Implementation of a nurse-led alternate care site for the management of the surge of patients with COVID-19 in an Italian emergency department

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ABSTRACT

Background To accommodate and separate the large numbers of patients going to hospital with COVID-19, many EDs had to create new pathways for patients. We describe the outcomes of patients treated in a nurse-led alternate care site (ACS) at our hospital.

Methods This was a retrospective study of outcomes of patients managed at the ACS of 'San Bassiano' Hospital ED, Bassano del Grappa, Italy between 9 March and 16 April 2020. Self-presenting patients aged 5 years and older, suspected of having COVID-19, were initially diverted to the ACS. Patients with a National Early Warning Score ≥5 or with a desaturation ≥4% after the walking test were sent back to the main ED COVID-19 path for further evaluation and medical attention and were not further followed up. In the ACS, patients received a CXR, blood samples and a nasopharyngeal swab to test for SARS-CoV-2, and were sent home. An emergency physician reviewed the results later and called the patient back 5–6 hours later with instructions to return for medical evaluation of abnormal findings, or to seek their general practitioner's attention. Patients received a follow-up phone call 15 days later to learn of their course.

Results A total of 487 patients were fully managed in the ACS and discharged home. Of the 392 (80.5%) patients with no abnormalities after the workup and instructed to stay at home, 29 reattended the ED in the next 15 days, and 13 were admitted. Among the 95 patients asked to return and receive medical attention, 20 were admitted and of those discharged, 3 reattended the ED within 15 days. At 15 days, no patient was deceased or received invasive ventilation; one admitted patient received non-invasive ventilation.

Conclusions A nurse-led ACS diverted a substantial proportion of patients from main ED resources without associated negative clinical outcomes.

Key messages

What is already known on this subject

⇒ A surge of patients with potentially emerging infectious disease presenting to EDs can rapidly deplete the hospital's resources, testing the resilience if not properly managed.

⇒ EDs have developed a variety of pathways to meet the demand and cohort of patients.

What this study adds

⇒ A nurse-led alternate care site for evaluation of patients suspected of COVID-19 without desaturation and National Early Warning Score <5 could serve as a model for future waves of other infectious disease outbreaks.

INTRODUCTION

As the frontline of hospital healthcare, emergency departments (EDs) are particularly challenged to meet the demand of patient surge during an infectious disease outbreak,[1] as previously demonstrated with seasonal influenza.[2] Additionally, the goal is to attempt to cohort potentially infectious individuals apart from those presenting with other illnesses and injuries. This work describes the activation and outcomes of a nurse-led alternate care site (ACS) for patients presenting to the 'San Bassiano' Hospital ED, Bassano del Grappa, Italy, with symptoms consistent with COVID-19.

METHODS

Setting and procedures

This ED has approximately 60 000 visits annually and is comparable with an American College of Surgery Committee on Trauma-verified level II trauma centre, with 413 inpatient beds, 16 intensive care unit (ICU) beds and 16 high-acuity cardiac monitored beds.

After the first cases of COVID-19 were detected in Veneto region on 21 February 2020, a pathway to evaluate patients suspected of COVID-19 in an area separate from the main ED was created by repurposing part of the main ED and adding a prefabricated module and two tents in the parking lot outside the ED. The ACS was staffed during the day (08:00–20:00) by a nurse and a radiology technician. The nurses were recruited from temporarily suspended services (eg, ambulatory care or operating rooms).

On arrival to the main ED entrance, patients self-presenting were screened by a clerical staff member for fever and symptoms potentially suggestive of COVID-19 infection (figure 1 and online supplemental material 1). Those aged 5 years and older and screened positive were immediately diverted to the ACS as 'COVID-19 suspect', while the others were sent to the main ED triage station.

