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### **A national multicentre study of outcomes and patient satisfaction with the virtual fracture clinic and the influence of the Covid-19 pandemic**

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**A NATIONAL MULTICENTRE STUDY OF OUTCOMES AND PATIENT SATISFACTION WITH THE  
VIRTUAL FRACTURE CLINIC AND THE INFLUENCE OF THE COVID-19 PANDEMIC: THE  
MAVCOV STUDY**

Zhan H. Ng<sup>a</sup>, MRCS – [derrick.ng@nhs.net](mailto:derrick.ng@nhs.net)

Samantha Downie<sup>b</sup>, FRCSEd(Tr&Orth) – [samantha.downie3@nhs.scot](mailto:samantha.downie3@nhs.scot)

Navnit S. Makaram<sup>a</sup>, MSc, MRCSEd – [nmakaram@ed.ac.uk](mailto:nmakaram@ed.ac.uk)

Shivam N. Kolhe<sup>c</sup>, MBBS, MRes – [shiv.kolhe@newcastle.ac.uk](mailto:shiv.kolhe@newcastle.ac.uk)

Samuel P. Mackenzie<sup>a</sup>, MD, FRCSEd(Tr&Orth) – [Sam.Mackenzie@nhslothian.scot.nhs.uk](mailto:Sam.Mackenzie@nhslothian.scot.nhs.uk)

Nick D. Clement<sup>a</sup>, MD, PhD, FRCSEd(Tr&Orth) – [nickclement@doctors.org.uk](mailto:nickclement@doctors.org.uk)

Andrew D. Duckworth<sup>a</sup>, PhD, FRCSEd(Tr&Orth) – [andrew.duckworth@ed.ac.uk](mailto:andrew.duckworth@ed.ac.uk)

Tim O. White<sup>a</sup>, MD, FRCSEd(Tr&Orth) – [tim.white@nhslothian.scot.nhs.uk](mailto:tim.white@nhslothian.scot.nhs.uk)

On behalf of the MAVCOV collaborative authors

**Author affiliations:**

<sup>a</sup>Department of Orthopaedics and Trauma, Royal Infirmary of Edinburgh, 51 Little France, Edinburgh, EH16 4SA, UK.

<sup>b</sup>Department of Orthopaedics and Trauma, Ninewells Hospital and Medical School, Dundee, DD2 1UB, UK.

<sup>c</sup>Newcastle upon Tyne Hospitals NHS Trust, Newcastle upon Tyne, NE1 4LP, UK.

**Corresponding author:**

Zhan H Ng

Address: Royal Infirmary of Edinburgh, 51 Little France, Edinburgh, EH16 4SA, UK.

Email: [derrick.ng@nhs.net](mailto:derrick.ng@nhs.net)

**Declarations of interest:** none

**Approvals:** The study was reviewed by the local NHS Research Ethics Service and registered with the local musculoskeletal quality improvement group. Institutional review board or ethical committee approval was not required.

**Declaration of interests**

☒The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

## **ABSTRACT**

### **Background**

Virtual fracture clinics (VFCs) are advocated by the British Orthopaedic Association Standards for Trauma (BOAST). We aimed to assess the impact of the transition from face-to-face fracture clinic review and identify any change in clinical outcome and patient satisfaction.

### **Methods**

A national, cross-sectional cohort study of VFCs across the UK over two separate two-week periods pre- and during the first UK COVID-19 lockdown was undertaken. Data comprising patient and injury characteristics, unplanned reattendance and complications within three months following discharge from VFC were collected by local collaborators. Telephone questionnaires were conducted to determine patient satisfaction and patient-reported outcome for patients discharged without face-to-face consultation. The primary outcome measure was the percentage of unplanned reattendances after direct discharge from VFC review.

### **Results**

Data was analysed for 51 UK VFCs comprising 6134 patients from the pre-pandemic group (06/05/2019-19/05/2019) and 4366 patients from the first UK lockdown (04/05/2020-17/05/2020). During lockdown, rate of direct discharge from VFC increased significantly (odds ratio (OR) 2.01,  $p<0.001$ ) from 30% ( $n=1856/6134$ ) to 46% ( $n=2021/4366$ ). The rate of compliance with BOAST guidance recommending fracture clinic review within three days also increased (OR 1.93,  $p<0.001$ ) from 82% ( $n=5003/6134$ ) to 89% ( $n=3883/4366$ ). There were no differences in the rates of unplanned reattendance (6% pre- and 7% during lockdown,  $p=0.281$ ) or complications (0.2% for both,  $p=0.815$ ). There were 1527/3877 patients discharged without face-to-face review from VFC who completed telephone questionnaires (mean follow-up 18 months in pre-pandemic group and 6 months in lockdown group). Satisfaction was high in both cohorts (80% pre- and 76% lockdown,  $p=0.093$ ). Dissatisfaction was associated with an unplanned reattendance ( $p<0.001$ ) or a missed injury ( $p<0.05$ ).

### **Conclusion**

Despite a significant rise in direct discharge from VFC, there was no significant change in unplanned attendances, complications, or patient satisfaction. However, there are factors associated with dissatisfaction and these should be considered in the evolution of VFC.

## HIGHLIGHTS

- The COVID-19 pandemic saw an improvement in adherence to BOAST guidelines for fracture clinic review within 72 hours, demonstrating successful nationwide integration of VFC practices.
- Despite a significant increase in direct discharge rates from VFC during the COVID-19 pandemic, there was no change in unplanned reattendance, complications or patient satisfaction.
- Several variables such as unplanned reattendance and missed injuries were consistently associated with patient dissatisfaction – this calls for targeted interventions to improve patient experiences and outcomes in a VFC setting.

