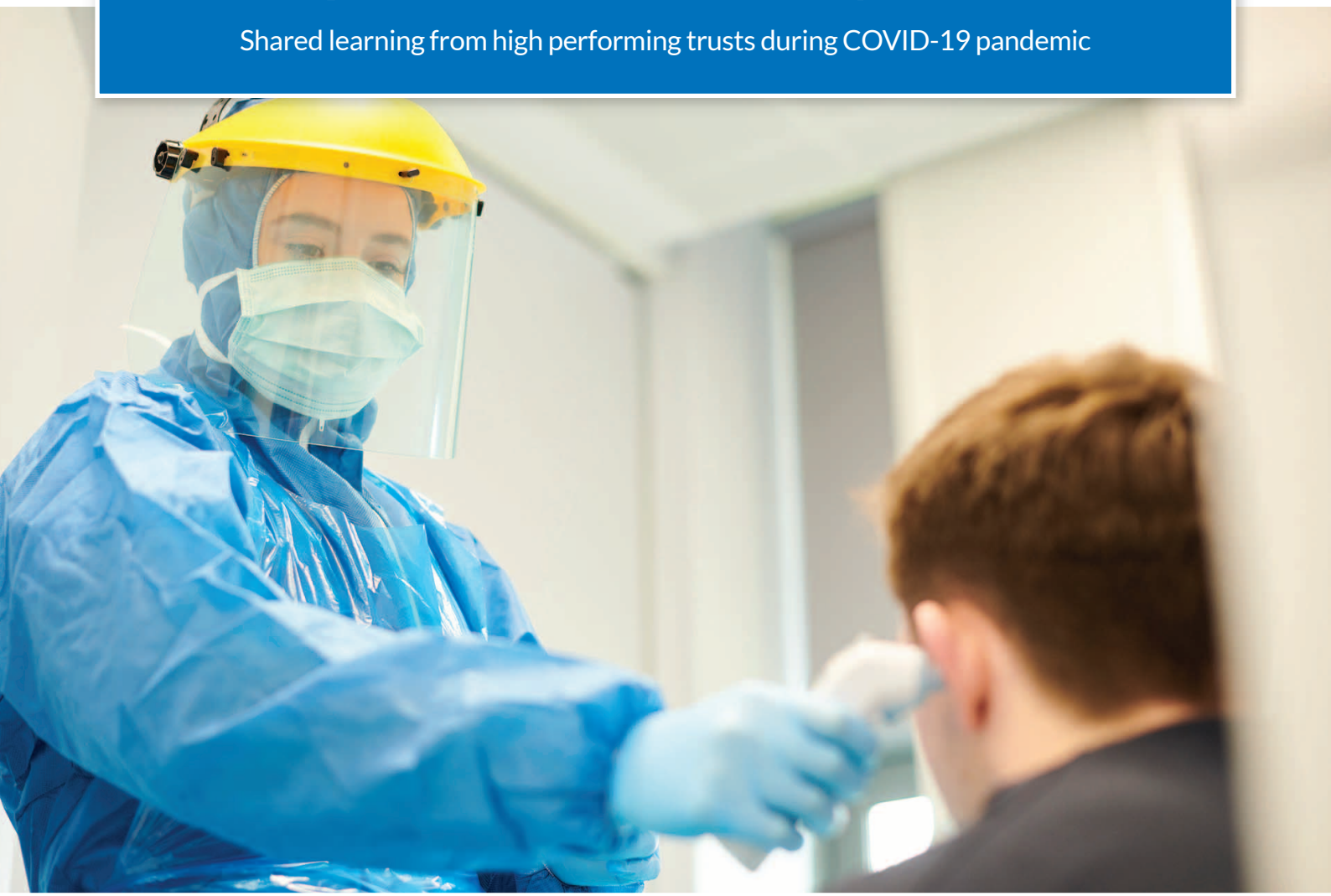
NHS

GIRFT
GETTING IT RIGHT FIRST TIME

December 2020

Clinical practice guide for improving the management of adult COVID-19 patients in secondary care

Shared learning from high performing trusts during COVID-19 pandemic



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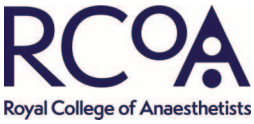
We would like to thank the following NHS trusts for their engagement with this study and their support in assisting us to gather good practice:

- Barts Health NHS Trust
- Bedfordshire Hospitals NHS Foundation Trust
- Guy's and St Thomas' NHS Foundation Trust
- Lancashire Teaching Hospitals NHS Foundation Trust
- London North West University Healthcare NHS Trust
- University Hospitals of Leicester NHS Trust.

The programme of work has been endorsed and co badged by the following:



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Foreword by Professor Tim Briggs CBE, GIRFT Chair

I am pleased to recommend this practice guidance that summarises some of the excellent work carried out by many NHS hospital trusts at a time of national crisis. The COVID-19 pandemic has currently changed the world as we know it and the ways of working across all sectors, and nowhere is this truer than in our health service. Learning has occurred at pace in a way not seen before thanks to the tireless commitment of colleagues to meet the challenge across the country, often at the expense of their own health and wellbeing. Clinical staff across a range of specialties worked collaboratively and demonstrated great resilience in often unfamiliar environments (i.e. redeployed medical and surgical teams) for which they must be commended.

The GIRFT principles of a data-led approach advised by the wealth of experience of our national clinical leads across different medical specialties has been used to address unwarranted variation, where it may exist and improve care based on best practice. During the first COVID-19 wave the data has highlighted that NHS trusts learnt quickly on how to improve outcomes for their patients, in what were uniquely challenging circumstances. Trusts have done exceptionally well, changed practice when the evidence became available, resulting in a reducing mortality rate even when admissions remained high. All the evidence we have collected about trusts and patient outcomes during COVID-19 demonstrates only limited variation despite the pressures on the system. This demonstrates that the NHS has risen to the challenge and delivered for the population it serves.

Following our initial review of the data we identified several trusts which performed particularly well during the pandemic. We have targeted a number of these with in-depth virtual visits and collated valuable learning from them, to identify key strategies that have led to a successful approach. Learning from best practice from such units is crucial if the NHS is to maintain essential services both acute and elective during a second wave and subsequent outbreaks. The enthusiasm of these trusts to share their learning and best practice with our GIRFT team at virtual deep dive visits has resulted in this document.

This is important because the first wave of the pandemic saw a large fall in the number of acute medical patients presenting as an emergency. Since the end of the lockdown, acute and emergency medical activity has retuned back to the pre-lockdown numbers whilst outpatient and elective surgery has struggled to return to business as usual. The NHS has committed to maintaining outpatient activity and elective services during a second surge. It will be challenging to realise both these objectives if COVID-19 patient surges occur, in a similar way to the first wave.

As we approach winter, and the further demands this will also bring to NHS trusts, it is important that whenever possible we share best practice to help meet these unique challenges. I am delighted that the specialty societies have given their support for this report which not only provides reassurance of the excellent performance of many hospital trusts during the initial COVID-19 pandemic but also highlights key actions to support the future success of trusts and colleagues as we continue to improve patient care and outcomes in the coming months.

Professor Tim Briggs *CBE*

Professor Briggs is Consultant Orthopaedic Surgeon at the Royal National Orthopaedic Hospital NHS Trust. He led the first review of orthopaedic surgery that became the pilot for the GIRFT programme, which he now Chairs. Professor Briggs is also National Director of Clinical Improvement for the NHS.

Introduction by Annakan Navaratnam GIRFT Clinical Fellow

Our analysis of COVID-19 patient outcomes is based on information from national datasets and the rich knowledge obtained from virtual deep dive visits to some of the high performing NHS trusts in England. This document encapsulates the findings from the GIRFT cross-specialty COVID-19 deep dives undertaken in September/October 2020. The aim is to provide guidance in the secondary care management of COVID-19 adult patients based on the experience of hospital trusts that performed well during the early phase of the COVID-19 pandemic.

In order to share this learning with clinicians and managers, this document summarises the challenges and responses utilised during the COVID-19 pandemic thus far as well as identifying successful innovations employed by trusts. It is by no means an exhaustive catalogue of all successful interventions in COVID-19 patient treatment but we hope the insight provided by the range of trusts, both in size and geographical location, who experienced high activity in the early phase of the pandemic provides a valuable resource to clinicians as further outbreaks of COVID-19 cases emerge.

The document is divided by specialty and cross-cutting themes. GIRFT clinical leads and fellows have authored their own specialty section based on the learning from trust departments. There will be some repetition of themes across the sections e.g. CPAP management, but this will provide insight into these topics from a specialty viewpoint e.g. acute medicine, respiratory and critical care, and reinforce key messages. We hope this guidance will be of benefit to all secondary care clinical and management staff, but specialist clinicians will be particularly interested in the experiences of their peers. Furthermore, we have included case studies throughout the document which will be of value to reference and potentially adopt locally.

Mr Annakan Navaratnam *MBBS BSc (Hons) FRCS (ORL-HNS)*

Mr Navaratnam is GIRFT Clinical Fellow and Otolaryngology – Head and Neck Speciality Registrar

Executive summary

Purpose

- This document summarises the challenges faced and responses utilised by the high performing trusts we visited as part of the GIRFT cross-specialty COVID-19 deep dives, as well as identifying successful innovations they implemented.
- It is not intended to be a comprehensive summary of COVID-19 related management, which can be found in other specialty-based guidance, but rather it presents key learning points from the cross-specialty trust deep dives undertaken in September/October 2020.
- It aims to provide guidance to hospital clinical staff and managers in the secondary care management of COVID-19 patients based on the experience of hospital trusts that performed well during the early phase of the COVID-19 pandemic.
- We hope that trusts will be able to identify aspects of the shared learning we describe which they may be able to utilise and adopt locally.

Background

- The COVID-19 pandemic is a complex challenge that has stretched health services globally.
- Understanding the factors that influenced hospital outcomes for COVID-19 patients during the first wave of the pandemic is crucial to inform clinicians whilst also recognising that there will be significant differences in future practice such as the continuation of elective services.
- The GIRFT programme has sought to understand the national landscape through analysis of national hospital datasets and by engaging NHS trusts with excellent outcomes for COVID-19 patients through cross-specialty deep dives.

Analysis of national hospital data

- Analysis was undertaken to investigate factors influencing in-hospital COVID-19 related mortality rates using hospital episode statistics data covering discharges from 1 March to 31 May and extended to 31 July 2020 where data were available.
- Statistical analysis adjusting for patient risk factors including age, sex, ethnicity, deprivation, and co-morbidities was performed and variation over time and between trusts was investigated.
- COVID-19 patient in-hospital mortality rates improved over time from late March to May and this improvement was more substantial after statistical adjustment for patient risk factors.
- Patient risk factors for increased odds of in-hospital mortality included older age, male sex, living in a more deprived area, more severe frailty, Asian ethnicity and all comorbidities on the Charlson co-morbidity index except peptic ulcer disease and mild liver disease.
- Once adjusted for risk factors, there was limited variation in COVID-19 mortality rates between NHS trusts.
- However, there were several trusts that demonstrated excellent outcomes for COVID-19 patients including four trusts with adjusted in-hospital mortality probabilities of greater than two standard deviations below the mean for the analysed time period. These were some of the trusts that we engaged with for the cross-specialty deep dives.

Clinical specialty guidance following trust deep dives

Infection prevention and control

- A coordinated hospital-wide approach should be taken to infection prevention and control with close collaboration with local authority public health departments and Public Health England.
- Effective communications strategies should be developed, and routine audits undertaken, to ensure compliance with personal protective equipment, hand hygiene, social distancing, and environmental cleanliness in both clinical and non-clinical areas.

Emergency medicine

- Adequate emergency department staffing, facilities, and estate together with well-planned systems ensures preparedness for any unexpected extra need for urgent and emergency care.
- Integration with and support from in-hospital clinical teams and operational managers is essential to cope with extra numbers of patients with special requirements and a rapidly evolving local and national situation.
- Preplanned clinical pathways and modified departmental patient flow routes facilitate rapid treatment and safe movement of patients.

Critical care and Anaesthesia

- Local and regional planning for COVID-19 surges needs to consider local patient population characteristics (disease prevalence and demographics) in the context of research that has identified patient and critical care unit factors that affect outcomes.
- Stuff: Equipment stock and supply chains need to be reinforced to ensure adequate provision of respiratory and renal support.
- Space: Physical critical care space and location of additional critical care beds needs to be considered carefully in collaboration with estates teams.
- Staff: Redeployment of staff to critical care should be on a staged escalation basis that aims to preserve and optimise care for all patients (COVID-19, non-COVID-19, emergency and planned) for as long as possible, while ensuring adequate advance training and preparation for likely COVID redeployment at higher levels of escalation. Plans should be mindful of wellbeing and psychological impact on both critical care and redeployed staff.
- Systems: Mutual aid should be undertaken to provide support to hospitals and systems through patient transfers, staff redeployment and appropriate sharing of equipment and resources.

Acute and General medicine

- Reduce and control demand through community services.
- Ensure all facilities are used to manage acute patient presentations depending on need.
- Assess patients in the environment appropriate for their needs first time and avoid unnecessary patient transfers.
- Use evidence-based management where available and incorporate into trusts specific guidance e.g. awake proning, CPAP use and corticosteroids.
- Have clear discharge criteria with specific components (e.g. walk test) with home monitoring (e.g. home oxygen saturation monitoring) and follow up arrangements (telephone or face to face).

Respiratory medicine

- A significant proportion of patients attending hospital with COVID-19 will require oxygen therapy and/or ventilatory support.
- Local guidelines should be in place for: managing patients with COVID-19 requiring oxygen therapy (taking note of oxygen flows to wards and potential oxygen demand); respiratory support units for the initiation and maintenance/management of ventilatory support either outside or within critical care, use of dexamethasone and remdesivir, documentation of ceilings of care / escalation protocols and the follow up of patients post COVID-19.
- Follow up of patients post COVID-19 with a structured process should be implemented involving chest imaging and assessment of physiological and psychological issues, specifically considering fatigue and breathlessness (with or without desaturation). This process should be based upon the British Thoracic Society guidelines.
- Appropriate and adequate stocks of equipment and consumables need to be available to cope with any potential surge in activity.
- Multidisciplinary respiratory response teams can be useful for identifying patients at risk of deterioration, managing resources, cohorting of patients and initiating treatment.
- It is likely respiratory rotas need to be redesigned to allow for increased respiratory team support. Consideration should be given to the sustainability of any rota redesign and if respiratory physicians should come off the acute medical take where resources allow.

Geriatric medicine and Community care

- Effective initial assessment of frailty linked to advance care planning is required around appropriateness of invasive treatment and use of critical care.
- Effective recognition strategies of atypical COVID-19 presentations in frail older adults with a clear pathway for delirium care should be implemented with effective management of nosocomial infection risk in these patients.
- Outreach support to care homes and community teams and hospital specialists linked to community services including ambulance service must be established.
- High quality end of life management should incorporate support for patients (who may be distressed and have sensory impairments) and their carers.

Diabetes

- National clinical guidelines should be rapidly adopted and disseminated, to optimise glycaemic control in COVID-19 patients both with and without diabetes.
- A seven-day inpatient service should be maintained and where this does not exist, it should be rapidly developed, with diabetes specialist nurses playing a vital role.
- Inpatients with diabetes should be proactively identified and reviewed, using technology for virtual reviews where appropriate.
- Maintaining outpatient services, especially foot and pregnancy services, is vital in preventing admissions, facilitating early supported discharge, and providing ongoing chronic disease management.

Cross cutting themes

Trust leadership and management

- Staff welfare and support is essential. Active monitoring should be undertaken to ensure those at risk do not burn out.
- Clinical and managerial leaders need to be work "shoulder to shoulder", with continuous input from frontline multidisciplinary clinical staff who can provide real time updates in a rapidly changing situation.
- Trusts with a relatively flat control and command system communicate better with clinical specialty teams than those with a complicated, hierarchical structure.
- Strategies that have flexibility and are easily adaptable have more utility than rigid systems.
- Regular communication with all staff groups from a single source is essential to provide reassurance.
- Electronic trust data systems that hold hospital and local area information have been proven useful for patient location tracking, monitoring nosocomial infection rates and predicting future demands on the system.

Research

- All patients admitted to hospital should be considered for ongoing COVID-19 research trials.
- Recruitment strategies could include a one-stop approach to recruit patients (rather than several people attempting to recruit to different studies at different times).
- Trusts without established research connections can link with clinical research networks and local universities for support to facilitate research activities.

Clinical coding

- Accurate clinical coding is crucial to understand hospital activity especially when hospitals are under strain during COVID-19 patient surges.
- Senior clinicians should collaborate with clinical coding teams to establish processes to validate coded clinical data.
- Clinical coding teams should routinely investigate specific areas at high risk of poor code accuracy and collaborate with clinicians to validate the clinical coding.
- Clinical codes should be cross-checked with alternative clinical data sources to improve the accuracy and completeness of clinical coding.

