essential in preventing the SARS-CoV-2 spread.[4]

Positive rRT-PCR was associated with a severe prognosis (death in 32%), especially in men (death in 58%), confirming previous studies.[1,2] Among the 22 negative rRT-PCR residents presenting COVID-19 symptoms, 1 died and the others recovered completely, suggesting that severe COVID-19 outcomes could be generally, but not always, predicted by positive testing.

Testing remained positive for 3 weeks or more in two-thirds of the rRT-PCR–positive residents. One remained positive for 8 weeks, indicating that NHs facing a COVID-19 outbreak should be prepared to maintain prolonged protective measures in residents tested positive for SARS-CoV-2. In accordance with our regional guidelines,[6] this NH was considered to be COVID-19 free when none of the residents and HCP were diagnosed within the 14 days after the last positive result. COVID-19–free NHs apply regional recommended measures to prevent any further COVID entrance and spread. In our Occitanie region, these measures include[6]

1. checking that rRT-PCR testing in HCP and visitors with COVID-19 symptoms or in those having had contact with suspected or confirmed COVID-19 cases (daily screening) is negative before entering the premises;
2. checking that rRT-PCR testing in all new residents and in all residents having spent more than 24 hours outside the NH (especially after hospitalization) is negative before entering;
3. checking that residents, HCP, and visitors who had previously tested positive for COVID-19 meet all 3 follow-up NH entrance criteria: (a) resolution of fever (without use of fever-reducing medications) and of other COVID-19 symptoms within the past 48 hours, (b) 2 consecutive negative rRT-PCR results collected ≥24 hours apart, and (c) the first control test collected at least 7 days after the positive testing or 7 days after the first COVID-19 symptoms;
4. obliging visitors allowed to enter the NH to sign a charter in which they agree to adhere to standard and transmission-

based precautions to prevent COVID-19 spread in the NH (systematic face mask wearing, hand hygiene, and especially social distancing) as well as a registry with contact details to facilitate testing and contact tracing should a new case be diagnosed in the NH;
5. admission to a private room and 14 days of isolation for every new resident and every resident having left the NH for at least 24 hours (especially after hospital stay);
6. testing of every resident having left the NH for less than 24 hours (especially for medical consultation) 5 to 7 days after a possible contact with COVID-19;
7. daily screening of all residents for COVID-19 symptoms (including atypical symptoms) and testing if there is any doubt; and
8. regular testing of HCP, visitors, and residents at a high risk of encountering COVID-19 subjects outside the NH (health care workers who have a care activity outside the NH, visitors of several NHs, hemodialyzed patients, etc) (This measure can be justified in regions with moderate or substantial community transmission, but it is not recommended in our region, in which community transmission now is considered as low.)

Residents and HCP with positive rRT-PCR developed IgG antibodies against the SARS-CoV-2 in 96% and 100%, respectively, suggesting that most frail older adults living in a NH, as well as the HCP, can produce an antibody response against SARS-CoV-2.

Two residents (5%) with negative rRT-PCR developed antibodies and all had fever or respiratory symptoms consistent with COVID-19 in the 14 days before. This suggests that residents with COVID-19 symptoms should benefit from the same IPC strategy as residents with positive rRT-PCR, even if tested negative. Five HCP with negative testing developed antibodies against SARS-CoV-2 (11%) and some of them had no COVID-19 symptoms. This suggests that if specific COVID-19 IPC measures must be implemented in HCP with confirmed or suspected COVID-19, all HCP should wear a face mask, even if asymptomatic and with negative testing.

Conclusions and Implications

The present study supports the recent American testing guidance for NHs. It demonstrates that (1) testing all NH residents and HCP as soon as a new case of COVID-19 is diagnosed and (2) repeating tests in all previously negative subjects once a week until the testing identifies no new COVID-19 cases is effective in detecting asymptomatic COVID-19 residents and HCP. It also shows that (3) proposing COVID-19 IPC measures in residents and HCP tested positive or with COVID-19 symptoms and (4) taking precautions in all other HCP should be effective in blocking the dissemination of the virus in NHs facing a COVID-19 outbreak.

Acknowledgments

The authors thank Anna Bedbrook for editorial assistance and all residents and health care personnel of the nursing home.

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