# **A NATIONAL MULTICENTRE STUDY OF OUTCOMES AND PATIENT SATISFACTION WITH THE VIRTUAL FRACTURE CLINIC AND THE INFLUENCE OF THE COVID-19 PANDEMIC: THE MAVCOV STUDY**

## **ABSTRACT**

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Virtual fracture clinics (VFCs) are advocated by the British Orthopaedic Association Standards for Trauma (BOAST). We aimed to assess the impact of the transition from face-to-face fracture clinic review and identify any change in clinical outcome and patient satisfaction.

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### **Results**

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36    **KEYWORDS**

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2    37    Virtual fracture clinic; Outcome; Patient satisfaction; Triage; Trauma; COVID-19; Telemedicine;

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4    38    Collaborative research

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## INTRODUCTION

Since the inception of the virtual fracture clinic (VFC) in 2011, the concept has been widely adopted throughout United Kingdom (UK) orthopaedic practice(1). The VFC model, utilising early review of records and radiographs by senior orthopaedic care providers, has been shown to save money, minimise complications and is widely accepted by patients(2-4). With the 2013 British Orthopaedic Association Standards for Trauma (BOAST) guideline on fracture clinic services recommending review of all orthopaedic trauma patients within 72 hours(5), the VFC has been an increasingly popular alternative to face-to-face review in order to manage the increasing numbers of patients referred to orthopaedics with an acute traumatic injury(6). VFC studies published pre-2020 demonstrated rates of discharge from the VFC without face-to-face review in 26% to 57% with a 5-10% unplanned reattendance rate and less than 1% conversion to surgery(3, 4, 7-11).

The COVID-19 pandemic resulted in a rapid increase in VFCs, encouraged by the now archived BOAST guideline on management of trauma patients under COVID-19 lockdown(6, 12). This guideline recommended that wherever practicable, routine care should comprise non-operative management, patient-initiated follow-up and telephone consultation. Given that the literature summarising changes in fracture clinic management during the UK COVID-19 lockdowns demonstrated a significant decline in face-to-face consultations(13) and higher rates of direct discharge from the VFC(14), it was deemed vital to ascertain whether this had any influence on patient outcomes and/or satisfaction.

The primary aim of the MAVCOV study was to determine whether the rapid reduction in face-to-face review in the VFC during the COVID-19 pandemic was associated with any change in patient satisfaction or outcomes. The primary outcome measure was the rate of patients undergoing unplanned clinic reattendance within three months of discharge from the VFC without face-to-face review. The null hypothesis was that there was no difference between the follow-up regimes. Secondary outcomes included assessment of the change in VFC practice on other outcomes such as complication rate, conversion to surgery and patient satisfaction.

## METHODS

The Multi-centre Audit of Virtual fracture clinic management during the COVID-19 pandemic (MAVCOV) study was a national cross-sectional cohort study that was designed to sample consecutive patients across the UK during the peak of the first lockdown (May 2020) compared to a similar period pre-lockdown in May 2019. The protocol underwent peer-review prior to data collection(6).

### Study setting

Fifty-one centres from across the UK participated in the study and each local data collection team was led by a consultant orthopaedic surgeon. All consecutive adult patients over the age of 18 years managed in a VFC during 6 May 2019 to 19 May 2019 (pre-lockdown) and from 4 May 2020 to 17 May 2020 (lockdown) were included in the study.

### Service survey

An online service survey (**Online material 1**) was administered as per the protocol to participating VFCs and identified when the VFC had been started locally, grade of staff involved, availability of treatment protocols, staff training for VFC referrals and access to injury-specific patient information resources.

### Retrospective VFC data collection

There were no reported deviations from the published protocol(6). All consecutive adult patients from the pre-lockdown and lockdown cohorts were retrospectively identified from VFC databases and other hospital records. Patient and injury characteristics including age, sex, type of injury, mechanism of injury and place of injury were collected. The waiting time for VFC assessment and grade of staff making decisions were audited against the BOAST 7 fracture clinic services guideline(12).

The primary outcome measure was the percentage of unplanned reattendances after direct discharge from VFC review. Secondary outcome measures included the rates of missed injuries, complications and any subsequent change following discharge from VFC, as well as patient satisfaction.

### Outcome questionnaires

Patients in the lockdown cohort and pre-lockdown cohort who were discharged from VFC without face-to-face review were contacted by local investigators to complete a telephone questionnaire (**Figure 1**) at 6 months and 18 months respectively following virtual discharge. Patient satisfaction data were collected using a five-point Likert scale. Patients who reported 'satisfied' or 'very satisfied' were categorised as satisfied; those who reported 'neither satisfied nor dissatisfied', 'dissatisfied' or 'dissatisfied' were categorised as not satisfied. The NHS Friends and Family Test was administered. Patients were asked if they would prefer the VFC or a face-to-face fracture clinic appointment for the same injury should they experience it again. Patients were also asked if they received a telephone call and injury-specific information leaflet from the VFC, and if they had used the VFC helpline or reattended hospital in the event of any concerns.

## Statistics

Data was analysed by the central study team at the University of Edinburgh using SPSS Statistics version 27.0 software (IBM, USA). Continuous variables were analysed using range and measures of central tendency (mean and standard deviation (SD) for parametric data, median and interquartile range (IQR) for non-parametric data). Study groups were compared using the chi-squared test or Fisher's exact test for categorical variables and Student's t-test for continuous variables as appropriate. Statistical significance was set at  $p < 0.05$ .

## Ethics / patient & public involvement

Ethical approval and information regarding patient and public involvement were detailed in the study protocol(6). There were no significant deviations from the published protocol.

## RESULTS

A total of 51 orthopaedic centres participated in the study (**Figure 2**). In May 2019, 6134 patients were identified from 44 VFC units, including two centres that subsequently discontinued their VFC service. In May 2020, 4366 patients were identified from 49 centres, including seven with a newly launched VFC. **Figure 3** shows the flowchart for the inclusion of study participants.