Background

The COVID-19 pandemic has strained hospital systems internationally due to the rapid and prolonged nature of increased patient flow to acute secondary care providers. In England, the rate of COVID-19 infections in the population has been variable both temporally and spatially with London, the Midlands and the North-West regions experiencing a higher overall burden earlier in the pandemic.(1,2) This will have resulted in an asymmetric impact on NHS hospitals in England.(3)

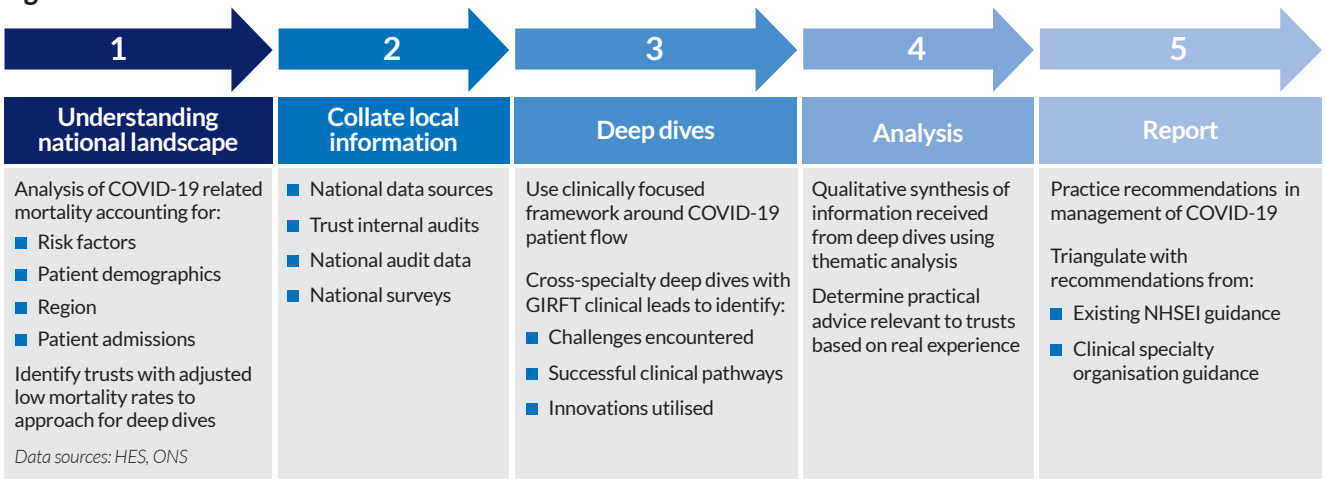
The diverse experiences of NHS trusts during the pandemic will have resulted in different outcomes for patients in absolute numbers. Multiple other patient factors (e.g. age, sex, comorbidities) and hospital factors (location, population density) will have influenced overall outcomes. Furthermore, the different and complex methods used for reporting patient death can make it difficult to determine accurate mortality rates.(4)

There have been several studies in the academic literature that have reported the factors that influence COVID-19 patient outcomes in England (5,6) but little analysis of variation in outcomes between NHS trusts. Such analysis would help identify hospitals that may potentially demonstrate excellence in clinical practice and obtaining further information regarding this will help spread learning for management of this complex presentation. The Getting it Right First Time Programme (GIRFT) uses hospital data to better understand variation in clinical practice and identify high-quality patient care. We sought to analyse the available data to better understand hospital practice and outcomes during the first surge in cases during the COVID-19 pandemic.

The findings from our analysis were used to identify NHS hospital trusts in England that may be able to provide information regarding good practice in hospital management of COVID-19 patients. Following the identification of these trusts, a pilot project was undertaken to engage with six trusts covering a range of service delivery models across England. Virtual deep dive meetings were cross-specialty and multidisciplinary and aimed to draw out valuable learning. Using the knowledge gained from engaging with trusts we have been able to produce this guidance to inform future practice in the COVID-19 era to benefit both staff and patients.

Project overview

Figure 1



This project followed a five-stage process detailed in figure 1. Analysis of COVID-19 mortality rates was undertaken to understand the national landscape and identify high performing trusts with low mortality rates or evidence of substantially improved performance over time. Using this information further bespoke data packs were created for these six trusts and these formed the basis of cross-specialty, multidiscipline virtual deep dives where information regarding the trust experience of the pandemic, responses used, and innovations developed were captured. This knowledge was then further analysed and triangulated with existing evidence to produce this practice guidance.

Analysis of national hospital data

Methodology

Analysis was undertaken for all COVID-19 patient hospital discharges in England between 1 March 2020 to 31 May 2020, using Hospital Episode Statistics (HES) data linked to Office for National Statistics (ONS) COVID-19 death information. COVID-19 cases were identified by ICD-10 codes (U071, U072). Laboratory confirmed COVID-19 were coded as U071 and those diagnosed clinically with COVID-19: U072. U072 is assigned to a clinical or epidemiological diagnosis of COVID-19 where laboratory confirmation is inconclusive or not available. Adjusted mortality rate analysis was undertaken using a multilevel logistic regression model considering covariates including patient demographics, comorbidities, and timing of discharge. For some analyses the variables age, deprivation score and date of discharge were treated as continuous and modelled using restricted cubic splines where indicated. Details of the analysis methodology and results can be found in the appendices.

Improvement in patient in-hospital outcomes over time

The rate of decline in crude (unadjusted for case-mix) NHS trust in-hospital mortality rates was rapid: a 16% reduction between late March and May (Figure 2). Adjusted analysis that accounted for the changing patient demographics of COVID-19 hospital admissions over time show that the change in probability of in-hospital death was more significant, with a 33% decrease between the first seven days of March to the last seven days of May. The improvement in mortality rate was greatest in the older age bands (see appendix 1, supplementary figures 1,2) In extended analysis, covering the five months from March to July, the adjusted estimated probability of in-hospital mortality continued to drop during June and July, see Figure 3. There was a sharper decline in mortality rates in mid- to late-April.

This may indicate that as understanding of the COVID-19 disease progressed and innovations in practice were identified and utilised, such as use of CPAP (7), patient outcomes improved. The learning that trusts acquired during this difficult initial stage of the pandemic in England resulted in rapid changes in practice that benefitted patients and should be commended. Length of stay increased over time for both patients discharged alive and those that died demonstrating a change in clinical practice. (see appendix 1, supplementary figure 3).

Analysis was repeated using date of admission instead of date of discharge (excluding patients admitted in July but not discharged before the end of July). The same trend in reduction in COVID-19 related in-hospital mortality over time was observed (see appendix 1, supplementary figure 4). This along with the data regarding length of stay described earlier confirms that this reduction in mortality rate over time was not simply due to difference in the length of stay between survivors and non-survivors.

Figure 2: COVID-19 discharges and mortality (%) rate per week

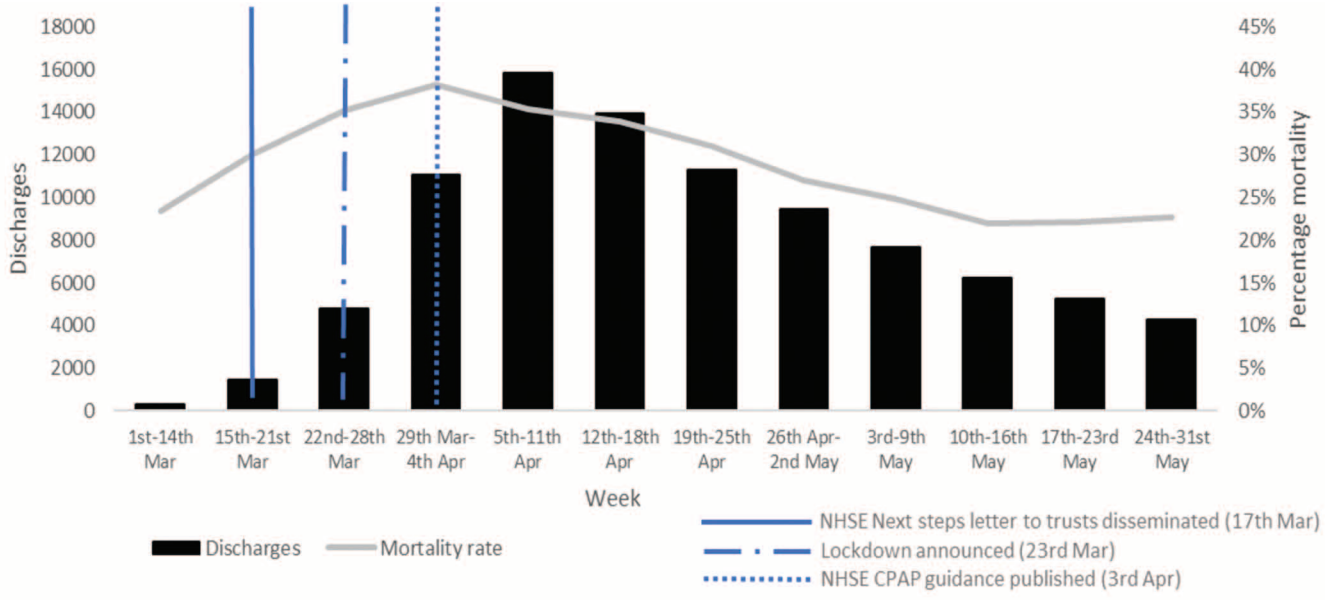
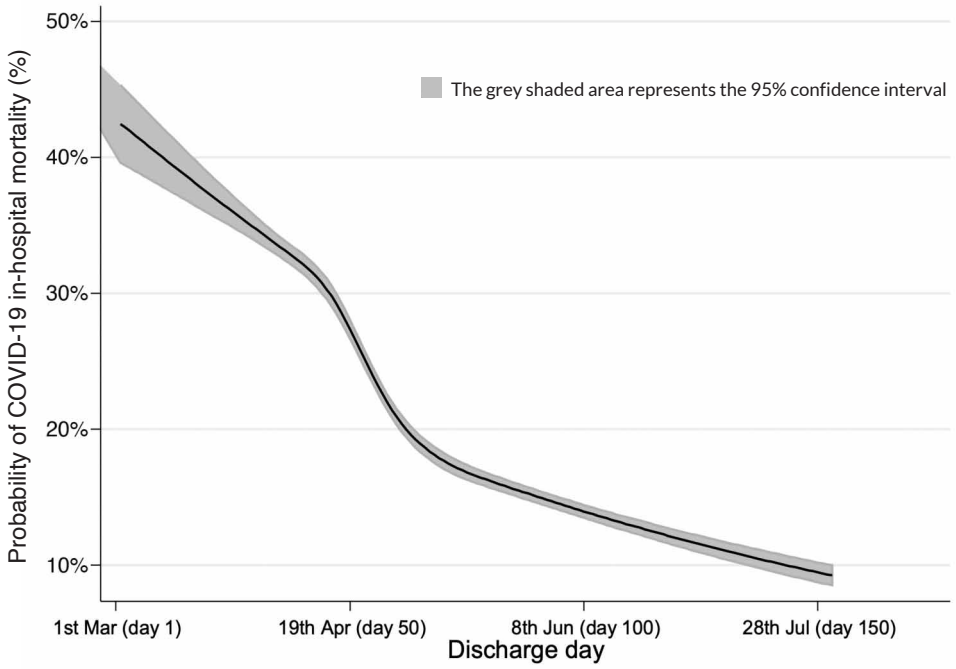


Figure 3: Estimated probability of COVID-19 related in-hospital mortality March -July 2020.



Predictors of mortality

Analysis using multilevel logistic regression models demonstrated that there was a significant and consistent trend toward greater odds of death with increasing age and this was the strongest association identified from the variables studied. Male sex, greater deprivation and Asian/Asian British and mixed ethnicity were also associated with significantly greater odds of death. Frailty and all co-morbidities investigated, except mild liver disease and peptic ulcer, were significant predictors of mortality (Figure 4). In analysis where age was modelled as a continuous variable, age had a shallow sigmoid relationship with in-hospital mortality (Figure 5).

In summary, older age, male sex, Asian and mixed ethnicity, and deprivation all increased the odds of in hospital death in patients with COVID-19 infection. The following co-morbidities were also associated with higher odds of mortality from COVID-19: peripheral vascular disease, congestive heart failure, acute myocardial infarction, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disease/rheumatic disease, moderate or severe liver disease, diabetes, paraplegia/hemiplegia, renal disease and cancer.

Figure 4: Plot of odds ratios for covariates that influenced COVID-19 mortality

(Odd ratio scale on x axis, point represents odds ratio and bars represent 95% confidence interval)

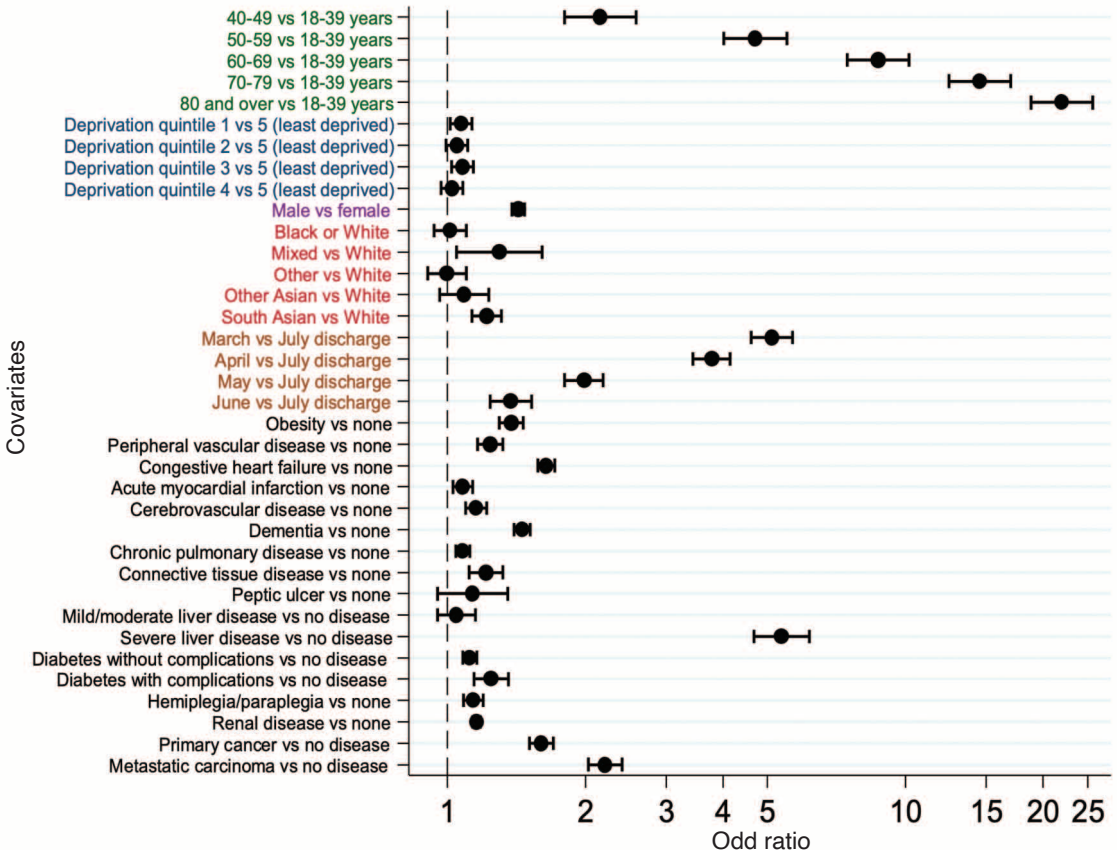
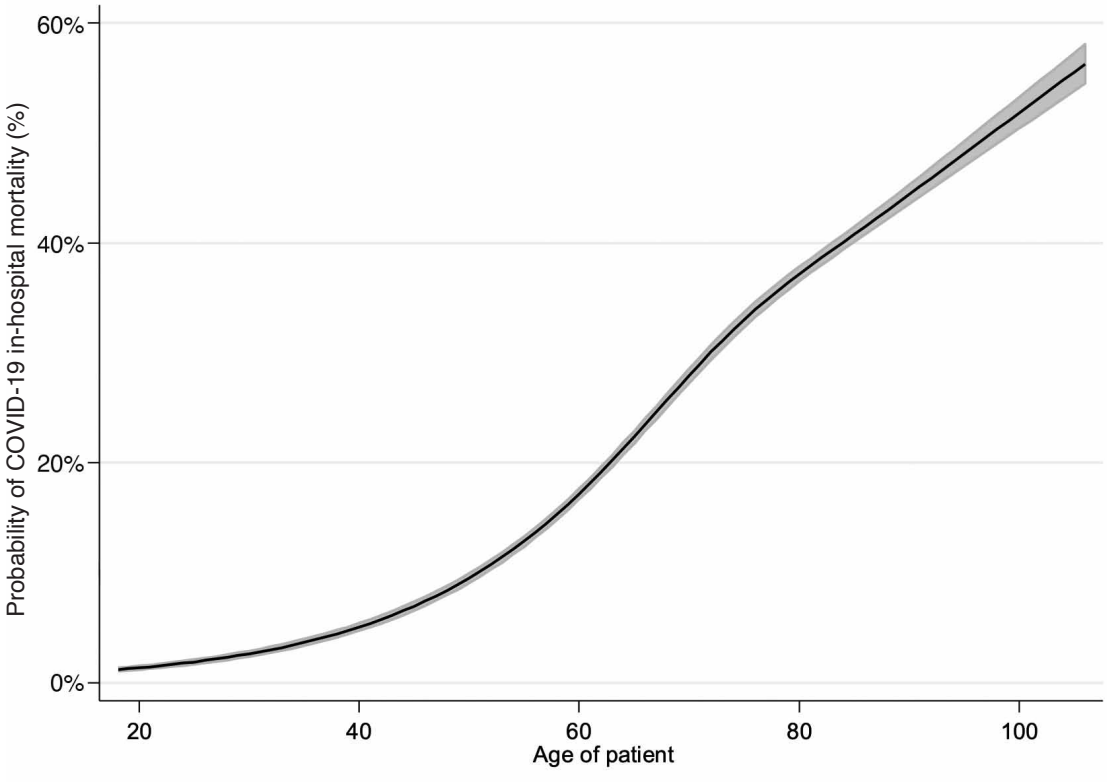


Figure 5: Adjusted estimated probability of COVID-19 in-hospital mortality by age



Limited variation in mortality rates between trusts

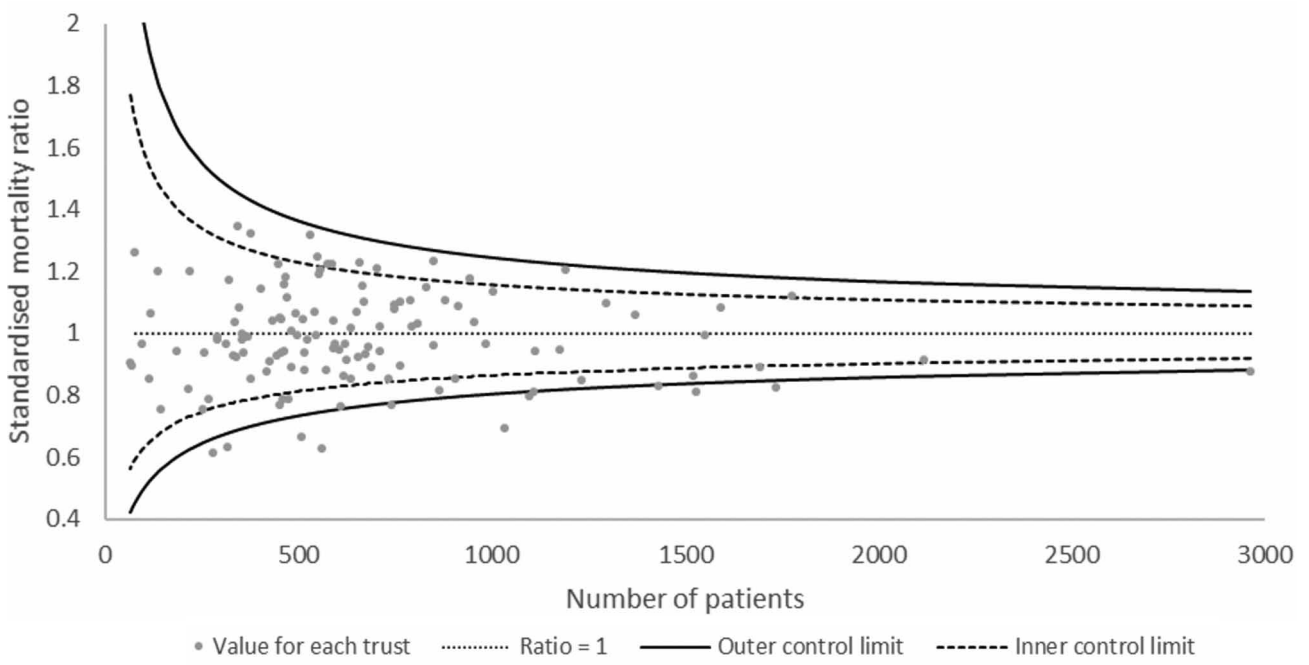
Analysis of trust variation in mortality rates was based on U071 codes only. Based on the intra-class correlation coefficient (3.1%), there was very little clustering of deaths within trusts, suggesting that the trust a patient was admitted to had little bearing on their mortality risk relative to other factors, most notably age.

