# PROCESS AND SYSTEMS Experience of using a regional network of hospitals in the care of older inpatients with COVID-19 in spring 2020

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#### Introduction

Frail, older patients with COVID-19 have an increased risk of hospital admission and death.

#### Methods

We studied a regional model of care used for older patients with COVID-19 in spring 2020 across three settings: an acute teaching hospital, a district general hospital and a temporary emergency hospital. We also studied demographic and outcome data for these patients.

#### Results

Increasing bed capacity in non-acute sites freed up beds in acute hospitals. Strict admission criteria and multidisciplinary team involvement allowed for the safe delivery of care in step-down sites.

#### Conclusion

This model of care allowed for patient flow out of acute sites following the acute stage of their illness allowing for an increase in bed capacity while providing a safe setting for ongoing management.

**KEYWORDS:** COVID-19, pandemic preparedness, hospital networks, MDT working, health systems planning

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#### Introduction

SARS-CoV-2 has had devastating consequences worldwide, with older people suffering a disproportionate burden. \(^{1-4}\) In England and Wales, residents in care facilities accounted for 29% of all COVID-19-related deaths. \(^5\) In addition to age, frailty has emerged as an important determinant of outcomes in patients aged  $\geq$  65 years with COVID-19, and measures of frailty such as the Rockwood Clinical Frailty Score (CFS) have been shown to be valuable predictors of both mortality and morbidity in patients with COVID-19. \(^{6-9}\)

The varying degrees to which COVID-19 affects patients has also presented a clinical dilemma. Even older patients may have asymptomatic or mild disease and may not need to be cared for in acute hospital settings. A global drive to employ remote patient monitoring programmes and home-based models of care have allowed de-escalation of patients to community settings. L11.12 Even so, there has been a significant surge in the demand for inpatient beds, particularly for older patients.

International responses to the challenge of increased hospital admissions included the adaptation of existing hospital facilities as well as the construction of temporary emergency hospitals. Though the UK's national response included the network of 'Nightingale' hospitals, in the north-west region, modelling of anticipated needs led the NHS Nightingale Hospital North West (NNW) to focus on ward-based care. An analysis of all admissions to the NNW has previously been performed, and identified frailty as a key clinical characteristic of the cohort.

There was a clear necessity for a safe place of care for this vulnerable cohort of frail, older patients, both during their acute illness and to allow isolation from other vulnerable people. Here, we will describe a regional service model that aimed to care for frail, older patients with COVID-19 across three settings: a temporary emergency hospital, a district general hospital and an acute teaching hospital. We will discuss the aims of care in each setting, the relationship between them and the lessons that can be learnt for future pandemic planning.

#### **Methods**

We collected demographic and outcome data from patients aged ≥65 years who had a positive SARS-CoV-2 PCR test, admitted to Wythenshawe Hospital (WH; acute hospital), Trafford General Hospital (TGH; district general hospital) and NNW (temporary hospital) for the care of patients with COVID-19 during the first

wave of the pandemic, between April 2020 and June 2020. A continuous sample of patients was identified at each site; the sample size was pragmatic, incorporating all patients admitted to the temporary hospital between 13 April 2020 and 17 June 2020, a consecutive sample of the patients admitted to the district general hospital COVID-19 unit between 03 April 2020 and 28 May 2020, and a consecutive sample of the patients admitted to the acute hospital who tested positive for COVID-19 from 01 March 2020 to 09 June 2020. As neither the temporary hospital nor the district general hospital had admitting units, patients at these sites were transferred from another hospital. For the temporary hospital, this represented local hospitals, as well as other NHS trusts in the north west. For the district general hospital, the majority of patients were transferred from the acute hospital. A small number of patients were already admitted to the district general hospital (non-COVID-19) ward) prior to testing positive. Therefore, the consecutive sample from the acute hospital represented those who either died there or were directly discharged to the community.

In order to assess the model of care, virtual meetings between study investigators were undertaken. Site characteristics assessed include admission and discharge criteria, services and facilities, multidisciplinary team (MDT) involvement, and trust policy guidelines.