### Patient and injury characteristics

**Table 1** shows the patient case-mix in each cohort. Compared with the pre-lockdown period in 2019, referrals during the lockdown period in May 2020 were older (49 and 51 years respectively,  $p<0.001$ ) and were more likely to be female (52% and 55% respectively,  $p=0.005$ ). During lockdown, a higher number of referrals were due to a fall from standing height (44% and 40%,  $p<0.001$ ), a fall over 2 metres (2% and 1%,  $p<0.05$ ) and cycling accidents (9% and 3%,  $p<0.001$ ). Injuries seen less commonly during lockdown included pedestrian road traffic accidents (0.1% from 0.4%,  $p<0.001$ ), motor vehicle accidents (0.4% from 1%,  $p<0.001$ ) and sports injuries (5% from 14%,  $p<0.001$ ). During lockdown, injuries were more likely to occur at home (37% versus 26% pre-lockdown,  $p<0.001$ ) and were less likely to occur in a public space (29% versus 32%,  $p<0.001$ ) or public building (1% versus 3%,  $p<0.001$ ).

**Figure 4** shows the site of injuries sustained. In 2019, 6134 patients were referred to VFC for a total of 6221 injuries; in 2020, 4366 patients were referred for a total of 4431 injuries. Injuries to the hand and wrist were more common in the pre-lockdown group (39 and 36% respectively,  $p=0.005$ ). Injuries to the shoulder and elbow were more common in the lockdown group (28% and 23% respectively,  $p<0.001$ ).

### Patient management

**Table 2** summarises VFC management of the study cohorts. In the lockdown group, patients were more likely to be reviewed at VFC within three days following presentation of injury. Compliance with the BOAST 7 fracture clinic guideline increased from 82% to 89% (OR 1.9;  $p<0.001$ ). The proportion of VFC decisions made by a consultant-grade orthopaedic surgeon decreased from 97% to 96% (OR 1.4;  $p=0.002$ ). During lockdown, the rate of discharge without further follow-up significantly increased from 30% to 46% (OR 2.0;  $p<0.001$ ).

### Clinical outcome following VFC discharge

**Table 3** demonstrates the outcome for individuals discharged from the VFC with no subsequent intention for further face-to-face clinic review. There was no difference in the rate of unplanned reattendance for the pre-lockdown or lockdown cohorts (6% and 7% respectively,  $p=0.281$ ). For those who did then go on to attend fracture clinic (unplanned reattendance), there was no difference in rate of change in management (5% and 6% respectively,  $p=0.699$ ). Four individuals in the pre-lockdown and nine individuals in the lockdown group went on to have surgery after initial discharge from the VFC (0.2% and 0.4% respectively,  $p=0.301$ ).

### Patient satisfaction following direct VFC discharge (without face-to-face review)

The patient contact rate for the pre-lockdown group was 36% (671/1856) with a mean follow-up time of 18 months (range 17-20 months); while the patient contact rate for the lockdown group was 42% (856/2021) with a mean follow-up time of 6 months (range 5-8 months) (**Table 4**). The majority of patients in both groups (80% pre-lockdown and 76% lockdown) were satisfied with their management at the VFC ( $p=0.093$ ). With respect to patient preference for the management of their injury, 42% of patients in 2019 and 47% of patients in 2020 preferred to attend a face-to-face hospital appointment; 32% of patients in 2019 and 33% of patients in 2020 preferred to be managed through the VFC.

**Table 5** describes VFC management and patient outcomes split into two cohorts: satisfied ('satisfied' or 'very satisfied') or unsatisfied (including 'neither satisfied nor dissatisfied', 'dissatisfied' or 'dissatisfied') following VFC discharge without in-person review. At six months follow-up (lockdown cohort), patients directly discharged from the VFC were more likely to be satisfied with their treatment if they had received a phone call from the VFC (61% versus 45% with no phone call,  $p=0.001$ ), an injury-specific information leaflet (65% versus 47%,  $p<0.001$ ), or were aware of the VFC helpline in the event of any concern (69% versus 39%,  $p<0.001$ ). A similar trend was seen at 18 months follow-up (pre-lockdown) although there was no difference in satisfaction rate if patients had received a phone call from the VFC.

Other factors associated with dissatisfaction included missed injury at VFC review (lockdown cohort,  $p=0.035$ ), unplanned reattendance to hospital (pre-lockdown cohort,  $p<0.001$ ), change in management upon re-attendance (pre-lockdown cohort,  $p<0.03$ ), or if patients had to use the VFC helpline following discharge (pre-lockdown cohort,  $p<0.001$ ). Patients were more likely to recommend the VFC to others ( $p<0.001$ ) or prefer VFC to face-to-face clinic appointment ( $p<0.001$ ) if they were satisfied with their treatment at the VFC.

## DISCUSSION

This is the first national multicentre study to assess patient outcome and satisfaction with VFC management. VFC and its use is vital to the future of how trauma services interact with their patients. The lessons learned may not only help prepare the response to future disease outbreaks; but will also provide invaluable data on the evolution of the virtual management of orthopaedic trauma patients as we strive for a more cost-effective and centralised healthcare service.

This study demonstrated that the percentage of patients who were reviewed within 72 hours in VFC as per BOAST 7 guidelines increased from 82% to 89% during COVID-19 lockdown, while other studies have reported a compliance of 45% to 100%(9, 15, 16). The expansion of VFC capacity accelerated by the pandemic may help achieve this standard for more patients. Previous studies have reported that the implementation of a VFC reduces the overall number of referrals from the emergency department to traditional fracture clinics by 15% to 28%(4, 9, 17). A recent study by Anderson et al. demonstrated a 65% reduction in the number of face-to-face clinic appointments following implementation of the VFC(18).