Once known predictors that influence patient outcomes were considered the mortality rates in the majority of NHS trusts in England fit within a normal distribution. Although there would have been variation in the approaches utilised by trusts during the pandemic, there does not seem to be explicit unwarranted variation in in-hospital deaths.

This analysis was based on U071 codes (patients with test confirmed COVID-19) for patient activity and death information, and therefore mortality rates differ to those presented with our earlier analysis which included patients with both U071 and U072 codes. The values of each trust were normally distributed (mean 27.3%, standard deviation 4.544), with three (2.4%) values greater than two standard deviations above the mean and four (3.2%) values greater than two standard deviations below the mean. No values were beyond three standard deviations from the mean.

Figure 6. Funnel plot of variation in standardised mortality ratio for COVID-19 by NHS hospital trust.

Outer control limit represents 3 standard errors. Inner control limit represents 2 standard errors.



Standardised mortality ratios (SMRs) were also calculated from the dataset based on the ratio of the predicted (by the logistic regression model) and observed mortality rate for each each trust. These data are presented above in Figure 6. None of the SMRs fell above the upper outer control limit (3 standard errors), suggesting no trusts had unduly high SMRs. Seven trusts had SMRs below the lower outer control limit (3 standard errors) suggesting relatively low mortality rates in these trusts.

Strengths and limitations of analysis

HES data provides a complete record of all COVID-19 related hospital activity in England, as such it represents a record of the pandemic experienced by hospitals in England during this time. Furthermore, the three-month and five-month analysis periods allowed us to look at temporal trends.

There are inherent limitations in using HES data due to the reliance on accurate completion of hospital administrative information. Although data are entered by trained coders, they rely on patient notes for information and only if this is recorded accurately will the information be reliable. HES provides only limited clinical information, and no record of how acutely unwell a patient was during their stay. We were unable to adjust for some potentially confounding factors due to missing or poor-quality data (e.g. smoking history and BMI (although obesity was used)).

In capturing all activity for patients diagnosed with COVID-19 we will have picked up some admissions where COVID-19 was not the reason for admission or a factor in a death. For this reason, when comparing the performance of individual trusts, we restricted our analysis to only those patients with test-confirmed COVID-19 and only those deaths where COVID-19 was the primary cause of death. The use of the ICD-10 codes may also have changed over time. However, our analysis of ONS cause of death data, and triangulation of our death data with that reported by COVID -19 Patient Notification System (CPNS) suggests that our data align closely with other available sources and are not a substantial over-estimate (see section 1 of appendices). Our decision to include all recorded COVID-19-related hospitalisations and deaths ensured our datasets are as complete a record of the pandemic as possible.

Our analysis was restricted to in-hospital mortality and therefore does not consider deaths outside the hospital and in the community. Therefore, patients who were discharged and subsequently died in the community (e.g. palliative patients discharged to hospices) would not be identified as deaths in this analysis. Analysis of these data by our team suggest that this was relatively rare, with fewer than 10% of deaths in people hospitalised with COVID-19 occurring within 30 days of hospital discharge.

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GIRFT cross-specialty virtual deep dives

Identification of high performing trusts

Although there was limited variation in trust performance based on our analysis, there were several trusts from across the country that demonstrated low mortality rates and/or greater than expected improvements in mortality rates as the pandemic progressed. This included four trusts with adjusted COVID-19 related mortality rates greater that two standard deviations below the mean. A number of these high performing trusts were selected to conduct deep dives for this pilot. Hospitals from regions of the country that experienced high levels of COVID-19 activity were selected and, within the limited time and scope of the study, an attempt was made to cover a range of hospital types from differing locations.

- Barts Health NHS Trust
- Bedfordshire Hospitals NHS Foundation Trust
- Guy's and St Thomas' NHS Foundation Trust
- Lancashire Teaching Hospitals NHS Foundation Trust
- London North West University Healthcare NHS Trust
- University Hospitals of Leicester NHS Trust

Deep dives

For the selected trusts, bespoke data packs were produced to inform deep dives. Analysis of outcomes, trends over time and case mix of COVID-19 patients in the context of the national landscape were presented.

Owing to the nature of the COVID-19 pandemic, virtual deep dives were undertaken during September/October 2020 using a video conferencing platform. In this cross-specialty multidiscipline format, GIRFT clinical leads and trust medical, nursing and AHP leads participated in discussions regarding secondary care management during the COVID-19 pandemic. The main topics covered were:

- Infection prevention and control
- Emergency medicine
- Critical care and Anaesthesia
- Acute and general medicine
- Respiratory medicine
- Geriatric medicine and Community care
- Diabetes
- Hospital management and leadership
- Research
- Coding

Whilst this was by no means an exhaustive list, discussion on these topics between relevant GIRFT and trust leads provided a valuable insight into trust wide strategies employed throughout the pandemic as well as identifying innovative solutions and successful practices.

Infection prevention and control

Introduction

Microbiology, pathology, infectious disease specialists and infection prevention and control teams have been pivotal in the response to COVID-19. The continuation of elective services as well as the impending influenza season as COVID-19 cases rise, poses a unique challenge to these services. However, the principles of effective testing and cohorting of patients remain of paramount importance to reduce the risk of nosocomial transmission. The following recommendations compiled from the experience of trusts (during COVID-19 deep dive visits) during the first wave of the COVID-19 pandemic should be used in conjunction with the latest IPC guidance from Public Health England(1) and NHS England and NHS Improvement(2) (NHSEI).

Key principles

- A coordinated hospital-wide approach should be taken to infection prevention and control with close collaboration with local authority public health departments and Public Health England.
- Effective communications strategies should be developed, and routine audits undertaken to ensure compliance with PPE, hand hygiene, social distancing, and environmental cleanliness in clinical and non-clinical areas.
- Advice regarding infection prevention and control is being continually updated. The latest NHS England and NHS Improvement guidance can be reviewed here: https://www.england.nhs.uk/coronavirus/publication/key-actions-infection-prevention-and-control-and-testing/

Recommendations

Cohorting of patients and flow management

- Triaging and cohorting should not be based on COVID-19 PCR results alone in patients presenting with a clinical syndrome compatible with COVID-19 due to the possibility of false negative results. COVID-19 negative results that do not match the clinical presentation should be repeated early.
- Cohorting of patients should be undertaken on a ward basis (as opposed to bays) to minimise the risk of cross infection from communal areas.
- *Bedfordshire Hospitals NHS Foundation Trust* used electronic monitoring of patient's COVID status using heat maps of the Bedford hospital site in conjunction with PHE's regional epidemiology team which informed the cohorting process. This allowed each individual patient to be tracked by ward/bed space in terms of COVID-19 status and reduced the risk of nosocomial infection.
- Consideration should be given to escalation procedures in a variety of scenarios including effective isolation and cohorting of patients in response to infectious outbreaks of influenza and norovirus.
- An excellent example of an evidence based diagnostic prediction model has been developed at *Whipps Cross Hospital (Barts Health NHS Trust)* to cohort acute admissions (see case study).
- Should elective surgical patients test positive for COVID-19, a clinical risk assessment should be performed to inform whether their surgery is able to be safely postponed for infection prevention purposes and to safeguard clinical outcomes.

Monitoring of nosocomial transmission

- Daily trust-wide reporting of nosocomial infections should be implemented showing possible and probable nosocomial cases based on number of days from admission to positive COVID-19 result. COVID-19 cases are defined as probable or definite healthcare-associated infections only if a patient is diagnosed from day 8 or day 15 after admission, respectively. In order to ensure cases are correctly attributed, the date that the sample is collected should be used (as opposed to the reporting date) and the testing regime for inpatients as set out by NHSEI should be followed.
- Clear pathways and responsibilities for contact tracing and isolation of contacts should be developed. This information should be correlated with occupational health and human resources information to identify staff members who may be affected, including situations where more than one staff member tests positive for COVID-19 in a clinical area.

Staff

- Staff should continue to ensure they are wearing PPE in accordance with PHE guidelines and local audits should be undertaken to ensure compliance. Appropriate education and training programmes for the donning and doffing of PPE should be available.
- FFP3 fit testing in line with the Health and Safety Executive guidance(3) should be carried out for all staff working in high risk areas including those where aerosol generating procedures are performed.
- Trust communications campaigns must be enacted to ensure the vaccination of staff against influenza to aid their protection, reduce staff absenteeism due to illness and reduce nosocomial transmission.
- Occupational health teams should work in tandem with human resources departments to monitor COVID-19 related sickness and absences on rostering and reporting systems. Clear guidance should be distributed to staff that are required to self-isolate.
- Compliance with social distancing and mask wearing in non-clinical areas should be enforced. The introduction of staggered break times, identification of additional rest facilities, ensuring maximum numbers allowed for social distancing are adhered to and utilisation of virtual technology for meetings may be beneficial to enable social distancing.

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CASE STUDY

Cohorting of acute admissions: Whipps Cross Hospital, Barts Health NHS Trust

Infectious diseases and acute medical team: Dr S Thomas, Dr M Nijjar, Dr D Fink.

During the first peak of the COVID-19 pandemic, Whipps Cross Hospital was placed under significant pressure with the number of COVID-19 admissions. This was made more challenging by the infection prevention and control considerations posed by the estates, primarily managing patients in large open nightingale-style wards and with a very limited number of side rooms.

Recognising infection prevention and control would be an on-going issue the Infectious diseases team aimed to create a scoring system to risk stratify patients according to the likelihood of having COVID -19. This tool is to be used alongside clinical assessment while awaiting swab PCR results in order to cohort patients according to their risk of infection into low, moderate and high risk. Using QI methodology, a retrospective cross-sectional study using electronic records and pathology data was used to create a diagnostic prediction model to aid clinical decision making. TRIPOD (Transparent Reporting of a multivariable prediction model for Individual Prognosis or Diagnosis) was used to develop and validate the model using routinely available data from a cohort of patients with suspected COVID-19 requiring hospital admission.

Importantly the model uses non-specialist tests that should be universally available in any setting which means the model should be generalisable to settings that are awaiting access to point of care testing including low income settings. The final multivariable model demonstrated adequate calibration and discrimination with AUC 0.8535 (95% confidence interval (0.8121 – 0.8950)). The risk score generated has a high negative predictive value (96.5%) which may have a range of roles in clinical practice but is intended to support COVID-19 infection control to ensure patient safety and conservation of isolation facilities.

The diagnostic prediction model *(www.whicidscore.com)* is intended for use by acute hospital staff to support clinical diagnosis of individuals with COVID-19 to guide infection control decisions within the first 24 hours of admission in the absence of laboratory testing results for SARSCoV-2, and is being used to good effect to safely cohort patients currently here at Whipps Cross Hospital.

This process of risk stratifying patients has been internally validated on the patient cohort seen in this catchment area and is being used currently to good effect in keeping patients safe whilst still improving the flow of patients into the hospital.

Emergency medicine

Introduction

Emergency departments were at the front line of the COVID-19 pandemic in the spring of 2020. The GIRFT visits in emergency medicine during the previous two years had already predicted that many EDs needed to do more in order to be prepared to receive patients with highly infectious diseases. Unwarranted variation in staffing, systems, facilities, estate and hospital support was exacerbated by the pressures caused by the new disease. In general, the EDs that were already best equipped for their 'routine work' were those that were most able to make the necessary adaptations to manage both case-mix and demand pressures during the coronavirus pandemic. (1)

Key principles

1. Adequate ED staffing, facilities, and estate together with well-planned systems ensures preparedness for any unexpected extra need for urgent and emergency care.
2. Integration with and support from in-hospital clinical teams and operational managers is essential to cope with extra numbers of patients with special requirements and a rapidly evolving local and national situation.
3. Pre-planned clinical pathways and modified departmental patient flow routes facilitate rapid treatment and safe movement of patients.

Recommendations

Hospital command and control systems: Trusts should have pre-existing, easily understood command and control systems that quickly adapt to changing situations.

- Trusts with a relatively flat control and command system communicated better with the ED than those with a complicated, hierarchical structure, especially if the system was newly implemented.
- The strict segmentation of strategic, tactical, and operational considerations proved to be overly simplistic.

System responsiveness: Agility of executive decision-making and subsequent operational implementation is essential to enable all trusts to respond to a new or rapidly evolving situation quickly, innovatively, and effectively.

- Trusts which were able to respond rapidly to a changing situation were able to correct any deficiencies in their preparedness very quickly. For instance, one hospital fitted a negative pressure airflow system to several ED cubicles over the course of a single weekend.

Demand reduction: Despite the experiences of spring 2020, future for preparedness for highly infectious diseases should not be predicated on anticipated demand reduction.

- Enormous reduction in demand occurred during the COVID-19 period of spring 2020. This helped EDs to cope with the rapidly changing situation.

Capacity: Adequate staffing levels are crucial for well-functioning EDs. Support from other hospital teams is essential, especially in special situations or times of increased pressure.

- Changes in ED rotas and redeployment of other staff to EDs greatly increased clinical capacity during the COVID-19 period. Intensivists and dedicated intubation teams provided vital specialist support.

Flow: Trusts should ensure that there is an adequate bed base for both elective and acute admissions, with an appropriate model, COVID-19 light, that allows continuation of elective cases, thereby providing reassurance and confidence to patients.

- Such a model might need to be developed across a system to be resilient. An operational model based on the 'Ready to Proceed' metric should be introduced.

Flow: Patients for whom ED treatment does not add value should be streamed directly to the relevant specialty.

- Many sites reduced ED congestion by streaming identified cohorts of patients directly to services run by non-ED teams. These included 'musculoskeletal injuries to orthopaedics', 'children to paediatrics', 'mental health patients to psychiatric services' and 'eye problems to ophthalmology'.
- This change substantially improved the timeliness of almost all emergency assessment and treatments. In addition, reduction in elective activity led to unprecedented availability of acute hospital beds, with occupancy levels below 70% in many sites. In consequence, there were very few delays to admission from the ED.

Clinical pathways: All trusts should take note of national guidance and ensure that it is reflected in their local guidance and practice.

- ED specific clinical pathways were published by NHSE in March 2020 and included guidance agreed with the British Society of Thoracic Imaging. These provided practical guidance on assessment of disease severity.
- Sites that adopted these guidelines were able to provide clear and consistent advice to their clinical teams. Recognition of both silent hypoxia and the value of exercise provocation testing to assess the risk of deterioration were essential in reducing avoidable morbidity/mortality during the first wave of the pandemic.

Therapeutic changes specific to COVID-19: In extreme situations, national bodies should be able to issue pragmatic guidelines based on consensus as soon as evidence is available.

National guidance would support the timely adoption of:

- Administration of oxygen (desirable saturation levels and methods of administration)
- Avoidance of NIV in the ED
- Awake proning of patients before consideration of IPPV
- Recognition of renal failure (c.f. ARDS and therefore change in IV fluid regimens)
- Use of LWMH in patients with high D-dimer / CRP results
- Commencement of dexamethasone in patients with an oxygen requirement

ED estate: In ED redesign, consideration to be given to having the majority of 'majors' cubicles enclosed with doors (and not just curtains). Each cubicle should have a sink for hand washing. Some of the cubicles should have anterooms for source isolation together with a negative pressure airflow system.

- ED departments which had an estate which was built or modified with consideration to infection control were able to isolate infected patients and minimise transmission risk to both other patients and staff.

IT systems: All EDs should have IT systems which enhance clinical care without impeding productivity.

- The EDs which had well-designed, properly integrated, and staff-friendly computer systems were able to collect information and respond to it quickly and effectively.
- The use of specific ECDS codes for COVID-19 (which were introduced in March 2020) enabled syndromic surveillance of the pandemic at some sites.

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CASE STUDY

Barts Health NHS Trust

During the COVID-19 pandemic, Barts Health NHS Trust made significant structural changes to their emergency departments to optimise patient care. At one site, the resuscitation bay was converted into seven negative pressure rooms over a single weekend. Initially this resuscitation bay consisted of just two negative pressure rooms, with the five remaining cubicles separated by half walls that did not extend to the ceiling and had curtains at their entrance. To convert them into negative pressure rooms, the spaces above the walls were sealed with Perspex, and both doors and Perspex view panels were installed at the foot of each of the bays. Extraction pipes were inserted below the ceiling and hung in parallel to the existing system. The new negative pressure rooms could not be connected to the existing extraction system due to infection control risks, so a parallel system was set up. A final door was inserted to separate six of these negative pressure rooms from the outside corridor, to form a sealed "AGP Resus". One of the negative pressure rooms remained outside this door, and was used for more vulnerable or paediatric patients who were likely to require aerosol-generating procedures.