The nurse in the ACS registered each patient, collected vital signs and calculated a National

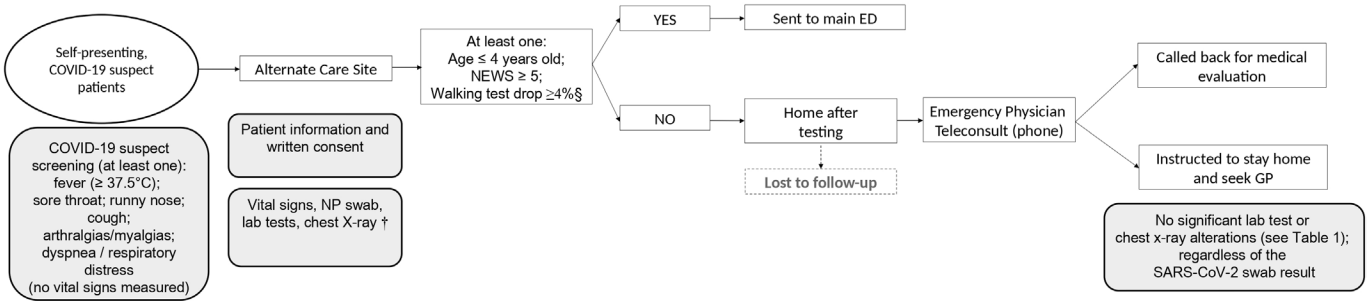

Figure 1 Organisation and procedures performed in the alternate care site (ACS). Self-presenting patients screening positive for fever or other suspected symptoms were diverted from outside the ED to the ACS. Those having at least one criterion for referral (children aged ≤4 years; patients scoring ≥5 at the NEWS or desaturation ≥4% at the walking test) were sent to the main ED COVID-19 path to receive immediate medical attention. Those remaining were sent home to wait for the results after completing the workup. †Vital signs: RR, HR, BP, SpO_2, body temperature, level of consciousness (A: alert; C: confused; V: verbal; P: pain; U: unresponsive). §Walking test: 6-minute long walking at sustained speed; a drop ≥4% in SpO_2 was considered significant and needing immediate medical evaluation. NP swab, nasopharyngeal reverse transcriptase PCR swab for SARS-CoV-2; lab tests, complete blood count with differential, creatinine, aspartate and alanine transaminases, lactate dehydrogenase, procalcitonin and C reactive protein. GP, general practitioner; NEWS, National Early Warning Score.

Early Warning Score (NEWS)[3] for adults, or an ad-hoc modified version of NEWS for paediatric patients (see online supplemental material 2), and asked the patient to perform a walking pulse oximetry test. Patients with NEWS ≥5 or >4% desaturation were sent back to the main ED. For those remaining in the ACS, a two-projection CXR was performed, regardless of symptoms, and blood samples were collected for a standardised panel analysis derived from the evidence available at that time.[4–6] A nasopharyngeal swab was performed for SARS-CoV-2 with reverse transcriptase PCR technique (VIASURE SARS-CoV-2, CerTest Biotec, Zaragoza, Spain) starting from 13 March 2020.

The ACS evaluation was designed to take 10 min to be completed. Patients were sent home after evaluation with instructions (see online supplemental material 3) and their chart was sent via fax to the main ED and scanned into dedicated digital repository. Every 4 hours, an emergency physician attending patients without COVID-19 in the main ED checked this repository for the results and called each patient. Physicians instructed the patient to return to the main ED if they had significant alterations of their tests (box 1). Otherwise, they were told to stay home, follow up with their general practitioner and practice self-care.

Participants

Patients who were managed in the ACS between 9 March and 16 April 2020 and aged 5 years old or more were included in the study; these patients were called again 15 days later to determine: survival; need to reattend any ED; admission to any hospital. The main outcomes were number of patients treated, called back for evaluation and instructed to stay at home. Patients sent back to the main ED after ACS screening were excluded from the study. Also, cases with more than one missing variable, lacking contact details, or patients not reached after three attempts on 3 consecutive days were excluded.

Analysis

Data from patient charts were encoded to a Microsoft Office Excel spreadsheet (V.2016, Microsoft Corporation, Redmond, Washington, USA). Data were presented as mean and SD or as percentages.

Patient and public involvement

Patients or the public were not directly involved in the development of this research.