The most striking finding of this study is that the percentage of direct discharge from VFC without physical review significantly rose from 30% to 46% during the pandemic. The discharge rate from VFC reported in the literature ranges from 26% to 63%(7, 9-11, 19). The increase in VFC discharge rate during the pandemic was largely driven by the focus on minimising face-to-face follow-up outpatient appointments as stipulated by the now archived COVID-19 BOAST guideline(12), rather than the changes in case-mix or lack of capacity in clinic.

Despite the 16% rise in direct discharge rate, there was no difference between the pre-pandemic and lockdown groups with respect to the rates of unplanned reattendances, missed injuries, complications or change in subsequent management plan. The low intervention rates following direct discharge reaffirm that the VFC model can be as safe as face-to-face follow-up and is effective in the management of minor stable injuries.

In this study, patient satisfaction was relatively static at 80% (pre-lockdown cohort) and 76% (lockdown cohort) compared with 90-97% reported in other studies(4, 11, 20-22). The discrepancy in satisfaction in this study versus the published literature may be due to the fact that only patients directly discharged from the VFC were given the satisfaction questionnaire in this study. Patient dissatisfaction was associated with an injury that was missed at VFC review, any unplanned reattendance, change in management plan, or the need to use the VFC helpline to raise a problem following discharge. Dissatisfaction was found to impact on recommendation of VFC services to friends and family. An emphasis on a 'Getting It Right First Time' (GIRFT) approach (23) with senior decision-making at initial VFC review to ensure accurate diagnosis and initial management could mitigate dissatisfaction, with effective plans in place to promptly review patients either remotely or in-person should they have any concerns following direct discharge.

This study also identified several other factors associated with dissatisfaction, including patients not receiving a phone call or injury-specific information leaflet or being unaware of the VFC helpline in the

event of a concern. This reiterates the importance of an effective patient interface as a vital part of the VFC. A systematic review into virtual clinics in a variety of medical specialties showed that improved communication and improved self-management advice are positively associated with patient satisfaction(24). Chapman et al.(8) reported that 40% of fifth metatarsal fractures which were initially planned for virtual discharge were sent clinic appointments following telephone review. This highlights telephone review as an essential part of the VFC service as a safety net to minimise the risk of occult symptoms or patients concerns which may not be evident in the initial radiographs or emergency department documentation. Individuals should also be given timely written patient information about their injury and an easily accessible point of contact so they can ask questions or seek advice without necessarily having to attend hospital. As such, many VFCs have developed online patient information and care packs with advice about the relevant injury and any rehabilitation exercises required to help patients self-manage their injuries(25-27).

Strengths of this study include its large sample size and multi-centre recruitment, thus minimising bias from any one region across the UK. In addition to this, this study is unique in its collection of multicentre prospective data on patient outcome and satisfaction, its patient and public involvement during development and a published study protocol. This study is pragmatic and accounts for variation in local clinical practice, which improves the external validity of the results. There are no previous multicentre studies assessing VFC outcomes, and none relating to the changes from the COVID-19 pandemic.

This study has several limitations including the relatively low contact rates (36% and 42% of potential cohorts) and different follow-up periods between groups for the telephone questionnaire. Although there was no difference in reattendance or complication rates, the threshold for intervention between the pre-pandemic and lockdown group may be different and the three-month follow-up may not have captured all late sequelae of trauma. Nonetheless, the rate of unplanned reattendance following direct discharge in this study of 6% before the pandemic and 7% during the pandemic, and conversion to surgery of 0.2% before the pandemic and 0.4% during the pandemic, are both comparable to those in literature. Mackenzie et al.(3) reported in a study of 6,688 patients with a mean follow-up time of 54 months that 6% of patients reattended fracture clinic and 0.2% underwent a surgical intervention following virtual discharge. A study of 17,269 patients by Dey et al.(7) showed 7.5% reattended fracture clinic and overall 0.1% required surgery following virtual discharge.

In conclusion, despite a large rise in direct discharge from VFC during the COVID-19 pandemic, there was no significant change in unplanned reattendance, complications or patient satisfaction. Patient satisfaction was generally lower than the published rates in the literature, but this may reflect sampling of those patients discharged without face-to-face review only. Patients directly discharged from the VFC were more likely to be satisfied if they had received a phone call from the VFC, an injury-specific information leaflet, or were aware of the VFC helpline in the event of any concern. Other factors associated with dissatisfaction included missed injury at VFC review, unplanned reattendance to hospital or a change in management upon re-attendance. This suggests that an important aspect of VFC practice that patients value is being provided with a source where further

information regarding their injury and management can be obtained, and an efficient point of contact in case they had specific questions not provided in the standardised information leaflet. It also reinforces the value of the GIRFT approach, as a correct initial diagnosis and management strategy appears to be one of the most effective means of ensuring patients are satisfied with their VFC care pathway. In comparison to face-to-face follow-up, VFC services are safe and lead to satisfied patients; however several factors are associated with dissatisfaction and should be under key consideration moving forward.



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TABLE LEGENDS

**Table 1.** Patient and injury characteristics pre-lockdown *versus* lockdown.

**Table 2.** Virtual fracture clinic management pre-lockdown *versus* lockdown.

**Table 3.** Three-month outcomes following VFC discharge without face-to-face clinic review pre-lockdown *versus* lockdown.