For the duration of the weekend when the structural changes were being carried out, the paediatric ED department was converted into a temporary resuscitation bay and paediatric patients were admitted directly to the children's ward. Longer-term, the observation ward was converted into a "Cold Majors" and "Cold Resus", with separate staffing. These separate streams of admission for patients who were either likely or unlikely to have COVID-19 minimised the risk of nosocomial infection.

Other changes made throughout the trust included increases in staffing including through redeployment and rota changes, to provide a 7-day service and increase consultant and nursing presence, as well as direct admissions to specialties including medical wards, paediatrics, orthopaedics, obstetrics and gynaecology, and mental health. Respiratory admission decision-making was supported by trust-wide criteria. All those with an abnormal chest X-ray were admitted, while those with normal chest X-rays and borderline observations were discharged home with home oxygen saturation monitoring and daily follow-up. The Physician Response Unit was used to provide home visits for shielding or vulnerable patients, and all COVID-19 swabs were followed up by a consultant.

There was clear communication and coordination between the different sites, and a WhatsApp group with all the trust emergency departments was set up. During the peak of the pandemic, the London Ambulance Service diverted all acute patients to the largest central site, as the pause in elective work meant that hospital bed capacity was no longer an issue. The diversion was also made possible because of the lockdown-related reduction in traffic, so ambulances could rapidly travel between the sites.

Critical care and Anaesthesia

Introduction

Critical care units have been at the forefront of the secondary care response to the COVID-19 pandemic; in many places the number of patients requiring critical care (CC) rapidly exceeded the established bed numbers. The CC GIRFT workstream had already identified a significant unmet need for CC services, inequitable access to CC and many units had inadequate resources of beds and staff to meet normal demands resulting in cancelled elective surgery and non-clinical patient transfers. The pandemic response required rapid expansion of critical care beds, flexibility from doctors, nurses and AHPs normally working in other specialist areas to move to support CC and the rapid institution of inter-hospital transfer services. This response enabled CC to meet the demand placed upon it by COVID-19 but at the expense of stopping much elective work. In general, units that were adequately resourced for normal service they were able to adapt and expand to cope with the pandemic demands.

The Intensive Care Society, Faculty of Intensive Care Medicine, Association of Anaesthetists, Royal College of Anaesthetists and British Association of Critical Care Nurses have provided guidance throughout the first wave with rapid updates for both anaesthesia and critical care. This guidance and further updates can be found at *https://icmanaesthesiacovid-19.org/*. Further training material can also be found at *https://www.esicm.org/*.

However, in addition, valuable lessons have been learnt from the multi-specialty deep dives with selected trusts, as well as other sources. This section does not aim to be an all-inclusive guide to treatment which can be found elsewhere (see above) but focuses on sharing successes and problems to assist CC units in being more able to cope during future COVID-19 outbreaks.

Key principles

- Local and regional planning for COVID-19 surges needs to consider local patient population characteristics (disease prevalence and demographics) in the context of research that has identified patient and critical care unit factors that affect outcomes.
- **Stuff:** Equipment stock and supply chains need to be reinforced to ensure adequate provision of respiratory and renal support.
- **Space:** Physical critical care space and location of additional critical care beds needs to be considered carefully in collaboration with estates teams.
- **Staff:** Redeployment of staff to critical care should be on a staged escalation basis that aims to preserve and optimise care for all patients (COVID-19, non-COVID-19, emergency and planned) for as long as possible, while ensuring adequate advance training and preparation for likely COVID redeployment at higher levels of escalation. Plans should be mindful of wellbeing and psychological impact on both critical care and redeployed staff, and take long-term training needs into account as far as possible.
- **Systems:** Mutual aid should be undertaken to provide support to hospitals and systems through patient transfers, staff redeployment and appropriate sharing of equipment and resources.

Critical care surge planning

- One in five of hospitalised adult COVID-19 positive patients may require ICU and because of the high infectivity of this virus coupled with the scale of the population at risk, surges of patients presenting at hospitals over a short period of time can potentially overwhelm CC departments.
- Local disease prevalence and demographics information from local public health teams should enable better planning.
- On univariable analysis older, males from non-white ethnic groups, obese and from more deprived groups were disproportionated affected in the first wave. (1) Mathematical modelling of the local patient population taking this into account may support surge capacity prediction and planning.
- There is some evidence to support that critical care units in hospitals with more than 1 unit (potentially indicating ability to flex and expand) may demonstrate association with better outcomes for COVID-19 patients. (1) This should be considered in regional planning.
- On univariable analysis, better outcomes for all invasively ventilated patients, both COVID-19 and non-COVID-19, appeared to be consistent across the units with lower mortality. (1) There was some evidence to support that units with greater prior experience in invasive ventilation during 2019 (i.e. had greater volumes (number) of critically ill patients receiving invasive ventilation during 2019) were associated with better outcomes for COVID-19 patients.

Equipment

Ventilators

- It became clear that anaesthesia machines are difficult to manage for long term support and their use should be avoided if possible.
- Supplies of new ventilators may be different to those staff are used to working with creating a training requirement.
- Supplies of compatible disposables should be considered on regional and national basis with mutual aid as needed.

Continuous positive pressure ventilation (CPAP)/Non-invasive ventilation (NIV) /High flow nasal oxygen (HFNO)

- Increased use of CPAP and HFNO with or without prone positioning may reduce the need for invasive ventilation, key is timely recognition of failure and escalation to intubation if appropriate.
- Oxygen/medical gas supply needs to be anticipated (particularly HFNO/CPAP/NIV requiring higher oxygen flow rates), both vacuum insulated evaporator capacity and pipework flow need to be considered especially when new areas are identified for expansion of critical care services.

Renal support

- Continuous renal replacement therapy (CRRT) and fluids had significant supply issues in the first wave. Mutual aid from trust renal services and more innovative solutions should be considered if this recurs. It should be recognised that renal support for those patients outside of a CC setting should be undertaken in centres that are capable and experienced in delivering dialysis services.
- *London North West University Healthcare NHS Trust's* critical care unit worked with their renal service to meet CRRT demand through use of mobile dialysis machines, traditionally used in the home setting. (2)
- *Guys and St Thomas' NHS Foundation Trust* utilised resources in house to aseptically produce equivalent fluid used for CRRT when external supplies of dialysis fluid were not available. However, this would only be feasible for relatively small volumes and would need to be undertaken with the support of pharmacy colleagues.

Drugs

- Same agents used for both CC sedation and theatre anaesthesia. It is important to work with pharmacy teams to manage supplies and across disciplines to support continued services e.g. maximizing use of regional and local anaesthesia for both elective and emergency surgery therefore sparing sedatives for CC.
- Consider using the pharmacy teams to prepare infusions of sedatives, vasopressors etc, to support nurses when nurse to patient ratios are stretched or redeployed nurses are working in unfamiliar environments.

Personal protective equipment

- Strategies should be utilised to minimise unnecessary PPE use (such as pre-made infusions by pharmacists, handover from transfer teams away from the patient bed space and following SPACES (Sharing patient assessments cuts exposure to staff) guidance from the British Thoracic Society and Royal College of Physicians. (3)

Space

Physical space and location of additional critical care beds needs to be considered carefully

- Running several small separate areas was seen to compromise safety and continuity of care in at least one hospital.
- Opening and establishing COVID-19 and non-COVID-19 units could stretch staffing in smaller hospitals.
- Consideration in regional planning should be given to potentially keeping some hospitals non-COVID-19.
- Potentially AGP treatments such as CPAP and NIV should be performed in cohorted areas with appropriate infection prevention and control measures.
- Work with engineering and estates to ensure services in expanded critical care areas have adequate supplies of oxygen, water (for increased sinks), water for haemodialysis, electric sockets, WiFi and cabling.

Staff

- Nursing: discussions held with trusts suggest that local actions to maximise nurse to patient ratios for ventilated patients during maximum surge supported effective delivery of care. Further guidance on this subject from NHSEI will be made available.

- CC units should, with their trusts, ensure adequate refresher courses and training for colleagues likely to be deployed, recognising the need to preserve as much elective work as possible.
- Anaesthetists provided support for CC when elective operating stopped during the 1st wave, but advance planning will be needed for graded reduction of elective operating with maintenance of cancer and urgent surgery if possible.
- Designated teams drawing on competencies of the expanded workforce (including redeployed medical and surgical colleagues) can be utilised for specific phases of care e.g. intubation, proning, changing lines, tracheostomy and transfer.
- Pharmacists play a vital role in critical care especially during surges. There should be a dedicated pharmacist to critical care in every unit.
- Palliative care staff should be involved in supporting patients and families at end of life care.

Systems

- Mutual aid by patient transfers, staff sharing, equipment and supplies sharing will be needed. Some units may be less willing to provide this support on a background of pressure to continue normal services. Operational delivery networks should be linking closely with regional operational and clinical teams to optimise patient care, both emergent and elective. Aid can be required at short notice and must be made readily available.
- Clear, close communication between wards and critical care is essential to ensure timely referral and admission to CC.

  At *University Hospitals of Leicester NHS Trust*, respiratory physiotherapists worked with critical care outreach teams to ensure regular and early reviews of patients on the respiratory ward and highlight those who may need critical care support through a seek and search strategy supported by electronic patient records.
- COVID-19 is a multisystem disease necessitating input from respiratory, infectious diseases, microbiology, haematology, renal, cardiology and palliative care as well as CC teams.
- Patients should have clear escalation plans that are established on hospital admission to guide decision making regarding critical care management.
- Longer total critical care length of stay showed some association with better outcomes (1), COVID-19 patients may require longer lengths of intensive care support than comparable pathologies and therefore consider reviewing decisions on treatment withdrawal in light of this.
- Family communication is an aspect of critical care that could not always be maintained adequately early in the COVID-19 pandemic. Considerations should be made for a named visitor particularly at end of life and the use of technology should be utilised to facilitate family communication through smart phones, iPads, lifelines (secure virtual visiting) (4) . Daily family updates can be done by shielding or isolating staff from home if electronic information systems are in place.
- Electronic patient records were found to be extremely helpful by the units that have them, supporting remote handovers, prescribing, family communication by team members away from the bedside.
- ECMO services are available and should be utilised for referral and advice.
  https://www.signpost.healthcare/ecmo-referral-pathway

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Acute and General medicine

Introduction

The recommendations in this section are to guide secondary care trust acute and general medicine departments by identifying successful strategies from the first wave. Some of these themes overlap with recommendations in the respiratory section and it is appreciated that specific aspects of delivery of care e.g. CPAP, will have been delivered by clinicians from different specialty backgrounds dependent on local trust arrangements.

Key principles

- Good communication – between primary and secondary care and within secondary care.
- Use data to plan for demand and monitor activity.
- Reducing and controlling demand through additional community services.
- Preventing unnecessary repetition or duplication.
- Ensuring all facilities are used to manage acute patient presentations depending on need e.g. outpatients, ambulatory care.
- Assessing patients in the environment appropriate for their needs first time and avoid unnecessary patient moves.
- Sharing the acute workload amongst medical specialities to prevent backlogs in other areas.
- Using evidence-based management where available.

Clinical pathways

Joint ED/Medicine clerking documents can used be throughout the admission process to reduce duplication.

- University Hospitals of Leicester NHS Trust utilised this document to streamline patient management and improve clinician productivity.

Clear documentation of frailty and ceiling of care on admission is essential to guide treatment.

- All patients who require admission to hospital should have the following criteria documented (1):
    1. Frailty using the Clinical Frailty Scale
    2. Escalation or Ceiling of care
    3. ReSPECT form (2,3) or DNAR form
- This was especially important during the pandemic and many trusts ensured these were completed on admission.

Clinical management

Oxygen prescribing targets for COVID-19 patients can be modified to oxygen saturations of 92-96%.

- The use of lower targets is supported by evidence from a clinical practice guideline in the BMJ (5), which may allow further reduction in the oxygen saturation targets, however, we initially suggest a target of 92-96%. (6) This should be incorporated into trust level guidance (7).

Consideration of a separate enhanced care area to deliver CPAP situated outside critical care and run by medical specialties (e.g. respiratory or acute medicine) may reduce the demand for invasive ventilation.

- Analysis would be required to calculate the number of beds needed which may be governed by the oxygen flow rate, number of machines, nursing numbers, physician numbers, ability to provide an area for aerosol generating procedures and adequacy of PPE.
- Management of patients in these areas should be undertaken with close support from critical care and clear escalation criteria and pathways must be in place.
- *Northwick Park Hospital (London North West University Healthcare NHS Trust)* has a high dependency unit which is run by a respiratory medical team with dedicated consultant, middle-grade and nursing leadership (pre-pandemic). It was expanded during the COVID-19 surge from six to 24 beds and was found to reduce the pressure on critical care.
- University Hospitals of Leicester NHS Trust expanded to two wards to deliver CPAP which also reduced the burden on their critical care colleagues.

Criteria for the management of respiratory failure in COVID-19 (oxygen, CPAP and invasive ventilation)

- Objective criteria for the management of COVID-19 is important to ensure appropriate use of resources and to reduce variation in care provided. NHS England and NHS Improvement (8)and SIGN (9) have produced guidance on this topic.

Awake prone positioning appears to be safe and may slow the respiratory deterioration in selected patients with COVID-19 who require oxygen supplementation or NIV/CPAP and reduces demand for invasive ventilation (10,11)

- Trusts should develop awake proning protocols to standardise treatment on medical wards.

Corticosteroid use for COVID-19 patients

- This should follow the national and evidence-based guidance. (12)

Cardiac arrest guidance should be disseminated throughout the trust.

- There should be clear guidance on use of PPE and requirement for chest compressions and defibrillation where appropriate.

Trust-specific full management pathway for the care of hospitalised COVID-19 patients from admission to discharge ensures standardisation of care.

- An example of a trust integrated pathway by *Guy's and St Thomas' NHS Foundation Trust* can be found in the case study section

Discharge and follow-up

Objective criteria for discharge from hospital (including emergency department and acute medical unit) should be used.

- Objective criteria for discharge of patients with COVID-19 is important to ensure that unwarranted variation is minimised.
- Departments should review the criteria regularly and adapt it, as necessary.
- Upon discharge, as a minimum, patients should get a follow-up phone call from the healthcare team, be encouraged to hydrate, take paracetamol and return if hypoxia develops (they are sent home with pulse oximetry).

Single assessment forms for patients who require support with activities of daily living (ADLs) on discharge can streamline process.

- Although patients may be fit to be discharged from hospital and their infection risk is diminished, they often require an extensive period of rehabilitation to recover. Multiple assessment forms that are used by different staff groups can complicate this process.
- Bedfordshire Hospitals NHS Foundation Trust therapists have developed a single assessment form designed by their therapist to provide this role to prevent unnecessary duplications and delays.

Post-discharge follow-up of COVID-19 inpatients

An effective follow up system should be in place for patients who are discharged from hospital who are diagnosed with COVID-19.

The system should involve:

- Telephone follow up after 24 hours.
- Provision of an oxygen saturation monitor for selected patients with advice regarding targets that indicate when a patient should contact the hospital and telephone number which is staffed 24/7 for direct contact in the case of acute deterioration.
- Advice leaflet to include advice on lying on the front and sleeping on the front (proning at home), oxygen saturation targets, and information regarding how to seek help.
- Breathing advice and techniques.
- Reinforced infection prevention and control precautions for the patient and family.
- Repeat chest X-ray follow up.
- Physiotherapy and occupational therapist support.

One-stop COVID-19 follow up clinics streamline patient pathways

- Guy's and St Thomas' NHS Foundation Trust has developed a follow up COVID-19 clinic where they provide same day: (i) CT thorax (ii) ECG (iii) 6 Minute walk Test (iv) Echocardiogram

Other general considerations

Same Day Emergency Care (SDEC) or Ambulatory Care

- SDEC ensures appropriate acute patients can be diagnosed, treated and discharged on the same day with ongoing clinical support as needed. This approach improves both clinical outcomes and patient experience, and reduced pressures in the urgent care system for all patients.
- The standard is to provide SDEC 12 hours a day, seven days per week. Trusts should work to develop this standard of care if they do not have it in place.

Referrals to medical specialties from the ED, AMU and the community

- Timely specialist medical review from the point of referral. The relevant medical specialty should indicate if a face-to-face or remote review is required based on the information provided.
- Access to specialist medical advice in the community (e.g. general practitioners and community nurses). It is important that it is well publicised, so it is used. This resource can prevent unnecessary referrals for acute admissions. Service activity should be monitored on an electronic database, so that adaptations can be made demand changes.
- Urgent specialty medicine clinic slots should be made available to support both of these services above (i.e. within one or two days of referral) to prevent unnecessary urgent admission to hospital. The numbers and outcomes should be monitored.

Consultants taking referrals for the acute take will improve patient flow.

- Using an experienced clinician to take referrals, who has significant clinical knowledge but also a deep understanding of the healthcare system and relationships within the trust and community, can enable alternative options other than admission to hospital.
- This is preferable to an untrained junior doctor, who is already overburdened with the acute take (13).
- Centres who have done this well have seen reductions in demand by at least 20% for all admission and 40% for GP referrals.(14)
- To provide this service, it must be adequately resourced with dedicated clinician time free of other duties and with administrative support.

Ambulance diverts when hospitals are under strain reduce demand and prevent unnecessary patient transfers of potentially high risk COVID-19 patients (especially those having aerosol generating procedures i.e. CPAP and manual ventilation)

- Assessment of 'strain' within hospitals need to take into account activity in the emergency department, medical wards and critical care department.
- Discussions between trusts and the ambulance services to develop a pathway which divert patients prior to admission away from strained hospitals should be in place.
- *Barts Health NHS Trust* developed a system with London Ambulance Service (LAS) to divert patients from acute hospitals within their trust such as Whipps Cross or Newham Hospitals to non-acute sites with critical care capacity, for example St Bartholomew Hospital.

