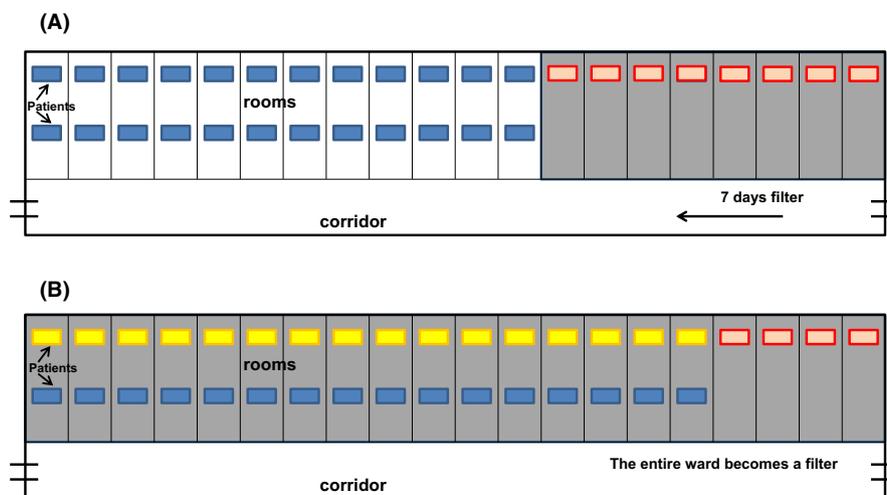


## Managing a SARS-CoV-2-free Hospital Unit of Internal Medicine to avoid in-hospital clusters

Besides its terrible claim in terms of human lives, SARS-CoV-2 pandemic hit hard also on the hospital management with most healthcare facilities being overwhelmed by hundreds of patients with SARS-CoV-2-related symptoms. Therefore, hospitals needed to combine prevention of in-hospital SARS-CoV-2 spread and maintenance of standard of care for non-SARS-CoV-2 patients. Such challenges also affected Italian facilities that were then reorganized with entire buildings dedicated to SARS-CoV-2.<sup>1,2</sup> Similarly, also the IRCCS San Martino Hospital in Genoa (Italy) created separate pathways for SARS-CoV-2-free and SARS-CoV-2-positive patients, both in the emergency department and in the different wards with our Internal Medicine division being designated as SARS-CoV-2-free by the director of the hospital. A major pitfall of such strategy was immediately identified in the rather long time of COVID-19 incubation, which

may hamper the allocation of patients to the correct and safe pathways. This issue was previously investigated by our research group in a recently published article in the *European Journal of Clinical Investigation* (EJCI), reporting clinical and laboratory variables useful to predict late in-hospital SARS-CoV-2 positivity.<sup>3</sup> Such patients—admitted at the ED as negative at the first test—were then found positive for the virus during short-term follow-up testing, when they already passed the filter ‘grey’ zones. During the second and third waves of virus spread, the IRCCS San Martino Hospital—the biggest healthcare facility of the Liguria Region—demonstrated great plasticity and adaptation by creating every week new COVID-dedicated units and moving the filter zones within the COVID-free wards. However, the big issue of incubation time remained and, given the high number of multiple occupancy rooms in our hospital, COVID-free units had



**FIGURE 1** Schematic of the patient distribution within the Unit of Internal Medicine. (A) From July to December 2020, patients entering after few days of stabilization in the ED were filtered for additional 7 days in rooms where they were maintained alone and submitted to serial SARS-CoV-2 testing (at admission in the Internal Medicine Unit and then every 3 days) (red rectangles). The other patients already passing the filter were maintained within the units in rooms with two beds (blue rectangles) and continued to be submitted to serial testing (every 3 days). (B) From January to June 2021, all patients entering from ED in the Unit of Internal Medicine were maintained during all the entire hospital stay in a filter that involved the entire unit. For each room with two beds, one patient was already COVID-19-immunized (yellow rectangles) and the second one was COVID-19-negative. Negative patients from the ED in the first 3 days in the Unit of Internal Medicine were maintained alone in the room and serially tested with SARS-CoV-2 testing

TABLE 1 Comparison of the ward performance before and after the implementation of the 'immunized patient' strategy

Clinical ward variables	July-December 2020 (6 months)	January 2021-June 2021 (6 months)
Beds available in the unit, <i>n</i>	37	36
Gender, female %	54.5	50.3
Age, years	75.5	77.1
Patients from ED, %	97.4	96.4
SARS-CoV-2 early positive (within 10 days from ED admission), <i>n</i>	86	24
Mean time to SARS-CoV-2 positivity from ED admission, days	8.87	8.90
SARS-CoV-2-negative patients discharged, <i>n</i>	437	529
Bed occupancy rate, %	84.3	96.2

Abbreviation: ED, emergency department.