**Table 4.** Telephone questionnaire results following VFC discharge pre-lockdown *versus* lockdown.

**Table 5.** VFC management and patient outcomes by overall satisfaction response.

**Table 1.** Patient and injury characteristics pre-lockdown *versus* lockdown.

	May 2019 (n=6134)	May 2020 (n=4366)	OR/ difference (95% CI)	p-value <sup>†</sup>
<b>Mean age at VFC, years (SD)</b>	48.7 (20)	50.7 (20)	2.0 (1.2 to 2.8)	<b>&lt;0.001*‡</b>
<b>Gender, n (%)</b>				
Male	2934 (48)	1968 (45)	1.1 (1.0 to 1.2)	<b>0.005*</b>
Female	3200 (52)	2398 (55)		
<b>Mechanism of injury, n (%)</b>				
Fall from standing height or less	2443 (40)	1906 (44)	1.2 (1.1 to 1.3)	<b>&lt;0.001*</b>
Fall downstairs	255 (4)	220 (5)	1.2 (1.0 to 1.5)	<b>0.032*</b>
Fall from height < 2 metres	238 (4)	185 (4)	1.1 (0.9 to 1.3)	0.359
Fall from height > 2 metres	67 (1)	73 (2)	1.5 (1.1 to 2.2)	<b>0.011*</b>
Pedestrian road traffic accident	22 (0.4)	4 (0.1)	0.3 (0.9 to 0.7)	<b>0.007*</b>
Cyclist accident	196 (3)	380 (9)	2.9 (2.4 to 3.4)	<b>&lt;0.001*</b>
Motorcyclist accident	105 (2)	63 (1)	0.8 (0.6 to 1.2)	0.279
Motor vehicle accident	58 (1)	17 (0.4)	0.4 (0.2 to 0.7)	<b>&lt;0.001*</b>
Sports	836 (14)	222 (5)	0.3 (0.3 to 0.4)	<b>&lt;0.001*</b>
Assault	119 (2)	89 (2)	1.1 (0.8 to 1.4)	0.718
Direct blow or crush	518 (8)	346 (8)	0.9 (0.8 to 1.1)	0.340
Other traumatic mechanism	460 (7)	284 (7)	0.9 (0.7 to 1.0)	0.050
Atraumatic	326 (5)	188 (4)	0.8 (0.7 to 1.0)	<b>0.018*</b>
Unknown	491 (8)	389 (9)	1.1 (1.0 to 1.3)	0.099
<b>Place of injury</b>				
Home	1595 (26)	1604 (37)	1.7 (1.5 to 1.8)	<b>&lt;0.001*</b>
Outdoor public space	1965 (32)	1265 (29)	0.8 (0.7 to 0.9)	<b>&lt;0.001*</b>
Public building	198 (3)	32 (1)	0.2 (0.2 to 0.3)	<b>&lt;0.001*</b>
Workplace	262 (4)	163 (4)	0.9 (0.7 to 1.1)	0.168
Nursing home	46 (1)	38 (1)	1.2 (0.8 to 1.8)	0.493
Other	255 (4)	62 (1)	0.3 (0.3 to 0.4)	<b>&lt;0.001*</b>
Unknown	1813 (30)	1202 (28)	0.9 (0.8 to 1.0)	<b>0.024*</b>

\*Significant, p&lt;0.05.

†Chi-squared test.

‡Independent-samples *t*-test.

OR, odds ratio; CI, confidence interval; SD, standard deviation; VFC, virtual fracture clinic.

**Table 2.** Virtual fracture clinic management pre-lockdown *versus* lockdown.

	May 2019 (n=6134)	May 2020 (n=4366)	OR/ difference (95% CI)	p-value <sup>†</sup>
<b>VFC within three days following presentation of injury, n (%)</b>				
≤3 days**	5003 (82)	3883 (89)	1.9 (1.7 to 2.2)	<0.001*
>3 days	967 (16)	388 (9)		
Unknown	164 (3)	95 (2)		
<b>Staff making decisions at VFC, n (%)</b>				
Consultant	5968 (97)	4201 (96)	0.7 (0.6 to 0.9)	0.002*
Other	166 (3)	165 (4)		
<b>VFC management</b>				
Discharge	1856 (30)	2021 (46)	2.0 (1.9 to 2.2)	<0.001*
Follow up	4201 (68)	2279 (52)		
Inappropriate referral to VFC	77 (1)	66 (2)	1.2 (0.9 to 1.7)	0.264

\*\*Recommendation from BOAST 7 fracture clinic guideline(5).

\*Significant, p<0.05.

†Chi-squared test.

OR, odds ratio; CI, confidence interval; VFC, virtual fracture clinic.

**Table 3.** Three-month outcomes following VFC discharge without face-to-face clinic review pre-lockdown *versus* lockdown.

	May 2019 (n=1856)	May 2020 (n=2021)	p-value <sup>†</sup>
<b>Unplanned re-attendances to hospital for initial injury, n (%)</b>	117 (6)	145 (7)	0.281
Due to			
Pain or concern	103 (6)	130 (6)	
Plaster or splint issue	13 (1)	14 (1)	
Wound problem	1 (0.1)	1 (0.1)	
<b>Missed injury, n (%)</b>	16 (1)	15 (1)	0.671
<b>Complications, n (%)</b>	3 (0.2)	5 (0.2)	0.815§
<b>Change in management upon re-attendance to hospital, n (%)</b>			
No change	88 (5)	112 (6)	0.699
Change	29 (2)	33 (2)	
Plaster/splint/sling change	22 (1)	21 (1.0)	0.348
Operative treatment	4 (0.2)	9 (0.4)	0.301
Intra-articular steroid injection	2 (0.1)	1 (0.1)	0.588§
Antibiotics only	1 (0.1)	2 (0.1)	1§

\*Significant, p<0.05.

<sup>†</sup>Chi-squared test.

§Fisher's exact test.

OR, odds ratio; CI, confidence interval; VFC, virtual fracture clinic.

**Table 4.** Telephone questionnaire results following VFC discharge pre-lockdown versus lockdown.

	May 2019 (n=671)	May 2020 (n=856)	OR/ difference (95% CI)	p-value <sup>†</sup>
<b>Mean follow-up time (range) (months)</b>	18 (17 to 20)	6 (5 to 8)	N/A	N/A
<b>Satisfaction with VFC, n (%)</b>				
Yes	536 (80)	653 (76)	0.8 (0.6 to 1.0)	0.093
No	135 (20)	203 (24)		
<b>Would have preferred face-to-face clinic to VFC, n (%)</b>				
Face-to-face fracture clinic	281 (42)	406 (47)	1.1 (0.9 to 1.4)	0.454
VFC	212 (32)	280 (34)		
No preference	178 (27)	170 (20)	0.7 (0.5 to 0.9)	0.002*

\*Significant,  $p < 0.05$ .