A close and effective working relationship with the estates team is important to adapt physical spaces to match clinical need.

- All specialties should have a named contact in the estates department who they can liaise with to resolves issues in a timely fashion. Examples of some of the impressive changes that the estates department have performed from our deep dive reviews include:
- Converting an open clinical area into separate rooms divided by walls and doors.
- Produced enhanced areas/wards to deliver NIV/CPAP.
- Putting doors on ward bays.
- Creating negative pressure rooms.
- Improving the oxygen delivery system to wards to deliver higher flow rates of oxygen.

Training is required for the many changes in care needed for the management of COVID-19 patients.

- This is a prime opportunity to provide interdisciplinary training which is likely to improve the care provided and the working relationship of staff. Key areas for training include:
    1. CPAP
    2. Frailty
    3. Ceiling of care (ReSPECT)
    4. Insulin initiation and titration
    5. Proning wake patients
    6. Oxygen target
    7. Risk stratification of COVID
    8. Cardiac arrest
- It is also clear that learning opportunities can be maintained for all healthcare staff even when redeployment has occurred. These opportunities should be grasped to progress in training.

Workforce organisation

Induction is essential for re-deployed staff that are placed in new clinical environments.

- A database of re-deployed staff and their skills should be maintained.
- All deployed staff should receive a comprehensive induction.
- Centres have used an induction checklist and shadowing of staff.
- Checklist or portfolio for return to work staff and reallocated/redeployed staff.
- Develop competency lists for the various roles and allow for demonstration of competences as acquired.
- Checklists should be provided to the new member rather than the supervisor, so they are able to guide their own development.
- Electronic systems that can be accessed remotely, like the NHS eportfolio system, would be of benefit

Resident consultant acute and general medicine cover should be maintained until at least 22:00.

- It is essential to have sufficient consultant cover to provide senior decision making at peak times of the acute medical take.

Ensure enough junior doctors are available to cover acute workload from 16:00-00:00.

- It is important to have junior doctor availability to match the demand throughout the 24-hour period and ensure sufficient workload for the consultant working the late shifts.
- Centres must review the patient numbers arriving across the 24-hour period.
- Centres should also review the evidence of how long it takes to clerk a patient and how long it takes for a consultant review to assist in calculating the staffing numbers. (15)

Runners on COVID-19 wards reduce the repeated need for 'donning and doffing' of personal protective equipment.

- Having staff to act as runners to get equipment and pass on information allows the staff delivering care to focus on this task. It is important however, that staff do get regular breaks out of PPE during their shift on top of their statutory breaks.

Communication

Providing COVID-19 advice within hospitals for staff.

- A system should be in place to enable staff to access up to date advice on the management of their patients with COVID-19.
- *Bedfordshire Hospitals NHS Foundation Trust* created a COVID-19 hospital helpline to provide advice and support for all staff.

Information technology (IT)

Electronic Prescribing (E-prescribing)

- E-prescribing on COVID-19 wards ensures that documents are not required to be taken between wards and staff do not need to unnecessarily move between COVID-19 and non-COVID-19 clinical areas.

Electronic patient record enables tracking of COVID-19/non-COVID-19 patients

- Tracking of COVID-19 patients is crucial. Many centres have found an electronic patient record which allowed patients to be tracked throughout the hospital invaluable for planning care delivery in hospital. This improved efficiency by enabling teams to respond rapidly to changes in patient flow.

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Respiratory

Introduction

SARS-CoV-2 infection typically causes respiratory symptoms and patients with severe illness are likely to develop respiratory failure (1). Over 40% of patients presenting to hospital will require oxygen therapy (2) with 17% of hospitalised patients needing ventilatory support (3).

Key principles

- Respiratory support units delivering respiratory support (defined here as continuous positive airway pressure therapy (CPAP), non-invasive ventilation (NIV) or high flow nasal oxygen (HFNO)) to patients with COVID-19 can reduce the burden on critical care services. These should be managed by respiratory teams or a collaborative approach with acute medical teams (the Acute & General medicine section also provides information on this).
- Local guidelines should be in place for: managing patients with COVID-19 requiring oxygen therapy (taking note of oxygen flows to wards and potential oxygen demand); respiratory support units for the initiation and maintenance/management of respiratory support either outside or within critical care, proning, use of dexamethasone and Remdesivir, and documentation of ceilings of care / escalation protocols.
- Target oxygen saturations for patients with COVID-19 can be adjusted to 92-96% (see the Acute & General medicine section) (4).
- Multidisciplinary respiratory response teams can be useful for identifying patients at risk of deterioration, managing resources, cohorting of patients and initiating treatment.
- It is likely respiratory rotas need to be redesigned to allow for increased respiratory team support. Consideration should be given to the sustainability of any rota redesign and respiratory physicians should come off the acute take where resources allow.
- Follow up of patients post COVID-19 requires a structured process involving chest imaging and assessment of physiological and psychological issues: specifically considering fatigue and breathlessness (with or without desaturation). This process should be based upon the British Thoracic Society guidelines (5).

RECOMMENDATIONS

Development of respiratory support units

Consideration should be given to providing advanced respiratory support safely outside of critical care.

- This could build upon existing NIV services.
- Most patients with COVID-19 requiring respiratory support (CPAP/NIV/HFNO) will be managed with CPAP where there is appropriate monitoring to identify the deterioration that may require invasive ventilation as part of the predetermined escalation plan. This requires a robust process with clear clinical guidelines and effective communication between ward staff and critical care; examples of clinical escalation guidelines can be found in the NHS England and NHS Improvement (6), and British Thoracic Society (7) guidance documents.
- Ideally respiratory support (CPAP/NIV/HFNO) for patients with COVID-19 should be delivered in negative pressure side rooms, however these areas may be limited. NHS England and NHS Improvement provide guidance on alternative locations of care provision (6). Cohorting patients to respiratory support units can provide a safe space for respiratory physiotherapy AGPs to be conducted.
- *The University Hospitals of Leicester NHS Foundation Trust* ward model involved managing CPAP patients on an expanded medical ward with close support from critical care. This therefore preserved critical care capacity for patients that required intubation and ventilation.
- The acute respiratory response multidisciplinary team at University Hospitals of Leicester NHS Foundation Trust utilised a 'seek and search' model using electronic patient records, led by the physiotherapists to identify COVID-19 patients that would benefit from CPAP and admit them to the CPAP ward.
- Consideration should be given to the oxygen capacity of a respiratory support unit which is likely to require higher oxygen flows.
- Estimations suggest 20 respiratory support beds per 250,000 population may be needed if the unit provides both step-up and step-down beds for critical care.

Clinical pathways

Patients should be cohorted based on the probability of COVID-19 infection.

- Respiratory teams can play an important role in assisting with the triage and management of patients suspected of having COVID-19. At Guy's and St Thomas' Hospitals NHS Foundation Trust the respiratory team were responsible for the 'suspected' COVID-19 ward to aid diagnosis and effective flow of patients to COVID and non-COVID wards.

There should clear local guidelines for the management of patients with COVID-19 including those who develop hypoxia and require respiratory support.

- These guidelines should include patient pathways for those who have an increasing oxygen requirement (see above and references (6) and (7)).
- Management pathways should include close communication between respiratory teams, other medical teams, critical care and emergency medicine.
- *Lancashire Teaching Hospitals NHS Foundation Trust* created a CPAP weaning guideline to optimise oxygen and CPAP machine use.

Develop a local oxygen policy and guideline for the management of patients with hypoxia and COVID-19 in line with national guidance (4).

- Consideration should be given to the areas of the hospital where oxygen flow will be highest, and this may require moving services to where oxygen capacity is greatest.

Develop a pathway for supporting colleagues working in the community.

- *Bedfordshire Hospitals NHS Foundation Trust* created a hotline staffed by a respiratory consultant.
- The BTS have developed guidelines on continuing respiratory services (see below).

Develop clinical pathways that incorporate ceiling of care and utilise the ReSPECT form to guide respiratory management.

Develop virtual wards in conjunction with acute respiratory response teams to allow for the early identification of patients at risk of deterioration.

Post-COVID follow up pathways

Develop follow up pathways in line with British Thoracic Society guidance (5).

- *Barts Health NHS Trust* has created an online survey given to patients after COVID-19 infection which screens their physical and mental health. This is used to identify the appropriate follow up plan for the patient.
- The BTS have created guidance on pulmonary rehabilitation for patients recovering from COVID-19 (8).

Equipment ulitisation

Identify equipment of high demand and initiate procurement processes / hospital regional sharing early.

- If inappropriate or incorrect equipment is provided by central supply chains, early actions, including feedback, and escalation is required to correct and prevent future errors.

Allocate appropriate areas for stock to be kept and assign responsible personnel for collecting and distributing equipment.

- *University Hospitals of Leicester NHS Foundation Trust* created a space for a central respiratory store where equipment was decontaminated, circuits set-up and equipment made ready to use when required.

Resource management

Identify areas where aerosol generating procedures can be carried out safely and patients can be cohorted.

- Some units have created dedicated areas for delivering CPAP (e.g. University Hospitals of Leicester NHS Foundation Trust and London North West University Healthcare NHS Trust).

Using the local oxygen policy ensure there are suitable plans for patient management if oxygen requirements increase.

Oxygen delivery can be limited by central supply through the hospital vacuum insulated evaporator and by the network of pipes that deliver oxygen to specific wards. Prior planning with the hospital estates department is crucial to prevent shortages.

Workforce organisation

Develop multidisciplinary acute respiratory response teams including members with critical care experience.

- At *University Hospitals of Leicester NHS Foundation Trust*, these teams effectively identified patients who had a high probability of deteriorating, those patients who could be recruited into research trials, and helped optimise resource use including oxygen.

Redesign the respiratory rota to allow for an increase in respiratory MDT support and respiratory consultant cover.

- Some sites redesigned the respiratory rotas to include 24/7 respiratory consultant cover and withdrew from the general acute take.
- *Bedfordshire Hospitals NHS Foundation Trust* assigned respiratory consultants to provide support to the emergency department, the medical wards, intensive care unit, and the community via a hotline.
- Consideration should be given to how a rota redesign would be maintained, or for how long it could be sustained.

Where possible nurse staffing levels should be maintained.

- For respiratory support units a minimum of one qualified nurse, competent in managing patients requiring respiratory support (including set-up and mask fitting), to four patients is advised. To allow for adequate staff numbers additional staff may need to be trained.
- Given the high-risk environment of respiratory support units staff should have individual risk assessments and appropriate PPE should be provided with the required training.

Maintaining regular respiratory services.

- To ensure clinical services for respiratory patients continue and waiting times do not increase, as occurred in wave 1, where possible, respiratory nurses, physios, pharmacists and physiologists should not be redeployed to non-respiratory sites.
- Routine and specialised commissioned services should be maintained as afar as possible to prevent patient deterioration and subsequent acute hospitalization, adding to the winter bed pressures.
- Support for services may be provided by senior medical staff who are self-isolating or are cannot be deployed to acute care provision by virtual methods. University Hospitals of North Staffordshire employed such consultants to undertake virtual clinics, validate GP referrals, and support registrars in undertaking consultations around the hospital site.
- The BTS and NICE have produced guidance for the delivery of care for respiratory services including asthma (9,10), COPD (11), ILD (12,13), lung cancer (14), TB (15), long term ventilation(16) and pleural (17).
- The BTS have produced guidance on the provision of bronchoscopy services (18) and restarting pulmonary rehabilitation (19).

Communication

Develop effective and consistent channels of communication within the department and with the wider organisation.

- *Lancashire Teaching Hospitals Trust* held regular multidisciplinary staff meetings to address concerns promptly.

Training and Guidance

Provide training for staff in the management of patients requiring respiratory support, including oxygen and non-invasive ventilatory support.

- All staff should be trained in using the non-invasive ventilators, including masks and circuits, used in their hospital. This should include back-up equipment for use if the usual equipment capacity is reached.
- *University Hospitals of Leicester NHS Foundation Trust* trained over 400 staff to be competent in managing patients being treated with CPAP.

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CASE STUDY

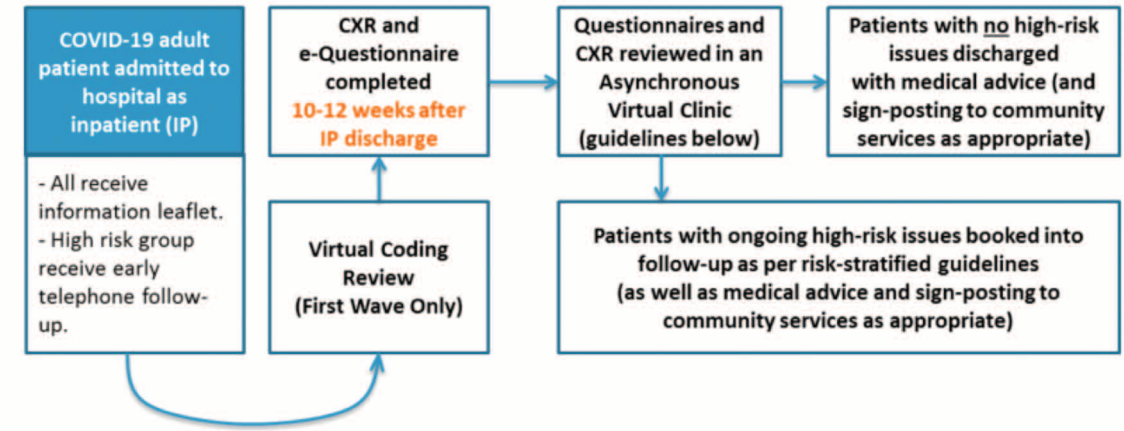
University Hospitals of Leicester NHS Trust

University Hospitals of Leicester NHS Foundation Trust has seen more than 1,500 patients with COVID-19 and more than 200 requiring critical care. In March, Acute Respiratory Response Teams (ARTT) were created to review patients and support the ward and outreach teams. They were formed of 8-10 multidisciplinary members, many with critical care experience, each shift. The ARTT would use a virtual ward to identify patients at risk of deterioration, review patients and escalate their respiratory support if required. In addition, they identified patients who would be suitable for clinical trials. The ARTT helped maximise resources by optimising oxygen use, ensuring patients who required an AGP were in the most appropriate area and overseeing the use of non-invasive ventilatory support.

CASE STUDY

Barts Health After-COVID Clinic

COVID-19 Post-discharge follow-up



Geriatric medicine and Community care

Introduction

Older adults are particularly vulnerable to adverse outcomes following hospitalisation from COVID-19 with a higher risk of death for patients >70.(1,2) Hospital Frailty Risk Score analysis shows that frailty and the severity of frailty significantly increase the risk of death. The hospital mortality rate from COVID-19 reduced markedly during the outbreak and this was largely explained by a large reduction in death rate for patients >70 and in particular those older than 80. The reasons for this are not clear but could include altered case mix linked to more robust out of hospital decision making and support, reduction in nosocomial infection of frail patients and improved in hospital treatment.(3)

Key principles

- Effective initial assessment of frailty linked to advance care planning around appropriateness of invasive treatment and use of critical care.
- Effective recognition / response to atypical presentations in frail older adults with a clear pathway for delirium care and effective management of nosocomial infection risk in these patients.
- Outreach support to care homes and community teams and hospital specialists linked to community services including ambulance service.
- High quality end of life management with support for patients (who may be distressed and have sensory impairments) and carers.

Main recommendations for management of older adults

Initial Assessment:

- Initial assessment of the severity of frailty should be conducted on admission using the Clinical Frailty Scale (Rockwood).(4)
- This assessment should be linked to effective, patient centred advance care planning discussion and agreement on ceilings of care particularly the use of critical care for those patients with poor prognosis either due to frailty or multi-morbidity.
- Hospitals reported that difficult conversations were often easier on admission than during routine care. In many hospitals, older people are admitted through the AMU and discussions of ceiling of care should take place at the point of admission.
- All older people should have a comprehensive geriatric assessment at the time of admission or very soon after admission.
- At Northwick Park Hospital, London, on admission, each patient had a clear treatment escalation plan completed by a consultant, which was introduced and reinforced throughout the pandemic. This was useful as it led to appropriate and individualised care and clear plans for teams from the start of the admission.

Atypical Presentation:

- COVID-19 can present atypically in frail patients. This needs to be recognised in order for potentially infected patients to be appropriately cohorted and proactively retested, including rectal swabs, as the virus can persist in faeces.

Delirium:

- Trusts should implement a clear, widely understood and high reliability delirium pathway (hospital wide) including a plan for cohorting and management of agitated patients.
- British Geriatrics Society have provided guidelines on Delirium in COVID-19 for trusts to utilise.(5)
- Delirium is a common presenting symptom of COVID-19 in frail patients and when causing agitation (hyperactive delirium) can increase the risk of nosocomial spread from patients who are "walking with purpose ". Delirium increases inpatient falls risk. There are risks in the use of drugs for sedation particularly in hypoxic patients or those with arrhythmia. Difficulty with swabbing may lead to false negative tests.

Nosocomial infection

- From the deep dive reviews the overall rate of nosocomial infection was not clear. The COPE-Nosocomial study found that in their patient population from hospitals in the UK and Italy, 12.5% of COVID-19 infections in older adults with were acquired in hospital.
- Frail patients, particularly those for whom presenting symptoms are atypical, and agitated patients cause particular risk.
- There was a high rate of staff sickness reported in specialist older person's wards.
- The risk was compounded in hospitals that had limited numbers of single rooms and slow return of test results.
- Restriction on hospital visitors and changed advice on use of PPE for staff appeared to be a crucial intervention in reducing nosocomial infection rates
- *University Hospitals of Leicester NHS Trust* formed 'clean' and 'COVID' teams in geriatric medicine early in the pandemic, including those covering community hospitals. There was a clear and regular patient testing strategy (at five and 13 days, then every seven days afterwards and 48 hours prior to discharge) and patients were only discharged to community hospitals or care homes once this testing has been completed.