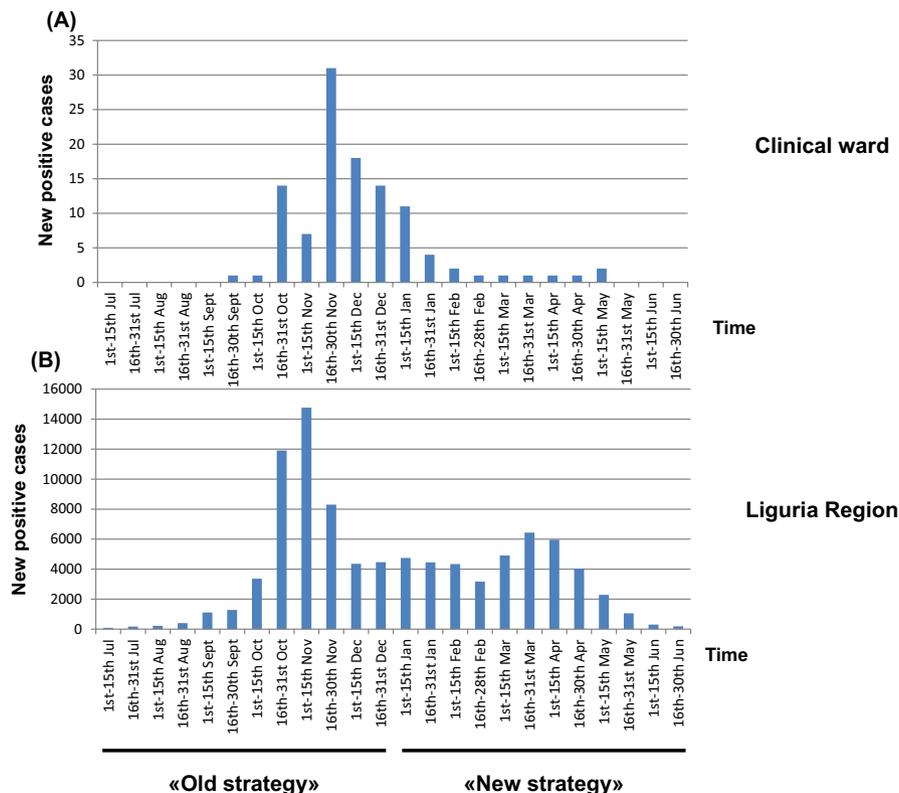


FIGURE 2 Overtime distribution of new SARS-CoV-2 cases from July 2020 to June 2021 in the clinical ward of Internal Medicine and in the global Liguria Region. (A) Distribution of early COVID-19-positive patients (within 10 days from entrance in the ED) in the Unit of Internal Medicine at IRCCS San Martino Hospital Genoa. The patients did at least two serial negative tests during 3–4 days of hospitalization for the stabilization in the ED and then were allowed to enter in the SARS-CoV-2-free Unit of Internal Medicine. These patients were then found positive at initial serial testing in the Unit of Internal Medicine. (B) Distribution of SARS-CoV-2-positive patients in the same time period in the Liguria Region (data obtained from the Italian Ministry of Health accessed on 12 August 2021)

to reduce the availability of beds for COVID-19-negative patients in order to isolate patients during the quarantine time. Such situation in COVID-free units had negative repercussions on COVID departments that could not transfer patients no longer positive for the virus but still requiring hospitalization. Based on these premises, we

built a novel strategy for our COVID-19-free Unit, asking for the collaboration of other professionals, particularly those working in ED. Starting from January 2021, we considered the entire COVID-free Unit of Internal Medicine as unique filter zone, admitting in each room of two beds a patient who did at least two serial negative tests during

3–4 days of hospitalization for the stabilization in the ED and another patient with recent COVID-19 disease with negative conversion of nasopharyngeal swabs (Figure 1A and 1B). The letters were transferred in our unit in many cases from COVID-19–dedicated wards, thereby facilitating the drainage of patients no longer positive for the virus from those units.

Results of this strategy are reported in Table 1 and Figure 2. First of all, differently from other reports,<sup>4,5</sup> we did not observe any case of reinfection. Also, as compared to the period from July to December 2020, the new strategy starting from January 2021 implied a dramatic reduction in COVID-19 early positive patients and an increase in discharge of COVID-19–negative patients, suggesting that the unit could improve the efficiency by caring more patients in a safer way (Table 1). The new strategy also improved the percentage of beds occupied by patients every day, thus reducing empty beds previously used for filtering patients. Interestingly, patients admitted to the Unit of Internal Medicine from July to December 2020 and from January to June 2021 were similar on age, gender distribution, percentage of provenance from the ED and the mean time of incubation of COVID-19 diseases, with the first positive nasopharyngeal swab found at around 8 days after the ED admission (Table 1). Of note, the stability of this last variable dramatically confirmed the quite long incubation time that represents an unmodifiable risk factor for in-hospital clusters. Figure 2 reports the overtime distribution of new cases in the Liguria Region and in our Internal Medicine showing similar trends for the two curves during the second wave (October–November 2020). Conversely, during the third wave (March–April 2021), the two curves dissociated with only few patients found positive for SARS-CoV-2 during the beginning of their staying in the ward. Besides the role of the newly implemented strategy, those data account for the important role of the Italian Vaccination Program for the Health Personnel and elderly patients who had a key role in increasing SARS-CoV-2 immunization and reducing the pressure for both COVID and COVID-free hospital units.

To conclude, we herein report a novel strategy to prevent in-hospital spread of SARS-CoV-2 in a COVID-free unit taking into consideration the quite long incubation time of this virus. Such strategy was helpful in containing the new positive cases during the third waves of the disease in Italy without reducing the number of hospitalizations for diseases other than COVID-19. Our approach bases on the immunization state of patients to create hospital rooms in which the possibility to transmit SARS-CoV-2 is hampered. To this end, a high degree of

collaboration is required between the ED and the different hospital units, as well as the best coordination from the hospital direction.

## KEYWORDS

cluster, hospital, SARS-CoV-2

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## CONFLICT OF INTEREST

The authors report no relationships that could be construed as a conflict of interest.

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