Primary clinical outcomes of interest were time to discharge, as defined by time from positive SARS-CoV-2 swab (taken at any site) to discharge; and mortality within 30 days of the patient's first positive SARS-CoV-2 swab.

Data analysis was performed in Stata/IC v14.2 and GraphPad Prism v7.0. The Kruskall–Wallis test was used to examine the differences between the age distributions. Length of admission (censoring in the event of death or transfer to another hospital) and time from first positive SARS-CoV-2 PCR result to death were compared across the three sites by Mantel–Cox tests, followed by pairwise comparisons between sites. The association between frailty and mortality in the 30 days from a positive PCR was evaluated using chi-squared tests and Fisher's exact test, dichotomising continuous variables where appropriate to reflect meaningful clinical thresholds.

# Results

## Demographics and baseline patient characteristics

A total of 244 patients were studied across the three sites: 97 out of 97 patients treated at the temporary hospital; 73 patients from a total of 506 admitted to the acute hospital and 74 from a total of 227 admitted to the district general hospital. The baseline clinical

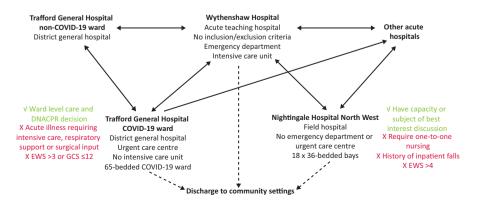
characteristics are shown in supplementary material S1. Patients at the district general hospital and temporary hospital were older than those at the acute hospital (p=0.001 and p<0.001, respectively). Patients were frailer (median CFS 6) at the district general and temporary hospital compared with the acute hospital (median CFS 4). Dementia was more commonly seen in patients admitted to the district general hospital and temporary hospital compared with those who were discharged directly from or died in the acute hospital (42%, 35% and 22%, respectively). This was also true for cerebrovascular disease with rates of 28% at both the district general hospital and temporary hospital, and 15% at the acute hospital. Further detail is also given in supplementary material S1.

#### Model of care and site characteristics

WH, an acute teaching hospital that is part of Manchester University NHS Foundation Trust (MFT), had an emergency department and an intensive care unit (ICU), with no exclusions for admission. TGH, a district general hospital, also part of MFT, accepted patients with COVID-19 from acute trusts for rehabilitation and discharge planning. This service was provided at TGH as closure of elective surgical services meant that a 65-bedded inpatient facility, along with trained nursing and allied health professionals, was available for repurposing. As a result, TGH was able to accept patients transferred from WH as well as internal transfers from other wards within the hospital. Of note, TGH did not have an emergency department, a critical care unit or ICU. In both WH and TGH, the COVID-19 wards were existing hospital wards that were repurposed as COVID-19 units.

NNW, a temporary hospital, is part of a national network of emergency 'Nightingale' hospitals opened to address bed pressures during the early stages of the pandemic. Though initially projected to provide level 3 beds for invasive and non-invasive ventilation, early experience of local trusts revealed that the greatest need would be for beds for older patients requiring rehabilitation and respite, or for those awaiting a negative SARS-CoV-2 PCR prior to discharge to a care facility. Therefore, NNW adapted its workforce and acceptance criteria to focus on care for older adults. Constructed within a conference hall, NNW did not have an assessment unit and accepted patients who were transferred from WH and other sites in the region after clinical stabilisation between 13 April 2020 and 17 June 2020. Further detail on NNW is described elsewhere. 15

Though the sites worked as distinct units, there was a flow of patients between them and other regional hospitals as illustrated



**Fig 1. Flow of patients between the three sites.** Solid lines represent transfer
between hospitals; dashed lines represent
discharge into the community. DNACPR =
do not attempt cardiopulmonary resuscitation; EWS = Early Warning Score; GCS =
Glasgow coma score.

in Fig 1. The temporary hospital and district general hospital had distinct admission and exclusion criteria to enable suitable patient selection (Table 1) and reflects the expertise and services offered at these respective sites. Key criteria included Early Warning Score (EWS) thresholds and confirmation of resuscitation status and ceiling of care, as per the Resuscitation Council UK's 'ReSPECT' forms. The temporary hospital also required that patients either had capacity to make decisions, or had been the subject of an MDT meeting to consider a best interest decision about their care. NNW did not accept patients with hyperactive delirium due to the potentially disorientating nature of the environment.