End of life care/specialist palliative care

- There was a high death rate (much expected) particularly in older adults. Some hospitals developed wards specific for management of dying patients. Specialist palliative care played a central role both in and out of hospital. Training for staff redeployed to palliative care teams was especially important.
- *University Hospitals of Leicester NHS Trust* – Palliative care team worked closely with the Discharge Hub, particularly recognising patients stating that they did not want to come into hospital or not wanting health care professionals within their home and how to co-ordinate patient's wishes. The team felt this speeded up the process of patients who wanted to receive end of life care at home. The RESPECT document was introduced in January 2020 with its use found helpful, particularly in guiding higher quality conversations regarding treatment escalation plans and end of life discussions.
- *Barts Health NHS Trust* and *Guy's and St Thomas' NHS Foundation Trust* utilised a web based tool already in use in London, so that advance care planning decisions were available to staff both in hospital and community – Co-ordinate My Care. (6)
- *Bedfordshire Hospitals NHS Foundation Trust* provided a dedicated COVID-19 end of life care ward was developed with eight side rooms. The aim was to improve the quality of care for these patients and there was a dedicated palliative care consultant.

Care home support

- Several trusts from deep dive visits described that there were a number of COVID-19 related hospital admissions from patients living in care homes in early phase of wave one of the pandemic.
- Admission to hospital for patients with multi-morbidity or severe frailty who may be approaching end of life may be inappropriate.
- Support for patients and carers is essential and proactive advance care planning can support this process. Some hospitals developed outreach support for care homes during the outbreak and linked this to a large scale advance care planning. The British Geriatrics Society (BGS) document COVID-19: Managing the COVID-19 pandemic in care homes for older people summarises the key actions required. (7)
- At *Guy's and St Thomas' NHS Foundation Trust*, consultant geriatrician lead care home support team was developed, which included a mobile messaging support system.
- *University Hospitals Leicester NHS Trust* developed a 'pre-transfer clinical decision' (PTCD) service; a consultant led service, providing direct advice and support to ambulance staff when attending to a patient, particularly in care homes. This service allowed support and decision making concerning transfer to hospital, or if possible, to remain in care home with targeted follow up by a GP with an interest in geriatrics.
- *Barts Health NHS Trust* ensured that all geriatric consultants had access to 'Coordinate My Care' and with an end of life co-ordinator, all residential and nursing homes in the borough were identified. Nearly all homes were visited to ascertain residents' needs and in particular the severity of their frailty. Coordinate My Care records were updated, and outstanding advance care planning discussions and documentation were completed.
- At *Bedfordshire Hospitals NHS Foundation Trust*, secondary care teams have been supporting primary care teams with clinical decision making for advance care planning, by identifying frail patients in care homes. During wave one, there were daily huddles between primary and secondary care, identifying and escalating any patients. This was complemented by weekly MDT to discuss patients advance care needs and support end of life care discussions.

Outreach virtual support

- The ability to access specialist advice for patients at home linked to community networks was a crucial support.
- *Lancashire Teaching Hospitals NHS Foundation Trust* developed a virtual frailty clinic that provided specialist advice in the community without patients needing to attend the hospital (see case studies).

Carers support

- The COVID-19 pandemic has been a distressing time for carers. There is a need for effective and frequent communication from wards to carers. Use of tablets to support communication was common. Some carers refused post discharge visits because of infection risk. Some patients refused to be admitted to hospital because of adverse reporting of treatment.

Community care

- Community hospitals did not have a central role in initial management of patients but did have a role in COVID recuperative rehabilitation. Some community teams supported COVID patients at home with plans to extend this clinical role for wave two.
- *Guy's and St Thomas' NHS Foundation Trust's* '@home service' aimed to support patients in their own home, and was developed to include community care for COVID patients at home. (8) This service enabled urgent clinical assessment and initial treatment to be delivered in patients' own home during the lockdown.

Key resources

Beneficial innovations from COVID-19 | British Geriatrics Society
Available from: *https://www.bgs.org.uk/policy-and-media/beneficial-innovations-from-covid-19*

Coronavirus and older people | British Geriatrics Society
Available from *https://www.bgs.org.uk/resources/resource-series/coronavirus-and-older-people*

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CASE STUDY

Lancashire Teaching Hospitals NHS Foundation Trust – Virtual Frailty Clinic

A nurse-led virtual community multidisciplinary team was set up to support patients post discharge. Every frail patient who was discharged from hospital was screened for appropriateness of referral to the Virtual Frailty Ward. It provided tailored telephone follow-up post-discharge to review progress, answer queries, maintain patient safety and prevent readmission. The telephone calls were coordinated with community services and consultants were available for additional support. On average there were 120 patients admitted to the virtual ward. The re-attendance rate decreased by 31% and readmission rate decreased from 13% to 7%. This service was identified for development after a pre-COVID GIRFT deep dive and came to fruition during wave one.

CASE STUDY

Case study: Lancashire Teaching Hospitals NHS Foundation Trust – Individualised therapy activities and distraction techniques

Therapy activities and distraction techniques were moved from group sessions to individually tailored activities according to patient need. Behaviour charts were kept for patients who became agitated, which helped the MDT to recognise triggers and promote de-escalation techniques to reduce agitation and the need to wander. This detailed behaviour analysis also proved valuable for therapists and social workers when preparing patients for discharge. 'Forget-me-not documents' were completed by a newly developed family liaison team; as visitors were heavily restricted, the team would liaise with families, giving updates and gaining insight into the patient as a person, which developed tailored distraction activities. A staged research project has started, developing the use of tailored music therapy linked to a patient's heart rate and whether it helps to reduce agitation, aggression and wandering, with an important aim to reduce exposure to COVID-19 to patients with dementia.

CASE STUDY

University Hospitals of Leicester NHS Trust – Meaningful Activities Facilitators

Meaningful Activities Facilitators, a service provided since 2013, continued during the pandemic; they offered individualised activities to patients who may have agitation, confusion, wandering or require support with nutrition and hydration. Positive benefits included reduced need for sedation. Other interventions that were felt to ensure effective delirium care included weekend working of Consultants (senior oversight) and actively avoiding movement between wards (through safe cohorting).

Diabetes

Introduction

Diabetes has been shown to be independently associated with increased rates of in-hospital death in patients with COVID-19. (1) Amongst COVID-19 patients with type 1 or type 2 diabetes, poor glycaemic control has been identified as a significant risk factor for COVID-19 related mortality. (2) The glycaemic management of patients with COVID-19 is also often extremely complex, and the routine use of dexamethasone in COVID-19 presents unique glycaemic challenges. (3,4) The combination of impaired insulin production and insulin resistance related to COVID-19, and impaired glucose metabolism resulting from dexamethasone use may result in significant hyperglycaemia, HHS and DKA in patients both with and without diabetes. (4) It is therefore of paramount importance that diabetes services are maintained as part of the COVID-19 response strategy and continue to be recognised as an essential component of acute hospital care. (5)

Key principles

- National clinical guidelines should be rapidly adopted and disseminated, to optimise glycaemic control in COVID-19 patients both with and without diabetes.
- A 7-day inpatient service should be maintained, and where this does not exist it should be commissioned, with diabetes specialist nurses playing a vital role.
- Inpatients with diabetes should be proactively identified and reviewed, using technology for virtual reviews where appropriate.
- Maintaining outpatient services – especially foot and pregnancy services – is vital in preventing admissions, facilitating early supported discharge and providing ongoing chronic disease management.

RECOMMENDATIONS

Clinical pathways

Inpatients with diabetes should be proactively identified, examples include:

- *Guy's and St Thomas' NHS Foundation Trust* liaised with their clinical coding team in order to obtain daily lists of all inpatients with diabetes, while other trusts used a "ward sweep" method.
- *Lancashire Teaching Hospitals NHS Foundation Trust* utilised automated hypoglycaemia, hyperglycaemia and ketone alert processes.
- In some trusts, patients with diabetes related complications were seen directly in ambulatory care on admission, bypassing A&E.

A comprehensive 7-day inpatient diabetes service should be available if possible, with daily inpatient ward rounds

- Some centres had a daily in-patient consultant ward round, while in others this was led by diabetes inpatient nurse specialists with telephone consultant support.
- At *University Hospitals of Leicester NHS Trust*, all inpatients with diabetes were reviewed virtually each day, using computer systems that enabled remote access to electronic patient records, blood glucose readings and drug charts.
- A 7-day dedicated COVID-19 telephone advice service was also set up and electronic referrals systems were maintained, with remote advice or in-person reviews as appropriate.

Patient self-management should be encouraged and maintained where possible during inpatient admission, i.e. self-administration of subcutaneous insulin, which can be difficult to facilitate when hospitals are under strain due to COVID-19 surges

Essential outpatient services should be maintained, including antenatal clinics, diabetic foot clinics, urgent face-to-face reviews and necessary blood test monitoring(6). All patients whose main care is with a specialist team should be given information regarding prioritisation for clinical review (telephone or in person) and advice regarding self-management.

- *Lancashire Teaching Hospitals NHS Foundation Trust* also maintained their insulin pump clinic and diabetic specialist nurse-led renal transplant clinic.
- Most trusts used a triage system to decide whether a review was needed, and whether a telephone or in-person review was most appropriate.
- *Bedfordshire Hospitals NHS Foundation Trust* and an increasing number of other trusts are now implementing video consultations.

Post-COVID follow up pathways

Safe and supported discharge should be facilitated, with appropriate education and follow-up in line with national guidance (7)

Equipment utilisation

Delivery of subcutaneous insulin in critical care settings can be undertaken safely to maintain glycaemic control for intubated and ventilated patient.

- Syringe driver shortages resulted in some critical care units being unable to set up variable rate intravenous insulin infusions. After discussion with inpatient diabetes teams, treatment plans of subcutaneous diabetes were implemented safely for these patients

All wards should have appropriate diagnostic equipment, including web-linked glucometers and point-of-care ketone tests.

Appropriate technology should be available to facilitate virtual patient reviews, including electronic patient records, inpatient diabetes dashboards, electronic prescribing charts and glucose readings.

Video call equipment should be available in hospital to facilitate communication.

Workforce organisation

Multidisciplinary inpatient diabetes teams should be maintained, and workforce shortages should be proactively addressed.

- In *Bedfordshire Hospitals NHS Foundation Trust* dietitians were up-skilled to perform wider duties to support nurses and were able to employ locum consultants to staff new patient clinics.
- Integrated care diabetes services and dieticians were used to support both outpatient and inpatient work.

Diabetes nurse specialist services should be maintained particularly in light of the increased morbidity and mortality in people with diabetes who acquire COVID-19 infection.

- In University Hospitals of Leicester Foundation NHS Trust, no diabetes specialist nurses were redeployed. Instead they were vital to support outpatient clinics, maintain the outpatient helpline and assist with inpatient reviews.

Communication

Effective and reliable channels of communication should be developed

- Communication channels should include within the multidisciplinary inpatient diabetes team, between other specialities in the hospital, between different sites and between hospital and community services.
- Trusts used daily 'huddles' with social distancing, messaging applications and conference calling technologies e.g. Zoom or MS Teams to facilitate communication.

Training and Guidance

National clinical guidelines should be rapidly adopted and disseminated

- These should be regularly reviewed and updated.
- Trusts either uploaded these directly onto the intranet, or incorporated them into local protocols.
- The optimum method of guideline dissemination should be considered, for example the use of mobile phone applications to disseminate guidelines and increase their availability.

Some trusts provided education of inpatient teams who had been redeployed and were less familiar with the latest diabetes management guidance.

Online patient education and guidance should be provided where possible

- *University Hospitals of Leicester NHS Trust* provided online DAFNE education for patients.

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CASE STUDY

University Hospitals of Leicester NHS Trust

During the COVID-19 pandemic, University Hospitals of Leicester NHS Trust maintained a 7-day inpatient diabetes service. Every inpatient with diabetes was reviewed daily using Nerve centre computer software, which facilitated virtual patient reviews and documentation, while telephone advice and in-person reviews were employed as appropriate. No diabetic nurse specialists were redeployed, and instead they played a vital role in maintaining diabetes services – supporting remote consultant clinics, operating the diabetes helpline and assisting with inpatient reviews. Essential outpatient services, including both virtual and face-to-face clinics, were maintained and online patient education courses, such as DAFNE, were set up. National guidance was rapidly circulated and incorporated into local protocols, which were reviewed and updated regularly.

CASE STUDY

Portsmouth Hospitals University NHS Trust

At Portsmouth Hospitals University NHS Trust, all diabetes clinics were maintained throughout the COVID-19 pandemic. This was done by switching the majority of clinics from a face-to-face to a virtual format, using a combination of telephone and video consultations, as well as collaboration between consultants to facilitate cross covering. Where face-to-face appointments were required – for example, diabetic foot clinics and antenatal diabetes clinics – appropriate modifications were made, and Public Health England guidelines were strictly adhered to. This has resulted in continued outpatient support and a minimal backlog of patients requiring review. Where appropriate, plans are being put in place to maintain virtual formats for some of these clinics to improve clinical efficiency going forward.

This comprehensive service was also maintained through collaborations between community and hospital services, and between hospital specialties. Inpatient support was bolstered by the community providers releasing their community diabetes nursing staff to help with inpatient diabetes cover, and the hospital became a hub for any queries or support for patients in the primary care setting. Endocrine consultants supported the COVID-19 response in collaboration with other chronic disease specialists, such as rheumatology and dermatology, and a rotational method was used to ensure adequate capacity existed to cover clinics. Supporting professional activities time and time for other activities, such as national or university roles, was sacrificed to help create necessary capacity.

CASE STUDY

Ipswich Hospital, East Suffolk and North Essex NHS Foundation Trust

At the start of the pandemic all diabetes specialists were to be redeployed to the wards but an alternative plan, devised by the diabetes team to best utilise their skills and those having to shield, was accepted by the senior clinical managers. This enabled provision of a seven day inpatient diabetes specialist nurse service, as well as telephone support to GPs, practice nurses, community nurses and directly to patients. The latter 'skeleton' service was based in the diabetes centre and staffed by the non-shielding community and outpatient diabetes specialist nurses supported by a diabetes consultant. These staff continued to deliver 'virtual' diabetes clinics via the telephone or video consultations. They also maintained face-to-face interspersed with virtual consultations for foot and antenatal services. This model has been adopted elsewhere.

A copy and a blank template for others to use is available online:
https://abcd.care/sites/abcd.care/files/site_uploads/Specialty%20guide_Template%20Diabetes%20and%20coronavirus_Final%207.4.pdf

Cross cutting themes

Trust leadership and management

Introduction

The impact of COVID-19 has required specific leadership and management considerations that have challenged established hospital administrations and led to more input from frontline clinicians. Furthermore, the frequency of communications amongst teams within healthcare organisations as well as between trust and central bodies increased drastically as the pandemic progressed. The challenges of maintaining hospital operations in a novel and seemingly unpredictable situation were overcome by collaborative efforts within hospitals and importantly local networks that provided mutual aid to benefit patients and staff.

Key principles

- Staff wellbeing must be at the centre of workforce management and planning.
- Clinical and managerial leaders need to work "shoulder to shoulder", with continuous input from frontline multidisciplinary clinical staff who can provide real time updates in a rapidly changing situation i.e. COVID-19 surge.
- We found evidence that trusts with a relatively flat control and command system communicate better with clinical specialty teams than those with a complicated, hierarchical structure.
- Strategies that have flexibility and are easily adaptable have more utility than rigid systems.
- Regular communication with all staff groups from a single source is essential to provide reassurance.
- Electronic trust data systems that hold hospital and local area information have been proven useful for patient location tracking, nosocomial infection rates and predicting future demands on the system.

Staff wellbeing

COVID-19 had a huge impact on the wellbeing of staff across the NHS. Trusts must continue to ensure that welfare of their staff is at the centre of any workforce considerations.

- Staff wellbeing is of crucial importance. It has been discussed throughout the pandemic (3) and further research into this topic has recently been commissioned (4).
- Many trusts throughout the country have employed strategies to address the psychological strain suffered by hospital staff through a range of measure including wellbeing hubs and tiered physiological support from specialists.
- In addition to maintaining these initiatives, debrief training and active monitoring of staff for moral injury and mental illness will be necessary to ensure those at risk receive the help required.

Clinical and managerial leadership

Regular updates from clinical team leads and feedback from trust senior management teams (SMT) will allow hospitals systems to remain agile in rapidly changing situations.

- Ensuring clinical leads with expert experience were allowed autonomy in the management of their department and were able to have a daily two-way dialogue with trust SMT enabled clinical departments to remain reactive to changes in guidance from central bodies (NHSE, PHE) whilst adapting appropriately to their own departmental demands.

  There has been evidence that involving clinicians in hospital management benefits organisations results in better patient outcomes. (1) University Hospitals of Leicester NHS Trust established a senior clinical cabinet that met three times a week with their SMT to help streamline processes for policy approval.

Adaptable and relatively flat command and control structure allowed for better interaction with clinical teams.

- Many trusts modified command and control to be more flexible and reactive by simplifying reporting and communication pathways. This will be important to consider as efforts will be made to continue elective work in future outbreaks.

Task and finish groups to deal with unexpected challenges.

- University Hospitals of Leicester NHS Trust created sub cells such as oxygen cell and renal replacement therapy cell to manage unexpected challenges such as oxygen delivery and reduced RRT availability. This allowed specialists to work in a multi-disciplinary manner and come up with solutions to these specific problems.

Local planning and mutual aid were key to trust COVID-19 responses

- Repeatedly from our deep dive visits we heard that collaboration with local and regional trusts was valuable to the COVID-19 response.
- Mutual aid in the form of patient transfers within critical care network or distribution of equipment enabled many hospitals avoid becoming overwhelmed.
- Sharing of data between trusts, in terms of bed occupancy and patient flow, enabled more reliable forecasting of future demand than centrally derived predictions.
- Informal sharing of learning through mobile messaging services informed hospital strategies and should continue.