<sup>†</sup>Chi-squared test.

OR, odds ratio; CI, confidence interval; VFC, virtual fracture clinic; N/A, not applicable.

**Table 5.** VFC management and patient outcomes by overall satisfaction response.

	Pre-lockdown cohort <sup>‡</sup>				Lockdown cohort <sup>‡</sup>			
	Satisfied (n=536)	Not satisfied (n=192)	OR/ difference (95% CI)	p-value <sup>†</sup>	Satisfied (n=653)	Not satisfied (n=117)	OR/ difference (95% CI)	p-value <sup>†</sup>
<b>Staff making decisions at VFC, n (%)</b>								
Consultant	531 (99)	187 (97)	2.8 (0.8 to 10)	0.140§	641 (98)	117 (100)	0	0.230§
Other	5 (1)	5 (3)			12 (2)	0		
<b>Discharge method, n (%)</b>								
Received phone call from VFC	258 (48)	96 (50)	0.9 (0.7 to 1.3)	0.655	399 (61)	53 (45)	1.9 (1.3 to 2.8)	<b>0.001*</b>
Received information leaflet	323 (60)	93 (48)	1.6 (1.2 to 2.2)	<b>0.005*</b>	427 (65)	55 (47)	2.1 (1.4 to 3.2)	<b>&lt;0.001*</b>
Patient aware of VFC helpline	323 (60)	90 (47)	1.7 (1.2 to 2.4)	<b>0.001*</b>	452 (69)	46 (39)	3.5 (2.3 to 5.2)	<b>&lt;0.001*</b>
<b>Outcome following discharge, n (%)</b>								
Unplanned re-attendance to hospital for initial injury	40 (7)	36 (19)	0.3 (0.2 to 0.6)	<b>&lt;0.001*</b>	56 (9)	15 (13)	0.6 (0.3 to 1.2)	0.144
Missed injury	8 (1)	4 (2)	0.7 (0.2 to 2.4)	0.741§	5 (1)	4 (3)	0.2 (0.1 to 0.8)	<b>0.035*§</b>
Complications	1 (0.2)	2 (1)	0.2 (0 to 2.0)	0.172§	2 (0.3)	1 (1)	0.4 (0 to 4.0)	0.391§
Change in management upon re-attendance	15 (3)	12 (6)	0.4 (0.2 to 0.9)	<b>0.030*</b>	11 (2)	4 (3)	0.5 (0.2 to 1.5)	0.264§
Used VFC helpline	23 (4)	41 (21)	0.2 (0.1 to 0.3)	<b>&lt;0.001*</b>	70 (11)	12 (10)	1.1 (0.6 to 2.0)	0.888
<b>Attitudes towards VFC</b>								
Would you recommend VFC to friends and family, yes (%)	501 (93)	55 (29)	9.6 (5.6 to 16.5)	<b>&lt;0.001*</b>	595 (91)	36 (31)	23.1 (14.3 to 37.2)	<b>&lt;0.001*</b>
Would you have preferred VFC to face-to-face clinic appointment, yes (%)	200 (37)	25 (13)	4.0 (2.5 to 6.3)	<b>&lt;0.001*</b>	247 (38)	11 (9)	5.9 (3.1 to 11.1)	<b>&lt;0.001*</b>

<sup>‡</sup>The mean follow-up time was 18 months for the pre-lockdown cohort and 6 months for the lockdown cohort respectively.

\*Significant, p<0.05.

<sup>†</sup>Chi-squared test.

§Fisher's exact test.

OR, odds ratio; CI, confidence interval; VFC, virtual fracture clinic.



## FIGURE LEGENDS

**Figure 1.** Telephone questionnaire and associated scoring system.

**Figure 2.** Virtual fracture clinic services recruited in the UK.

**Figure 3.** Flowchart showing the inclusion of study participants.

**Figure 4.** Site of injury pre-lockdown (n=6221) *versus* lockdown (n=4431).

1	Rate your pain when you first came into hospital with your injury in [month-year] on a scale from 0 to 10. 0 being no pain and 10 being the worst pain imaginable.	0 / 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10
2	Rate your pain now on average for the injury you had.	0 / 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10
<b>Regarding your treatment in the virtual fracture clinic for your injury:</b>		
3	How well did your orthopaedic treatment relieve your pain?	Very good / Good / Neither good nor poor / Poor / Very poor
4	How well did your orthopaedic treatment increase your ability to perform regular activities? [If patient asks, give example of writing, walking up the stairs etc.]	Very good / Good / Neither good nor poor / Poor / Very poor
5	How well did your orthopaedic treatment allow you to perform heavy work or sport activities?	Very good / Good / Neither good nor poor / Poor / Very poor
6	How satisfied are you with the virtual fracture clinic?	Very satisfied / Satisfied / Neither satisfied nor dissatisfied / Dissatisfied / Very dissatisfied
7	Thinking about the virtual fracture clinic, how was your experience of our service?	Very good / Good / Neither good nor poor / Poor / Very poor / Don't know
8	How likely are you to recommend the virtual fracture clinic to friends and family if they needed similar care and treatment?	Extremely likely / Likely / Neither likely nor unlikely / Unlikely / Extremely unlikely / Don't know
9	Would you have preferred the virtual fracture clinic or to attend a face-to-face hospital appointment for the injury you had?	Virtual fracture clinic / Face-to-face appointment / No preference
10	Did you receive an information leaflet relevant to your injury when you were first discharged from A&E / Minor Injuries Unit in [month-year]?	Yes / No / Not sure
11	How satisfied were you with the information on the leaflet?	Very satisfied / Satisfied / Neither satisfied nor dissatisfied / Dissatisfied / Very dissatisfied / Not applicable
12	Did you receive a telephone call from the hospital just after your injury in [month-year]?	Yes / No / Not sure
13	How satisfied were you with the information provided over the phone?	Very satisfied / Satisfied / Neither satisfied nor dissatisfied / Dissatisfied / Very dissatisfied / Not applicable
14	Were you aware that there was a helpline number to contact if you encountered problems?	Yes / No
15	Did you ever contact the virtual fracture clinic for further advice after being discharged?	Yes / No / Not sure
16	Did you visit your GP or return to hospital for your injury after being discharged?	GP / Hospital / GP and hospital / No
17	[If re-attended] What was the main reason of re-attendance?	Pain or concern (not due to a further episode of trauma) / Pain or concern (due to a further episode of trauma) / Conservative management (e.g. plaster/splint/sling) problem / Unable to manage at home / Wound problem
18	[If re-attended] When did you first return to GP or hospital?	Within / after three months following initial discharge
19	Is there anything about the virtual fracture clinic that would have made your experience better?	Free text