Each site had a range of allied health professionals offering a variety of services, as shown in Table 1, which were identified as being key to comprehensive geriatric care provision. At each site, clinical staff included geriatric and respiratory consultants, and all patients at the temporary hospital had a comprehensive geriatric assessment. Each site had on-site physiotherapists, occupational therapists, pharmacists and psychiatrists. The district general hospital and acute hospital had on-site speech and language therapists and dietitians and, although not on site at the temporary hospital, they were able to attend during working hours. New referrals were reviewed by the MDT at both temporary and district general hospitals. At the temporary hospital, each new referral was vetted by the consultant on duty, matron, therapist and pharmacists within the same day. If there were any mental health issues, it was also vetted by the mental health team.

The discharge process differed slightly between sites. Each site had a daily MDT meeting to discuss patient progress and barriers to discharge. At both the acute hospital and district general hospital, on-site social workers liaised with community services to coordinate community care and nursing home placements, if required. The temporary hospital did not have an on-site social worker but did have a discharge team that liaised closely with the North West Ambulance Service NHS Trust and local social services hubs depending on which area the patient came from. The temporary hospital did not accept patients who were for new nursing home placements because it was felt that the possible long admissions resulting from this would not be appropriate for a temporary hospital open for a limited time.

# Clinical outcomes

The median time from positive swab (at any site) to discharge from final site, adjusted to censor deaths and transfers, was 29 days at the district general hospital, compared with 10 days at the acute hospital and 12 days at the temporary hospital. Adjusted to censor deaths and transfers, the median time to discharge among patients who were admitted from a care home or nursing home (n=45) was 11 days (interquartile range (IQR) 7–14), slightly lower than patients who were admitted from their own homes or sheltered accommodation (13 days; IQR 7-26; n=131), which was not significantly different (p=0.109). Twenty-seven per cent of patients had died within 30 days of a positive swab at the district general hospital, compared with 44% of patients at the acute hospital and 10% of patients at the temporary hospital. Among 62 patients who died across the three sites during or after admission, the median time to death was 14 days at the district general hospital, 18 days at the temporary hospital and 7 days at the acute hospital, such that patients at the acute hospital had half the elapsed time to death of patients at the district general

and temporary hospital combined (ratio 0.5; 95% confidence interval 0.3-0.8; p<0.001).

Out of the 97 patients at the temporary hospital, 12 (12.4%) were transferred to another hospital: three emergency transfers for specialist care (two of whom subsequently died), six elective transfers for specialist care, one elective transfer for social reasons and two patients were transferred at the closure of the hospital. Two out of 74 (3%) patients at the temporary hospital were readmitted to the acute hospital, both for specialist care that could not be provided at the district general hospital.

#### Discussion

#### Model of care

The network described herein consisted of an acute teaching hospital, a district general hospital and a temporary hospital. This model of care, which involved maximising bed capacity at district general hospital and temporary hospital sites, allowed for patient flow out of an acute site and facilitated better management of the scarcity of inpatient beds while providing a safe and well-provisioned setting for recovery and ongoing medical management. Both the district general hospital and temporary hospital were able to provide safe care for older, frail patients. The temporary hospital had an MDT skill mix including geriatricians, physiotherapists and occupational therapists that allowed for a strong focus on rehabilitation prior to discharge. The district general hospital repurposed an existing ward and utilised an MDT already based in the hospital and was, therefore, additionally able to provide safe care for patients with delirium and other ongoing medical needs.