RESULTS

During the study period, 3498 patients accessed the ED (figure 2). Of the 2627 self-presenting patients, 647 (24.6%) were diverted to the ACS: 61 patients were lost to follow-up (23 did not answer at 15 days; 35 provided wrong contact details; 3 declined to participate in the study) and 99 patients were sent back to the main ED COVID-19 path for immediate medical evaluation (figure 2). Among the 487 patients discharged from the ACS, mean age was 47.5 (±17.2) years with 56.3% female.

Box 1 Emergency physician screening of patients, regardless of the swab result

1. No significant test alterations—instructed to stay home.
   - CBC and differential within normal range.
   - CRP <10 mg/dL.
   - Procalcitonin <0.1 µg/L.
   - Creatinine <2 mg/dL.
   - AST and ALT <3 times normal range.
   - No chest radiography alterations or isolated, monolateral lung consolidation.
2. Significant test alteration: asked to come back to receive medical attention.
   - Blood test alterations (out of the thresholds mentioned above) and/or
   - Chest radiography abnormal findings (eg, interstitial pneumonitis, diffused/bilateral lung consolidations, pleural effusion, pulmonary oedema).

A case-by-case interpretation of the lab and chest radiography results was performed by the emergency physician, who discussed the aftercare plan with each patient instructing them to stay home and seek their general practitioner's attention or to come back for medical evaluation.

ALT, alanine aminotransferase; AST, aspartate aminotransferase; CBC, complete blood count; CRP, C reactive protein.

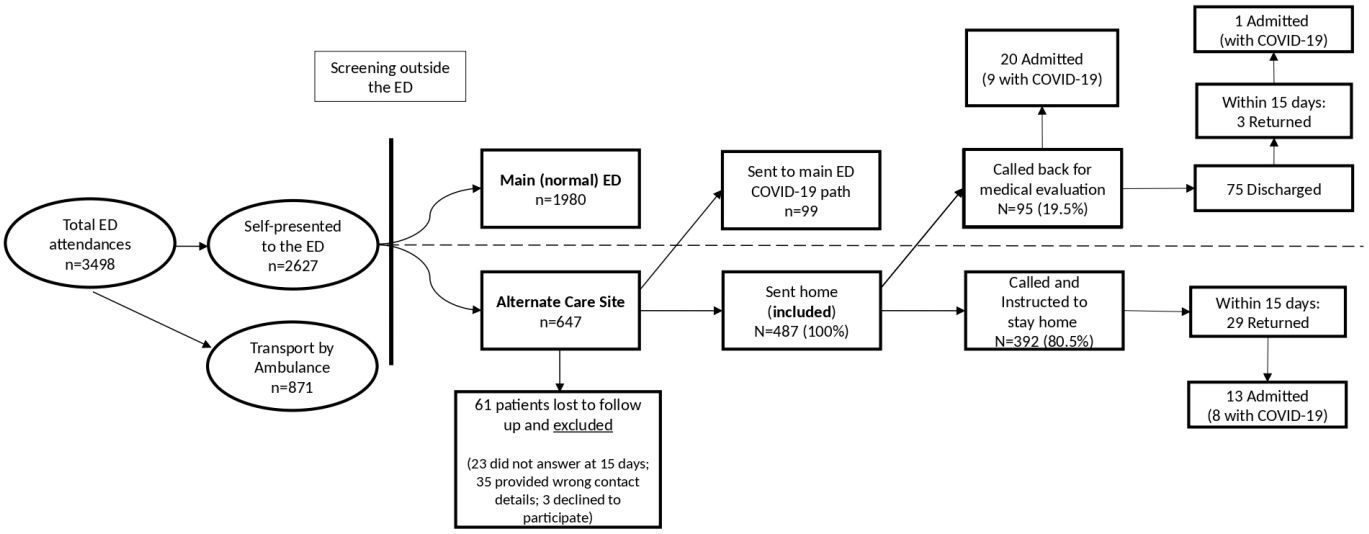

Figure 2 Representation of patient flux. Out of 2627 patients self-presenting to the ED, 487 were initially managed through the alternate care site, and 392 were removed from the main ED and sent home. Sixty-one patients lost to follow-up and not included in the percentages.

The mean NEWS was 1.70 (±1.42). One-third had a positive PCR test (table 1).