Clear and regular communication with all staff groups is essential to create a positive culture (2)

- The multiple pieces of information that hospital staff received from various sources were often confusing and occasionally conflicting. Many of the trusts we visited created a single source of information delivered through different methods (i.e. trust intranet, daily email, social media, updates via trust mobile phone application) to inform staff regarding updates and importantly regarding personal protective equipment which was often a source of anxiety.
- It was also important that this information was disseminated to non-clinical staff such as hospital maintenance and cleaning teams, porters and catering staff who may be employed by other organisations. L*ancashire Teaching Hospitals NHS Foundation Trust* ensured representatives of all groups of clinical and non-clinical staff were present at senior management meetings, with oversight in communicating to their cohort.

Data collection

- Several trusts described how data collection was not considered early in the pandemic, but soon recognised the importance of appropriate and timely process for this. Data subsequently was collected by dedicated teams of staff, which has helped in organisation-wide review of practice during the first wave and will inform planning for subsequent outbreaks.
- A streamlined process from both central bodies and trust teams that avoids duplication is required to improve this important process.

Maintaining accurate updated electronic patient data records can inform decision making

- This enables tracking of patient based on location, service, and clinical management. Furthermore, it can assist in predicting service demands in rapidly changing environments.
- *The University Hospitals of Leicester NHS Trust's* nerve centre was in-house produced and proved valuable in tracking the location of all COVID positive patients in the hospital for infection control, allocation of services, tracking of patient states e.g. patients high risk of needing critical care support based on respiratory support, oxygen requirement and saturation. University Hospitals of Leicester NHS Trust found that using an in-house developed system (as opposed to one developed by a third party) allowed it to rapidly adapt to the needs of the trust as the situation was changing.
- *Barts Health NHS Trust* undertook internal analysis of COVID-19 patient outcomes by hospital site. This enabled the trust to identify trends in-patient admissions, length of stay and outcomes to inform planning for future COVID-19 outbreaks.
- *Guy's and St Thomas' NHS Foundation Trust* took a data driven approached to clinical management of patients utilising their existing robust data platforms that had been used for research.

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Research

Introduction

Advances in research and incredible success in patient recruitment to clinical trials has been a notable achievement in the NHS during the COVID-19 pandemic; recognising the generosity of patients and engagement of clinical and non-clinical staff in the pursuit for effective treatments against COVID-19. In times of uncertainty, especially at the start of the pandemic, engaging with research amidst other competing priorities was challenging, but NHS trusts, of varying sizes, identified strategies to meet this challenge.

Key principles

- All patients admitted should be considered for ongoing COVID-19 research trials.
- Research trials from admission to post-COVID rehab are ongoing and adding to clinical practice that is evidence based, safe and effective.
- Recruitment strategies could include a one-stop approach to recruit a patient (rather than several people attempting to recruit to different studies).
- Strong commitment from senior management teams and Research & Development teams to clinicians on the frontline has proven important.
- Trusts without established research connections can link with clinical research networks and local universities for support to facilitate research activities.

All the trusts involved in producing this document highlighted the importance of supporting research into COVID-19 to improve patient care.

RECOVERY trial, (1) a national UK clinical trial aimed to identify treatments that may be beneficial for people hospitalised with suspected or confirmed COVID-19: A total of 176 UK hospitals recruited >12,000 hospitalised patients so far (15% UK COVID-19 patients) to this trial and which has contributed to the generation of new knowledge regarding the effectiveness of dexamethasone and potential benefit of remdesivir, in addition to the ineffectiveness of hydroxychloroquine and lopinavir-ritonavir. Such recruitment has led to more evidence based clinical practice and aims to improve the morbidity and mortality of COVID-19 in face of likely surges

Trust examples of engagement with research

- *University Hospitals of Leicester NHS Trust* was the lead recruiter for RECOVERY in the UK, in addition to being the lead recruiter for COVID-STOP, (2) second highest recruiter for SYNAIRGEN (3) and amongst the highest recruiters for RECOVER-RS. The reasons for such high support include research being embedded into the acute and clinical settings of the trust to ensure these studies are streamlined as possible. Research teams in Leicester include experienced clinicians and specialist nurses who work with service delivery teams, which helped to optimise care and give additional oversight of care and response to interventions. Strong links with University of Leicester is likely to have been a key factor, particularly in engaging 'bench to bedside' teamwork. (4)
- *Bart's Health NHS Trust* created a new one-stop framework, developed by a clinician, to support the recruitment of patients to COVID-19 research studies. This was designed to be a one-step approach to recruiting the patient, rather than a series of people discussing several, different studies. The Health Research Authority is set to roll out this document set for use across England and Wales.
- *Bedfordshire Hospitals NHS Foundation Trust*, similar to many trusts during the pandemic, aligned to a single Clinical Research Network (Eastern) and recruited 1,331 patients to COVID trials (as of 31st August). In view of funding challenges, support from the executive team has led to an additional research nurse post being created.
- At *Guy's and St Thomas' NHS Foundation Trust* a COVID-19 Research Prioritisation Group was established to ensure studies not competing and patients not being over-recruited with oversight of resources available to deliver. Research and development workforce, as a team, supported research and clinical activities despite different funding streams and priorities and a dedicated COVID-19 research workforce was established.

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Clinical coding

Introduction

Clinical coding is the translation of diagnoses and interventions into a set of codes which can be used for many purposes including payment, planning, clinical audit and epidemiological studies. Whilst for many clinicians, clinical coding has become synonymous with the National Tariff Payment System, in the context of clinical coding for COVID-19 this is not the focus. Statistical classification and coding were critical to containing the last SARS outbreak, and they are being called upon again to provide a dataset-of-record to support short- and long-term decisions and clinical understanding.

It is important to acknowledge that so long as there is clinical uncertainty in assigning precise diagnoses to every aspect of patient care, there is intrinsic uncertainty in assigning codes to them. However, many stochastic sources of data inaccuracy that are often related to poor process flows and documentation and interpretation of clinical terms, that limit overall clinical utility of the coded data, may be reduced through a partnership between clinicians and coders. (1) In this context, clinical validation of the coded dataset aims to ensure technical accuracy and clinical relevance: code assignments must conform to national standards, as determined by the NHS Digital Terminology and Classifications Delivery Service (TCDS), and reflect the nature and complexity of a patient's clinical journey.

Whilst the process and proportion of cases undergoing validation varies from hospital to hospital, it commonly involves collaboration between clinicians and clinical coders to improve technical and clinical data accuracy.

Feedback from hospitals undertaking systematic review of the coded clinical data for all COVID-19 cases, and disparities within HES data, demonstrate that there are some specific difficulties in relation to COVID-19 coding.

Key principles

- Senior clinicians should collaborate with clinical coding teams to establish processes to validate all coded clinical data for COVID-19 patients.
- Clinical coding teams should routinely investigate specific areas at high risk of poor code accuracy and collaborate with clinicians to validate the coded data prior to submission.
- Clinical codes should be cross-checked with multiple clinical data sources to improve the accuracy and completeness of the coded dataset.
- The clinician coding validation process, which may be supported with specific software and purpose built reports, is a two stage process: internal quality checking by the coding team; discussion of all unresolved coding issues with nominated senior clinicians.
- There are two main outcomes of the clinician coding validation process: changes to previously assigned clinical codes prior to data submission; dissemination of learning to clinicians and coder so that the information in clinical records is optimised for accurate code assignment and coders interpret clinical information accurately and consistently.
- The Multidisciplinary Coded Dataset Suggestions (MCDS, available in the Appendices) is a standard template of preferred clinical terms and code combinations for use as part of the COVID-19 coding validation process.

RECOMMENDATIONS

Ensure accurate clinical code assignment in eight areas at risk of poor clinical coding quality.

1. U071 test-positive COVID-19

U071 is the mandated diagnosis code (World Health Organisation and NHS Digital) for patients with signs and symptoms of COVID-19 infection and a positive laboratory test for COVID-19. Assignment of this code should be 100% accurate.

- A report detailing all positive COVID-19 test results for inpatients should be available to the coding department
- The clinical record should clearly describe whether a positive test result was obtained as part of investigating suspected COVID-19 (U071) or in a clinical setting when COVID-19 was not the main condition investigated or treated (e.g. screening an asymptomatic patient)

2. U072 test-negative COVID-19

U072 is the mandated diagnosis code when COVID-19 "is diagnosed clinically or epidemiologically but laboratory testing is inconclusive or not available." This code should not be used when COVID-19 was clinically suspected but ruled out by negative laboratory tests. (2)

U072 should only be assigned when the clinicians treated a patient as COVID-19 positive in the absence of a positive test result, having ruled out differential diagnoses (i.e. are not investigating the patient for an alternative diagnosis.) It should not be assigned on the first episode in a spell where in subsequent episodes COVID-19 has been ruled out.

- All U072 codes assigned should be checked using the clinician coding validation process

Bedfordshire Hospitals NHS Foundation Trust (and many other trusts) use a formal coding validation process to review the accuracy of all U072 code assignment

- The clinical record should clearly state when patients are treated for presumed COVID-19 in the absence of a test result. Suspected COVID-19 which is ruled out should be clearly recorded in the clinical record

Barts Health NHS Trust implemented a specially designed pro forma as part of the Electronic Patient Record (EPR) developed by the coding team and lead respiratory consultants to capture relevant information on COVID-19 patients

- Provide support to clinical coders for decision making when assigning codes for non-test positive COVID-19

University Hospitals of Leicester NHS Trust designed and implemented a coding flow chart to help coders with the assignment of U071 and U072 codes. Other trusts have designed and implemented similar flow charts

3. J128 pneumonia in COVID-19

There is a national clinical coding standard for coding pneumonia due to COVID-19 where the link has been made by a clinician. However, in many cases the clinical record will not explicitly state the link but will reflect the fact that the patient is COVID-19 positive and has pneumonia or pneumonitis. All of the hospitals involved in the deep dive have taken a local decision to code such cases as pneumonia due to COVID-19. HES data suggest that such an approach has not been universally adopted. Some hospitals code no anatomical (lobar or unspecified) pneumoniae in COVID-19 positive patients and others record approximately half of their pneumonia cases anatomically.

- Agree a local coding policy (between lead clinicians and clinical coding team) about the use of J128 to code all cases of pneumonia in COVID-19
- The clinical record should clearly specify details of non-COVID-19 pneumonia in COVID-19 patients, in particular bacterial and aspiration pneumonia

4. Y95 nosocomial conditions

Hospital acquired COVID-19 can be identified by the addition of diagnosis code Y95 "Nosocomial condition". A coder will only assign this code if there is a clinical statement to this effect, e.g. "hospital acquired COVID-19". Feedback from the coding teams at the six deep dive trusts suggests that clinicians do not always specify in the clinical record whether or not COVID-19 is nosocomial.

As a result of this the incidence of reporting for nosocomial COVID-19 in the coded clinical data is likely to be low and will not reflect all those cases where a patient was deemed to be COVID19 free on admission but tested positive after seven days or two weeks as an inpatient. HES data for 121 organisations reporting greater than 100 COVID-19 positive cases showed the

range of Y95 (nosocomial code) assignment as 0% to 11.1%. There were 23 reporting 0% of cases as nosocomial conditions, a further 55 reporting <1% as nosocomial and only 8 reporting >3% as nosocomial.

- There are separate detailed data sources used for capturing and reporting nosocomial COVID-19 and these should be used to validate the clinical coded data

University Hospitals of Leicester NHS Trust have designed a validation report for coding based on the mandated daily reporting on COVID-19 cases.

Hospital acquired conditions other than COVID-19 are also identified using code Y95. For example, there may be an increased risk of complications associated with the "proning" of seriously unwell patients for longer lengths of time. It is important to capture all complications of care and code them as accurately as possible.

- Use the clinician coding validation process (2) to improve the coding of hospital acquired conditions, including feedback to clinicians and coders to improve first time code assignment

East Kent Hospitals University NHS Foundation Trust coding team have set up a regular review process with specialist nurses in ICU to make sure that all complications associated with proning, such as line infections and bacterial pneumonia overlying COVID-19 pneumonia, are coded accurately.

5. Other conditions linked to COVID-19

In the same way that national clinical coding standards indicate that a clinician must have made a link between COVID-19 and pneumonia in order for it to be coded as such, the same will be true for other conditions associated with/caused by COVID-19. Where conditions such as myocarditis, gastroenteritis, intestinal infarction, etc. occur in COVID-19 positive patients the coder may only make an association if the clinician has specified that the condition is due to COVID-19 or where a local policy has been agreed.

6. J96 codes for respiratory failure

Clinical coders cannot interpret test results and infer diagnoses. In order to assign a code for respiratory failure it must be stated in the clinical record (either in full or as "T1RF" or "T2RF").

- Clinical coders should take care to look for a statement of respiratory failure for all COVID-19 (and COVID-19 suspected) patients, particularly when there is a diagnosis of pneumonia and/or the patient is receiving any form of ventilation support or oxygen therapy.
- Clinicians should ensure that respiratory failure is explicitly recorded in the clinical record.
- Checking whether or not patients had respiratory failure should be a part of any COVID-19 data validation process.

7. Codes based on measurements

National standards for clinical coding dictate that a clinical coder must not interpret test results. As well as respiratory failure (point 6 above) this standard includes tests that are effectively measurements, e.g. body mass index (BMI), haemoglobin (Hb) levels and tests for acute kidney injury (AKI). As a result of this, obesity, acute kidney injury, respiratory failure and other relevant conditions are not reliably or consistently coded. Many hospitals have local policies that allow clinical coders to convert BMI into a coded diagnosis but the threshold for what constitutes morbid obesity is not the same in all policies and there are some hospitals where obesity would never be coded on the basis of BMI alone. This problem is compounded by the fact that obesity is not on the list of mandatory comorbidities for clinical coding.

- Implement local coding policies for the coding of conditions defined or recorded by measurements and test results
- Enable access to the coding team for relevant results and data so that code assignment is accurate and consistent

8. Ventilation support

There are OPCS4 codes that can be used to record levels of ventilation support. Identified areas of possible coding weakness include interventions carried out on ICU, such as intubation (invasive ventilation) and tracheostomy. Multiple respiratory interventions identify clinical deteriorations and all key respiratory interventions, and their dates should be captured within the coded dataset.

- Validate procedure codes used for ventilation support against alternative data sources (e.g. ICU dataset and ICNARC)
- Ensure all instances of non-invasive ventilation, intubation and ventilation, and tracheostomies are captured

Certain interventions are not within the scope of OPCS4.9 (the current version of OPCS4 procedure codes). As a result of this there is no appropriate code for "proning". Due to the importance of this intervention some hospitals have taken a local decision to record it using the code X61.4 (Movement therapy NEC). While this code is far from ideal it is not normally used for any other purpose and so will allow the identification of proning as an intervention using clinical codes.

- Adopt a local coding policy on the coding of proning as an intervention

Tracheostomy is a crucial intervention. It may be performed with percutaneous or surgical methods at the patient bedside in ICU or in the operating theatre.

- Ensure all tracheostomies, tracheostomy tube changes, and tracheostomy decannulation are captured within the coded dataset
- Ensure surgical tracheostomy (E423) and percutaneous dilational tracheostomy (E423+Y408+Z243) are reliably differentiated
- Use new OPCS4.9 code E856 for all CPAP.

References

1. COVID-19 National Clinical Coding Standards and Guidance - Delen: Home - NHS Digital [Internet]. [cited 2020 Oct 17]. Available from: https://hscic.kahootz.com/connect.ti/t_c_home/view?objectID=19165328
2. Nouraei SAR, Hudovsky A, Frampton AE, Mufti U, White NB, Wathen CG, et al. A study of clinical coding accuracy in surgery: Implications for the use of administrative big data for outcomes management. Ann Surg [Internet]. 2015 Jun 1 [cited 2020 Oct 18];261(6):1096–107. Available from: https://pubmed.ncbi.nlm.nih.gov/25470740/

Appendices

Appendix 1 - Methodology and further results from analysis of national hospital data

Case ascertainment: COVID-19 cases were identified by ICD-10 codes (U071, U072). Laboratory confirmed COVID-19 were coded as U071 and those diagnosed clinically with COVID-19: U072. U072 is assigned to a clinical or epidemiological diagnosis of COVID-19 where laboratory confirmation is inconclusive or not available.

Primary outcome (death): deaths were identified using ONS records. An in-hospital death was recorded if the date of death was the same as or +/- one day of the date of hospital discharge recorded in HES. Recorded deaths were checked against two independent sources of COVID-19 mortality date in England:

1. NHS England's COVID–19 Patient Notification System (CPNS) which records daily deaths as close to the time they occur as possible.(1)
2. Discharge data recorded directly in HES by clinical coders at each trust. Two fields were used to identify deaths: discharge destination (code 79, patient died) and discharge method (code 4, patient died). Use of either of these codes was used to identify deaths in hospital.

Adjusted mortality rate analysis was undertaken, and the following covariates were considered in the statistical model:

1. NHS Trust
2. Patient age
3. Patient sex
4. Deprivation – Index of Multiple Deprivation for the Lower Super Output Area
5. Ethnicity – broad categories as used by NHS Digital
6. Comorbidities - 17 comorbidities used to construct the Charlson Comorbidity Index were included as separate covariates. The Index result itself was not used.
7. Date of discharge – 7-day periods starting from 1 March

To adjust mortality rates for covariates, mixed effects logistic regression models were constructed using the *'melogit'* command in the software package Stata. A mixed-effects model allows for adjustment for clustering of deaths within NHS trusts and allowed us to assess the relative impact of NHS Trusts on the variability in mortality across trusts.

A logistic model was preferred to a proportional hazards survival model as it was felt that the relatively short length of stay, the potential for time from symptom onset to presentation to vary systematically with some of the covariates under consideration, differences in discharge practice between trusts and the unsuitability of discharge date as a censoring point would mean that a survival model would add little in terms of model fit and may complicate interpretation.

Findings

Overall mortality rates

In patients aged ≥ 18 years, the number of COVID-19 patients and number of COVID-19 related deaths are shown in Table 1 for all NHS hospital discharges in England from the 1st March to the 31st May.

Table 1: COVID-19 discharges and mortality for those aged ≥ 18 years in all NHS trusts in England (1 March to 31 May 2020)

Location	Patients	Deaths	Mortality rate
All hospital wards	91,541	28,200	30.8%
Critical care	8,564	3,980	46.5%

Data source: HES for discharges, ONS for deaths.