Differences in mortality and length of inpatient stay between sites was expected, as these groups were selected based on clinical stability, complexity and level of care required. However, the relatively low 30-day mortality at the district general hospital and temporary hospital (27% and 10%, respectively), and the low rates of readmission to an acute trust shows that patients can safely and successfully be cared for in a step-down unit outside of an acute hospital. The greater length of admission at the district general hospital highlights the requirement for sufficient bed capacity to provide ongoing medical care and rehabilitation for older patients during a pandemic. By creating capacity for longer duration of stay, this approach likely also reduced the number of infectious patients returning to care homes.

Drawbacks in this model of care include potential disruption to continuity of care created by transfer between sites, and the risk of worsening confusion in patients already vulnerable to delirium. Although the construction of the temporary hospital in a conference centre offered a large, flexible floorplan, future pandemic planning may consider prioritising natural light and a dedicated physiotherapy area to reduce the risk of delirium and optimise rehabilitation. Additionally, the absence of critical care facilities at the temporary hospital and district general hospital required that patients in need of clinical escalation were transferred to an acute hospital. To minimise the need for urgent transfer, strict admission criteria (such as a threshold for EWS) were essential and enabled screening of patients who could safely be discharged to the district general hospital and temporary hospital. By requiring a documented ceiling of care discussion prior

Table 1. Admission	n and exclusion criteria and service	provision at the three sites	
	Temporary hospital	District general hospital	Acute teaching hospital
Admission criteria	SARS-CoV-2 PCR positive	SARS-CoV-2 PCR positive	As an acute hospital, there is no specific criteria for admission
	>18 years old	Have a ward level care decision with	
	NEWS2 score <5	a completed RESPECT form	
	Oxygen requirement <40% at time of transfer	Have a negative CPE swab in the previous 48 hours	
	Documented plan for ceiling of care		
	To have capacity to make medical and nursing decisions OR to have a best interest discussion		
Exclusion criteria	Require side-room admission for reasons other than COVID-19	Acute GI bleed or haemodynamic compromise	As an acute hospital, there is no specific criteria for admission
	Require bariatric equipment, parenteral or nasogastric nutrition	Acute chest pain with ECG changes to suggest MI requiring PCI / thrombolysis  Respiratory failure requiring invasive or non-invasive support  Previous admission to hospital in the previous 6 months requiring intensive	
	Require tracheostomy care		
	Require one-to-one nursing care		
	Inpatient falls within the previous 48 hours		
	Anticipated to require blood transfusion		
	Patients who are pregnant	care for the same condition  Patients who are pregnant	
	Patients with end-stage renal failure or who require dialysis	Patients with GCS score <12	
		Patients presenting with an acute	
		abdomen	
		EWS of >3	
Geriatric input	Clinical team included consultants in geriatric medicine	Clinical team included consultants and nurse specialists in geriatric	COVID-19 wards staffed by geriatric medicine, acute medicine and respiratory medicine consultants
	All patients had a comprehensive geriatric assessment	medicine  Not all patients seen by a geriatrician	
			Not all patients seen by a geriatrician
Respiratory input	Clinical team included respiratory medicine consultants	Dedicated respiratory consultant for COVID-19 unit	Clinical team included respiratory medicine consultants
Palliative care input	Palliative care specialist nurses and doctors available for advice and can attend as needed	Palliative care specialist nurses and doctors available for advice and can attend as needed	On-site palliative care team available for advice and review as needed
End-of-life visits	Able to facilitate visiting in the last days of life	Able to facilitate visiting in the last days of life	Able to facilitate visiting in the last days of life
Nutrition and dietitian	Speech and language therapists, dietitians able to attend during working hours from MFT hospitals	On-site speech and language therapists and dietitians Able to provide nasogastric and	On-site speech and language therapists and dietitians
	Unable to take patients requiring parenteral or nasogastric nutrition	parenteral nutrition	Able to provide nasogastric and parenteral nutrition
Care of patients with cognitive impairment	Declined patients with hyperactive delirium due to disorientating environment	Accepted patients with delirium	Accepted patients with delirium
	Accepted patients with hypoactive delirium		