After review of results, 95 patients were asked to return to the ED. Twenty were admitted (nine with COVID-19; five with community-acquired pneumonia (CAP); one with pulmonary embolism; one with upper gastrointestinal haemorrhage; one with congestive heart failure; one with severe anaemia; two with febrile leukaemia), while the remaining 75 were discharged with specific instructions. During the 15-day follow-up, 3 of the 75 discharged patients returned to the main ED and 1 was admitted (due to worsening COVID-19) (figure 2).

Among the 392 patients instructed to stay at home, 29 reattended the main ED within the following 15 days: 16 patients were then discharged after re-evaluation (two of them testing positive after the first visit in the ACS; two without swab results available) and 13 were admitted (eight for COVID-19; one for

Table 1 Characteristics of the 487 included patients

	Total patients included ('sent home') (n=487; 100%)	Instructed to stay home (n=392; 80.5%)	Called back (n=95; 19.5%)	Normal ranges (min–max; <max)
Gender—female (n; %)	274 (56.3)	232 (59.2)	42 (44.2)	–
Age (years; mean±SD)	47.5±17.2	46.0±17.9	53.7±17.9	–
rt-PCR swab positive (n; %)	161 (33.1)	105 (26.8)	57 (60.0)	–
NEWS (mean±SD)	1.70±1.42	1.60±1.42	2.12±1.42	–
Peripheral O_2 saturation	98.4%±2.2%	98.6%±2.3%	97.8%±2.7%	≥96%
Labs (mean±SD)				
White cell count (×10^9/L)	7.68±7.61	7.73±7.61	7.50±7.61	4.50–11.00
Neutrophils (×10^9/L)	4.56±2.46	4.46±2.45	4.99±2.45	1.80–7.70
Lymphocytes (×10^9/L)	2.24±5.53	2.37±5.53	1.69±5.53	1.00–4.50
Monocytes (×10^9/L)	0.71±1.84	0.71±1.84	0.69±1.84	0.20–1.00
Eosinophils (×10^9/L)	0.15±0.21	0.16±0.21	0.10±0.21	<0.70
Basophils (×10^9/L)	0.04±0.02	0.04±0.02	0.03±0.02	<0.20
Haemoglobin (g/L)	138.91±15.65	139.14±16.62	137.95±17.53	110–153
Platelets (×10^9/L)	243.77±71.70	131.41±71.44	112.64±71.84	150–400
C reactive protein (mg/dL)	1.78±3.96	1.33±3.96	3.62±3.95	<0.50
Procalcitonin (µg/L)	0.08±0.20	0.08±0.20	0.08±0.20	<0.10
Lactate dehydrogenase (U/L)	204.22±57.90	198.66±58.25	227.02±58.59	125–220
Creatinine (mg/dL)	0.96±0.56	0.95±0.56	1.00±0.56	0.90
AST (U/L)	28.92±20.91	27.12±20.91	36.33±20.91	5–34
ALT (U/L)	30.92±37.76	28.21±37.76	39.95±37.76	<55
CXR*				
Showing pneumonia	144	84	60	–
Negative or suggestive of disease other than pneumonia	338	303	35	–

*Five CXRs not performed because these patients declined.
ALT, alanine aminotransferase; AST, aspartate aminotransferase; max, maximum normal value; min, minimum normal value; NEWS, National Early Warning Score; rt-PCR, reverse transcriptase PCR swab for SARS-CoV-2.

CAP; three for neoplastic complications; one for congestive heart failure) (figure 2).

Considering patients sent to the ACS and removing those who reattended the ED, 363 visits were entirely removed from the main ED workflow and managed only through the ACS and following telephone medical consult (13.8% of self-presenting patients). A total of 32 patients came back and were seen in the main ED (6.6% of the included) (figure 2). None of those who returned to the ACS within the 15 days received invasive ventilatory support nor were treated in the ICU. One patient was discharged home from the ACS who reattended needed admission to a high-acuity unit receiving non-invasive ventilation. No ACS patients were deceased 15 days after their presentation.