Comparison with other records of death

The number of deaths recorded was slightly higher than reported by NHS England's COVID–19 Patient Notification System (CPNS) (96.2% of those recorded by ONS) deaths were recorded. The number of deaths was similar to that recorded directly in HES using discharge destination and method codes (99.6% of those recorded by ONS). (Table S1)

Table S1: COVID-19 deaths for those aged 18 years in all NHS trusts in England (1/3/20 – 31/5/20)

Data source	ONS	HES	CPNS
COVID-19 deaths	28,200	28,089	27,128

Data sources: Office of National Statistics (ONS), Hospital Episode Statistics (HES) and COVID–19 Patient Notification System (CPNS)

References

1. Satistics » COVID-19 Daily Deaths [Internet]. [cited 2020 Aug 16]. Available from: https://www.england.nhs.uk/statistics/statistical-work-areas/covid-19-daily-deaths/

Supplementary graphs

Figure S1: Weekly length of stay for those who survived to discharge and those who died during their hospital stay

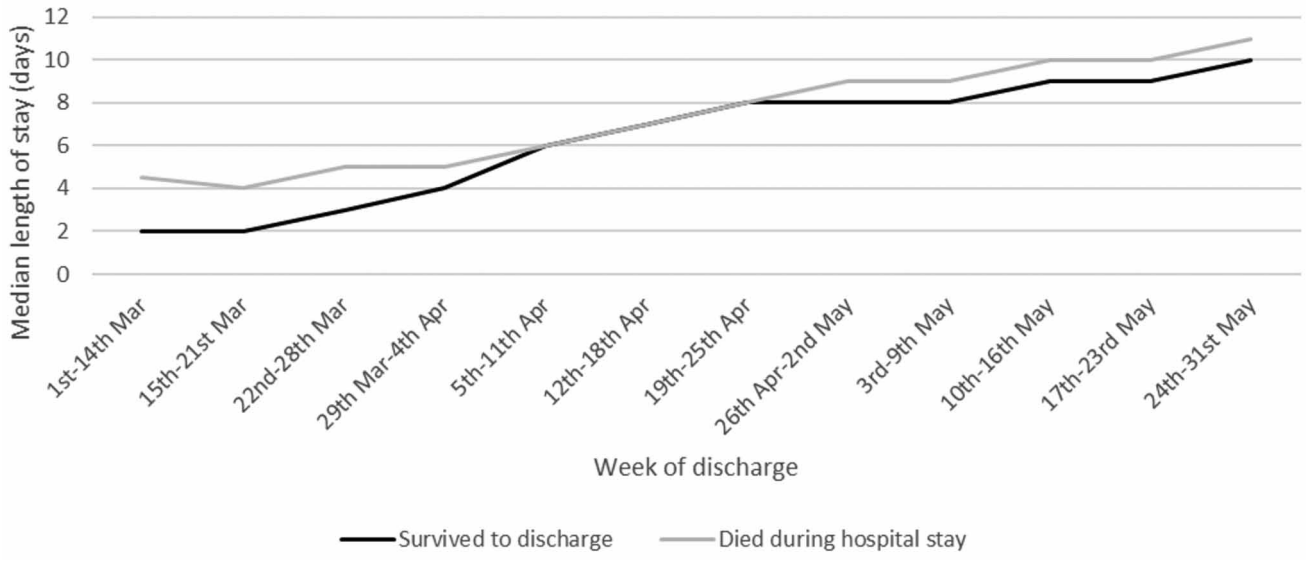


Figure S2: Weekly mortality rates in males by age band

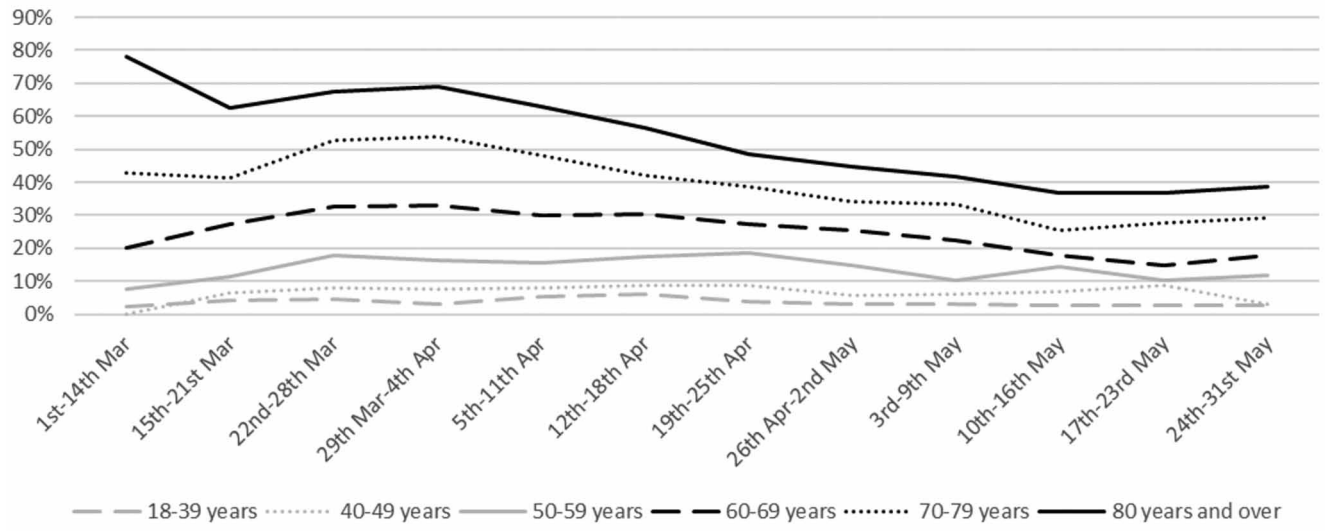


Figure S3: Weekly mortality rates in females by age band

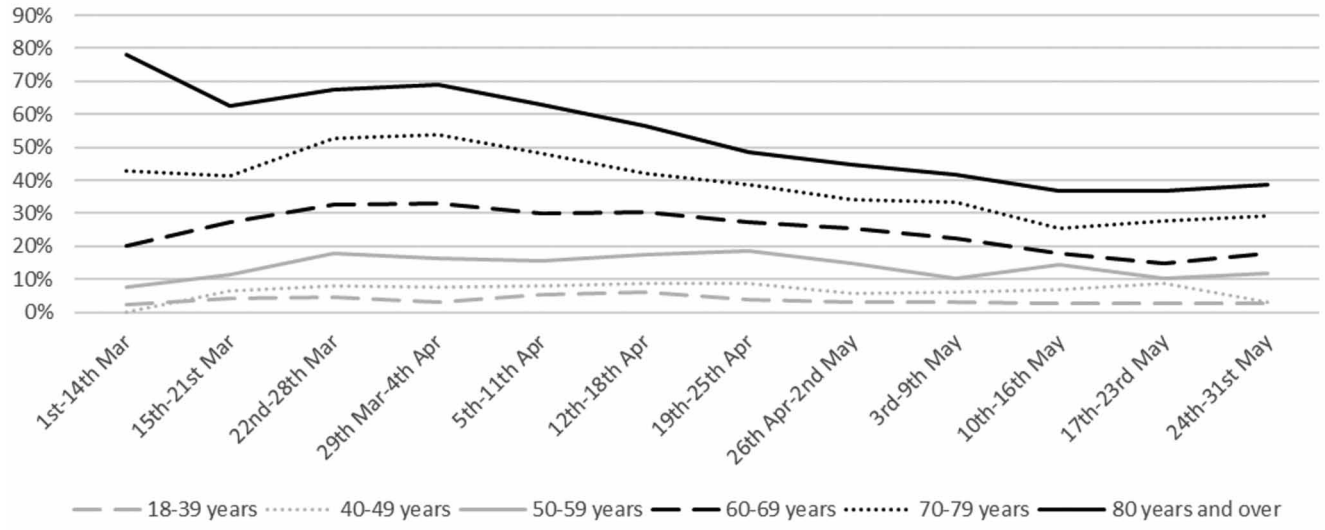
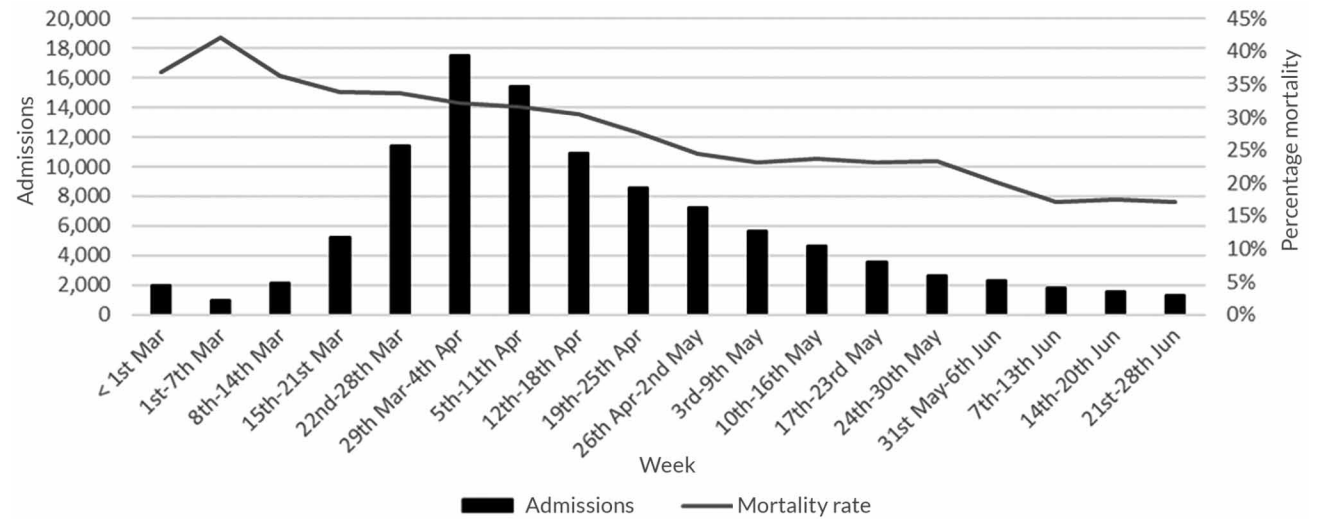


Figure S4: COVID-19 admissions and mortality (%) rate per week



Appendix 2 - GIRFT Multidisciplinary Coded Dataset Suggestions (MCDS) to improve accuracy and consistency of COVID-19 coding

Main COVID-19 clinical terms for sign and symptoms, diagnoses, and conditions

COVID-19 TRACKING / CODE ASSIGNMENT	*Code (ICD10)*	*Code position*
COVID-19 codes (non-obstetric)		
Symptomatic Coronavirus/COVID-19 – confirmed by laboratory testing	U071	Primary
Symptomatic Coronavirus/ COVID-19 - presumed but laboratory testing inconclusive or unavailable	U072*	Primary
Symptomatic Hospital acquired coronavirus/COVID-19 - laboratory confirmed	U071+Y95X	Primary
Symptomatic Hospital acquired coronavirus/COVID-19 - presumed but laboratory testing inconclusive or unavailable	U072+Y95X	Primary
Incidental COVID-19 - confirmed by laboratory testing	U071	First secondary
Incidental COVID-19 - presumed/clinically diagnosed but not laboratory confirmed	U072	First secondary
Suspected COVID-19 that was ruled out by testing	Z038	Any secondary
An asymptomatic patient, routinely tested (screened) for COVID-19 with a negative result	Z115	Any secondary
COVID-19 codes (obstetric)		
Symptomatic Antenatal/puerperal Coronavirus/COVID-19 - laboratory confirmed	U071+O985	Primary
Symptomatic Antenatal/puerperal Coronavirus/COVID-19 - presumed but not laboratory confirmed	U072+O985	Primary
Symptomatic Coronavirus/COVID-19 during delivery - laboratory confirmed	U071+Z370	Primary
Symptomatic Coronavirus/COVID-19 during delivery - presumed but not laboratory confirmed	U072+Z370	Primary
Antenatal/puerperal Coronavirus/COVID-19 - laboratory confirmed	U071+O985	Primary
COVID-19 exposure and isolation precautions		
COVID-related isolation (patient treated in side room, patient isolated)	Z290	Any secondary
Suspected or confirmed exposure to COVID-19	Z208	Any secondary

SIGNS AND SYMPTOMS OF COVID-19 **	*Code (ICD10)*	*Code position*
Cough	R05X	Primary/secondary
Shortness of breath, difficulty breathing, dyspnoea	R060	Primary/secondary
Wheezing	R062	Primary/secondary
Chest pain on breathing, pleuritic chest pain	R071	Primary/secondary
Throat pain	R070	Primary/secondary
New loss of smell or taste	R43-	Primary/secondary
Headache	51X	Primary/secondary
Chest pain	R074	Primary/secondary

Main COVID-19 clinical terms for sign and symptoms, diagnoses, and conditions

SIGNS AND SYMPTOMS OF COVID-19 ** (continued)	*Code (ICD10)*	*Code position*
Fever, pyrexia	R509	Primary/secondary
Fever and chills, rigor	R508	Primary/secondary
Muscle pain, myalgia, fatigue	M791-	Primary/secondary
Abdominal pain	R104	Primary/secondary
Diarrhoea	A083	Primary/secondary

DIAGNOSES AND CONDITIONS CAUSED BY OR ASSOCIATED WITH COVID-19	*Code (ICD10)*	*Code position*
Pneumonia / Chest infection		
COVID-related pneumonia: "Pneumonia", "lobar pneumonia", "Bronchopneumonia", "Alveolitis", "Acute firbrosis", "Proteinaceous exudate", "Chest infection", "Pneumonitis" X-ray/CT scan findings of "Consolidation" and/or "Characteristic COVID appearance"	J128+B972	Secondary
Aspiration pneumonia / aspiration pneumonitis, specifically described as such	J690	Primary/secondary
Bacterial pneumonia (only if specifically linked to a named organism)	J15-	Secondary
Respiratory distress / respiratory failure		
Adult respiratory distress syndrome, ARDS	J80X	Secondary
Type 1 acute respiratory failure	J9600	Secondary
Type 2 acute respiratory failure	J9601	Secondary
Type 1 chronic respiratory failure	J9610	Secondary
Type 2 chronic respiratory failure	J9611	Secondary
Metabolic acidosis	E872	Secondary
Upper airways		
Rhinitis, coryza, nasopharyngitis	J00X	Secondary
Laryngitis	J040	Secondary
Upper respiratory tract infection, URTI, Laryntotracheitis	J042	Secondary
Cardiac		
Cardiomyopathy	B332D+I430A	Secondary
Carditis	B332D+I521A	Secondary
Left heart failure	I501	Secondary
Cor pulmonale, Right heart failure	I260	Secondary
Congestive cardiac failure	I500	Secondary
Gastrointestinal		
Acute hepatitis	B178	Secondary
Gastroenteritis / Diarrhoea	A083	Secondary
Liver failure	K72-	Secondary
Intestinal ischaemia / intestinal vascular accident		

Main COVID-19 clinical terms for sign and symptoms, diagnoses, and conditions

DIAGNOSES AND CONDITIONS CAUSED BY OR ASSOCIATED WITH COVID-19 (cont)	*Code (ICD10)*	*Code position*
Vascular / Thrombo-embolic disease		
Vasculitis	I776	Secondary
Thrombo-embolism	I74-	Secondary
Pulmonary embolism	I269	Secondary
Coagulopathy / Coagulation disorder	D689	Secondary
Neurological		
Encephalitis	A858	Secondary
Hypoxic brain injury	G931	Secondary
Renal		
Urinary tract infection, UTI	N390	Secondary
Acute renal failure, acute kidney injury, AKI	N179	Secondary
Sepsis / Shock / Lymphopaenia		
Sepsis	A418	Secondary
Septic shock	R572	Secondary
Anaphylactic shock	T782	Secondary
Lymphopaenia	D728	Secondary
Mucocutaneous lymph node syndrome (Kawasaki)	M303	Secondary

Main COVID-19 clinical terms for interventions and procedures

Oxygenation / Ventilation support	*Code (OPCS)*	*Code position*	*Date*
Oxygen delivery (nasal cannula, high-flow nasal oxygen, OptiFlow, HFNO, HFNC, HFOT, Venturi mask)	X528	Any / As many times	All start dates
Continuous Positive Airway Pressure, CPAP	E856	Any / As many times	All start dates
Non-invasive ventilation, NIV	E852	Any / As many times	All start dates
Invasive ventilation, intubation and ventilation, I & V, mechanical ventilation	E851	Any / As many times	All start dates
Prone ventilation (Proning)	X614	Any / As many times	All start dates
Cricothyroidotomy	E422	Any / As many times	All start dates
Surgical tracheostomy	E423	Any / As many times	All start dates
Percutaneous (dilational) tracheostomy	E423+Y408 +Z243	Any / As many times	All start dates
Tracheostomy tube change	E426	Any / As many times	All start dates
Tracheostomy revision (surgical)	E424	Any / As many times	All start dates
Tracheostomy revision (percutaneous)	E424+Y408 +Z243	Any / As many times	All start dates
Tracheostomy decannulation	E427	Any / As many times	All start dates

Main COVID-19 clinical terms for interventions and procedures (cont)	*Code (OPCS)*	*Code position*	*Date*
Cardiorespiratory support, Extracorporeal Membrane Oxygenation, ECMO	X581	As many times	All start dates
Renal replacement therapy			
Haemodyalisis	X403	As many times	All start dates
Haemofiltration	X404	As many times	All start dates
Peritonearl dialysis	X402	As many times	All start dates

Post-COVID syndromes and sequalae	*Code (ICD10)*	*Code position*
Post-COVID syndrome (lung fibrosis)	J848+Z861	Any
Post-COVID pulmonary hypertension	I272+Z861	Any
Post-COVID laryngotracheal stenosis	J955+Z861	Any

* Assignment of U072 in the settings of a negative test result for COVID requires an explicit senior clinical direction with clear documentation that a false negative test result is believed to have occurred and the high clinical suspicion.

** These codes should only be used if the symptom cannot be linked to a definitive diagnosis like pneumonia in COVID.

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