Figure 2. Virtual fracture clinic services recruited in the UK.

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Figure 3. Flowchart showing the inclusion of study participants.

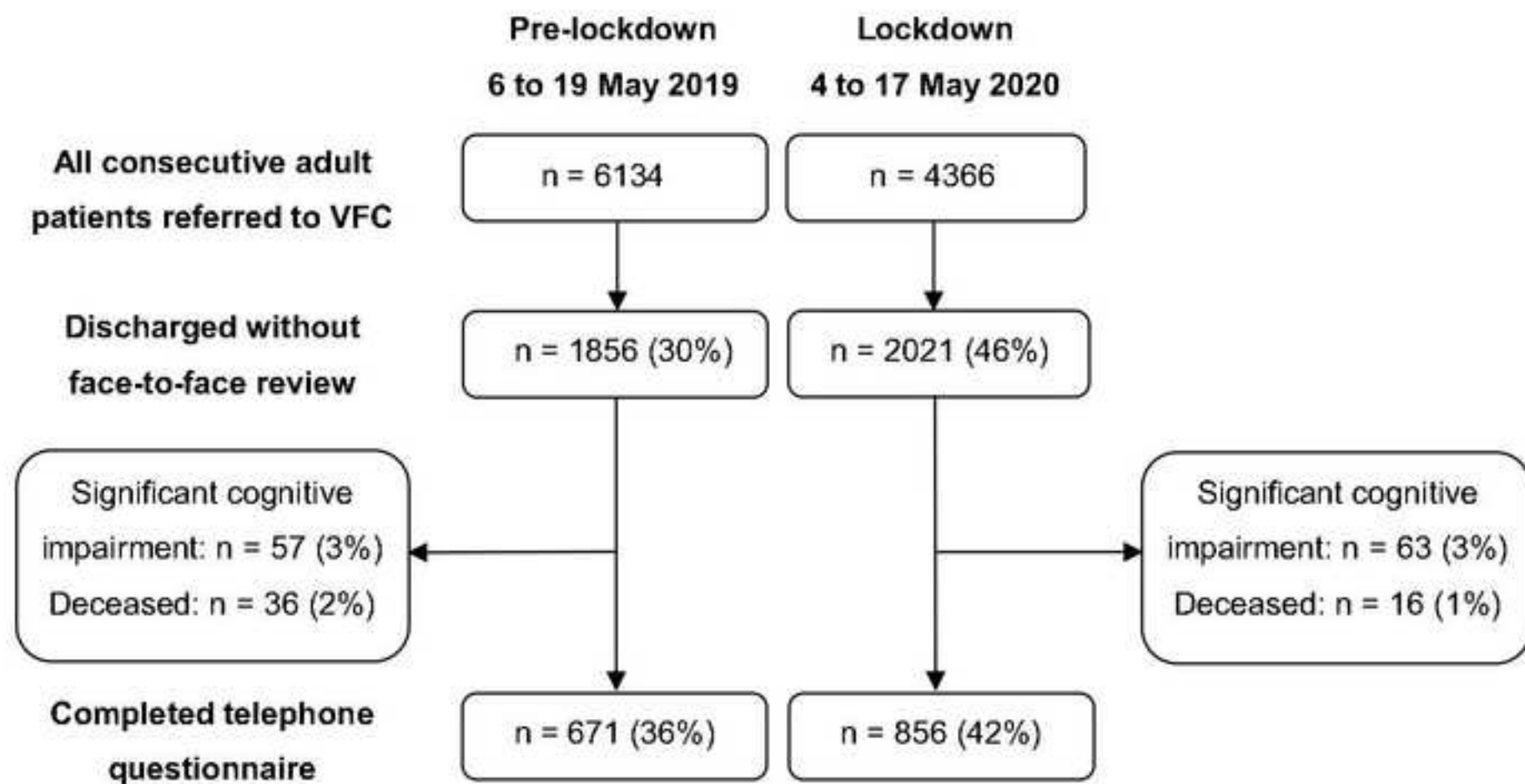
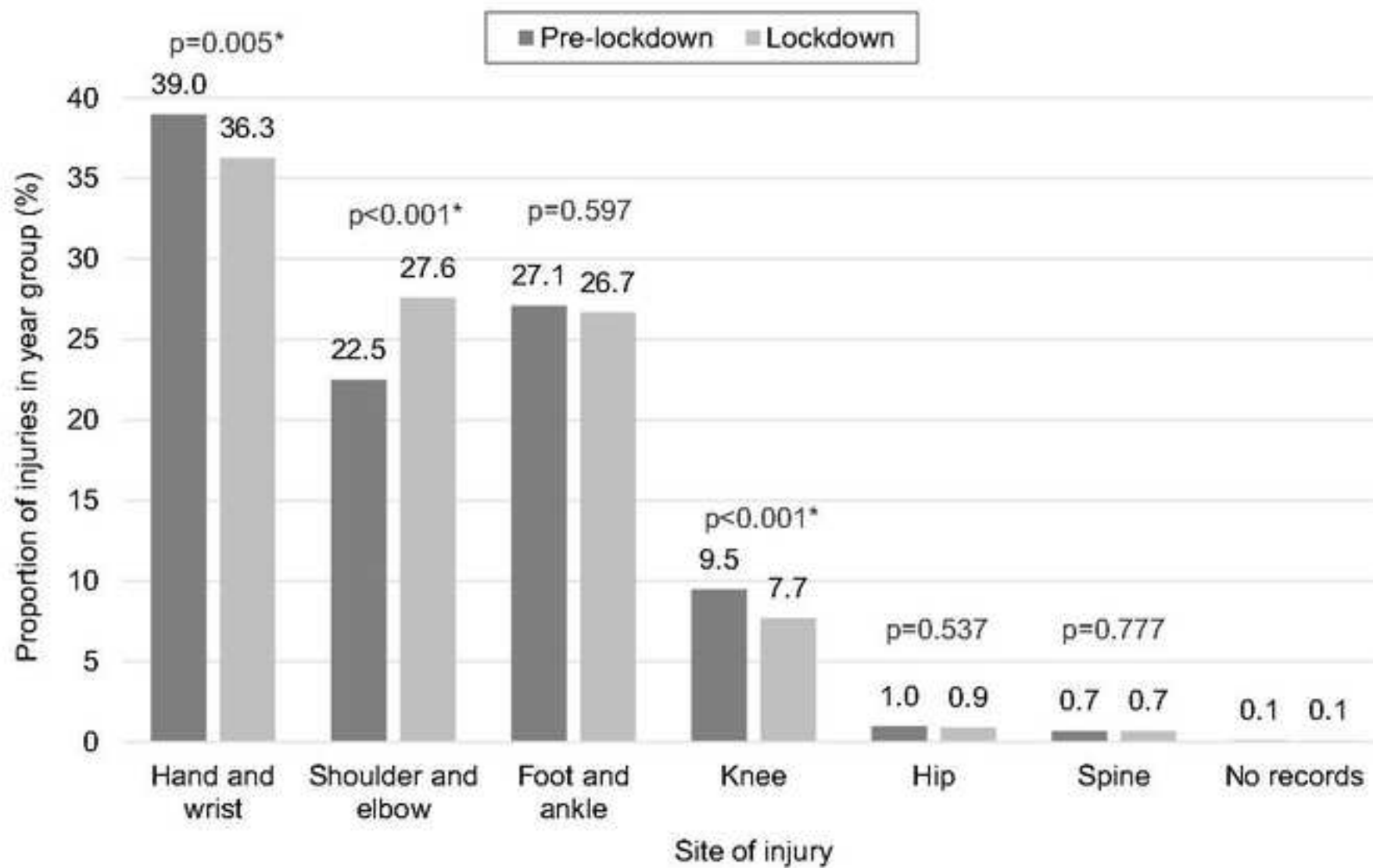