DISCUSSION

The crucial step in the function of ACSs during a pandemic surge is patient selection, to ensure proper throughput trying to avoid overcrowding while attempting to deliver an acceptable level of care.[1 7] At the time of this study, ED personnel were left like *rari nantes in gurgite vasto* (castaways in a large maelstrom), with neither rapid antigen testing nor specific data on clinical presentation of the emerging infectious disease to help diagnose COVID-19 among suspected patients. In this ED, screening criteria were based on the scarce literature available in late February 2020, taking as an example fever clinics established during the 2003 SARS outbreak in Singapore.[8] In this study, the creation of a nurse-led ACS was not associated with negative outcomes regarding patients' survival at 15 days; only 32 of 487 (6.6%) patients needed a second evaluation for all-causes in the same follow-up period. This is higher than all-cause return rates to the ED found by Liu[9] in 2013 (3.7% within 3 days) and by Sauvin *et al* in 2008 (2.2% within 8 days),[10] but can be explained by the higher number of days of follow-up of this study (15 days).

Of note, 19.5% of included patients were called back for medical evaluation after passing through the ACS and being sent home (n=95; figure 2), and nine of them were admitted since suffering from serious illnesses. While no adverse events were recorded among these patients, such results highlight the intrinsic high clinical risk of establishing this model in a pandemic surge context with no prior model to rely on, and could be limited in the future by lowering the NEWS threshold, triggering a diversion back to the main ED. During a crisis like the one experienced in early 2020 in Italy, the main objective is to preserve the hospital's resilience and capacity by adapting a model of providing as much care to the most of people as possible with the available staff, stuff and structure, as per disaster medicine principles.[7] Similarly, Suh *et al*[11] pointed out that far too much attention was dedicated to ventilators and critical care bed availability during the COVID-19 pandemic, while the high input of patients has been the real Gordian knot to unravel. In their ED, Suh *et al* rationalised patient throughput by avoiding lab testing and CXRs in patients presenting with only mild symptoms, but discharge required a clinical evaluation performed by a physician.[11] In other examples, emergency medical care was implemented by adding different forms of ACS before the ordinary flow of ED patients with a minimal impact on the level of care, probably thanks to a higher availability of 'staff, stuff and structure'.[12–14] Conversely, the ACS described in this paper was implemented to preserve the leading role of the emergency medicine physician in managing patients. The Italian emergency medical care system was already overstretched and understaffed before the pandemic, in part due to the lack of emergency medicine physicians—the first formal residency programmes started in 2010. The ACS protocol was deemed more reliable by the hospital board than having clinicians from another specialty work in an unfamiliar clinical setting such as the ED.

This work has several limitations. Patients lost to follow-up could have been deceased or attended an ED out of the district, leading to an underestimate of admission rates or mortality. We performed 15-day follow-up; a longer follow-up could have detected major adverse events. Since the study was performed at a single centre in a specific region of Northern Italy, conclusions may not be valid for other facilities. The protocols and procedures detailed were formally issued by the Hospital Crisis Unit and the Hospital Medical Board before the activation of the ACS, in order to allow nurses to send home patients without being seen by a physician. Jurisdictions that require a physician visit prior to ED discharge would require a similar waiver from the health authority to establish a nurse-led ACS. Patient satisfaction was not assessed, since in the Italian healthcare system, this item is not routinely tracked; however, this aspect could be determinant in other healthcare systems such as those with direct payment. Finally, new advances currently achieved, such as third-generation antigenic swabs or lung ultrasound, can definitely modify this ACS's protocol.

CONCLUSION

A nurse-led ACS for low-risk patients helped to manage the surge of patients potentially infected with SARS-CoV-2 even during a time that screening tools were lacking. Findings suggest the potential of ACSs to be implemented during surges of emerging infectious disease outbreaks.

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Contributors MPa, EW and AF conceived the study. MPa, MPi, EW and AF designed and conducted the study. MPa and AF supervised the conduct of the study. MPa, MPi, EV, AB, CC, CO and AF performed data collection. MPa provided statistical advice. MPa and MPi performed data analysis. MP and EW drafted the manuscript, and all authors contributed substantially to its revision and take responsibility for the paper as a whole.

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