	Temporary hospital	District general hospital	Acute teaching hospital
Ward structure	Staff members entered the clinical area in PPE allowing for movement of patients throughout the clinical area	Distinct bay areas and side rooms requiring PPE. Corridors were 'clean areas' where full PPE was not required, hence patients were restricted to side rooms / bays for infection control	Distinct bay areas and side rooms requiring PPE. Corridors were 'clean areas' where full PPE was not required, hence patients were restricted to side rooms / bays for infection control
Physiotherapy and occupational therapy	On-site physiotherapists and occupational therapists	On-site physiotherapists and occupational therapists	On-site physiotherapists and occupational therapists
Pharmacy	On-site pharmacists	On-site pharmacists	On-site pharmacists
Liaison psychiatry	On-site team available for advice and review	On-site team available for advice and review	On-site team available for advice and review
Resuscitation team	Resuscitation team on site 24 hours per day	Resuscitation team on site 24 hours per day	Resuscitation team on site 24 hours per day

MFT = Manchester University NHS Foundation Trust; MI = myocardial infarction; PCI = percutaneous coronary intervention; PPE = personal protective equipment.

to transfer, uncertainty over appropriate escalation in the event of clinical deterioration was avoided.  $^{16}\,$ 

### Limitations in this study

We have described a regional response that may not be representative of the national or global picture. However, local constraints and requirements were a key driver of the COVID-19 response across all settings and were fundamental to the successes and failures of managing the pandemic.

This article focused on inpatient outcomes and we are unable to comment on outcomes post-discharge such as readmission rates or level of independence or cognition, which may add to our understanding of this model for rehabilitation and the changing care needs of this cohort.

Additionally, this work utilised data from electronic patient records, and therefore lacked patient self-reported outcomes or experience measures. Collecting this data would inform future planning for emergency frailty services.

# Recommendations

The experience of the COVID-19 pandemic has highlighted the disproportionate impact on older, frailer individuals and the need to account for this in future pandemic planning. Older people are often overlooked in planning for pandemic and disaster management. Reports by the World Health Organization have aimed to provide clear recommendations to address this issue, such as the adaptation of healthcare systems and training staff to provide bespoke care to older patients.<sup>18</sup>

In line with these recommendations and our own findings, we propose that, when planning healthcare services in times of severe clinical pressures, care for older adults needs to be considered specifically. Rehabilitation wards in district general hospitals or a temporary hospital can be staffed and adapted to this vulnerable population. When considering the construction of temporary wards, planning should include methods of creating delirium-friendly environments, with features such as adequate signage, natural light, reduction of noise and minimal environmental hazards. Such wards should be based on an MDT

shared model of care rather than being medically led, with the focus on key principles of geriatric medicine such as recovery, reablement and maintaining independence. Staff will need to be appropriately trained to recognise complications such as decompensation of pre-existing comorbidities and geriatric syndromes including immobility and impaired cognition.<sup>19</sup> Cohesive care for older patients in line with these principles may be provided within an acute frailty unit, as suggested by *The NHS Long Term Plan*.<sup>20</sup>

This model is not only relevant for emergency planning but may also inform the design of regional frailty networks post-pandemic. In the context of worsening healthcare pressure, it is vital that we make the best use of community hospitals and facilities to relieve pressure on acute trusts, and to provide the best care for older patients. We propose that patients can be safely transferred from an acute trust to a dedicated frailty or rehabilitation ward as long as they meet strict clinical criteria and an appropriate staff mix is deployed. With an ageing population, there will be a need to provide greater capacity for specialist frailty care, which we believe can be offered in a closely integrated regional network. This network may also involve the use of virtual wards and should include a direct partnership with community services to provide holistic wraparound care.

# Supplementary material

Additional supplementary material may be found in the online version of this article at www.rcpjournals.org/fhj: S1 – Baseline characteristics.

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