Figure 4. Site of injury pre-lockdown (n=6221) versus lockdown (n=4431).

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\*Significant,  $p<0.05$ .  
p-value using chi-squared test.



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### **The MAVCOV Steering Committee and Writing Group consists of:**

Zhan H. Ng, MRCS

Samantha Downie, FRCS (Tr&Orth)

Navnit S. Makaram, MSc, MRCS (Ed)

Shivam N. Kolhe, MBBS, MRes

Samuel P. Mackenzie, MD, FRCS (Tr&Orth)

Nick D. Clement, MD, PhD, FRCS (Tr&Orth)

Andrew D. Duckworth, PhD, FRCS (Tr&Orth)

Tim O. White, MD, FRCS (Tr&Orth)

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Aberdeen Royal Infirmary: Jonathon Brown, Jun Wei Lim, Matthew Smith, Nicole Lau

Addenbrooke's Hospital: Achi Kamaraj, Andrew Zhou, Jiang An Lim, Lydia Jenkins, Maria Tennyson,  
Wasim Khan

Barnet Hospital: Amy Foster, Catharine Rutherford, Nikita Nathoo, Peter Domos, Thomas Padwick,  
William White

Basildon University Hospital: Andrew Robinson, Anuhya Vusirikala, David Ensor, Maheswara Akula,  
Vikram Vignaraja

Brighton and Sussex University Hospitals: Benedict Rogers, Fatemeh Kalabi, Gareth Chan, Jacob  
Clayton-Yeomans, James Gibbs, Rachel Titheradge, Stefano Spalvieri

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Ealing Hospital: Daniel Shaerf, Hamza Sheikh, Mark Poustie, Sumnima Rai, Umesh Birole

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Pravinkumar, Saira Baig

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Great Western Hospital: Anisha Mangtani, Devon Brameier, Jemma Rooker, Mohammed Azher Anwer, Nakulan Nantha Kumar, Ryan Lam

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Queen's Hospital Romford: David Ferguson, John Hambidge, Lilanthi Wickramarachchi



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Raigmore Hospital: Adeline Clement, Catriona Gibb, Joaquim Goffin, Murtadhah Jalal

Royal Berkshire Hospital: Billy Leung, Gregory Neal-Smith, Harman Khatkar, Mark Maher, Neville Davies, Tariq Aboelmagd

Royal Bolton Hospital: Jeremy Jarrat, Joseph McKay, Matthew Walmsley, Michael Greenhalgh, Olivia McCabe-Robinson

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Sandwell Hospital: Akshara Sharma, Alyssa van der Broeck, Laura Hartley, Marguerite O'Riordan, Sreenadh Gella

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