Kidney Care in London Virtual After-Action Review: Reflections on managing COVID-19

1st July 2020 @ 9:30 am - 4:30 pm

Aim of the day: To capture experience and learning from the first COVID surge to help renal teams plan for living with COVID safely and sustainably.

Output of the day: A Pan London report that provides practical guidance to clinical teams to help create a more resilient service before the next surge.

South London Renal Clinical Alliance
North London Kidney Advisory Group

Topic: Renal teams supporting AKI in the critically ill patient

Chair: Professor Claire Sharpe (KCH)

Purpose of the session:

- To reflect on the clinical collaboration between Critical Care and Nephrology teams and share practice from across London.
- Front line clinical teams will discuss local approaches to clinical management of AKI in critical care and explore options for reaching consensus on best practice.

Panel:

- Dr Rafik Bedair & Dr Daniel Jones (STG)
- Dr Chris Kirwan (Barts)
- Dr Marlies Ostermann (GSTT)
- Elaine Bowes & Dr Hugh Cairns (KCH)
- Dr Neil Duncan (Imperial)

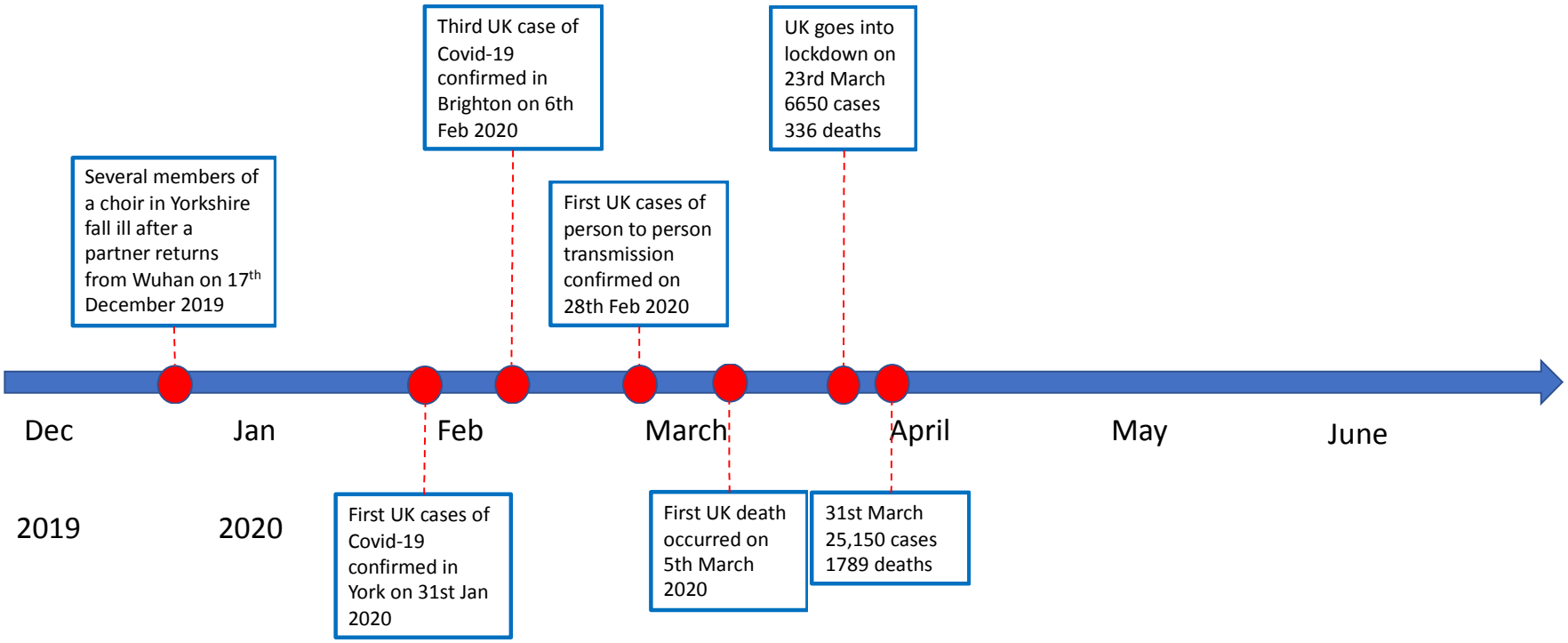
- Each of the units in London will share their local story of how Critical Care and Nephrology teams worked in partnership to manage AKI during the first COVID surge.
- Dr Jenny Cross
- Dr Ginny Quan

Professor Claire Sharpe

Kings College Hospital

Renal teams supporting AKI in the critically ill patient

THE UK TIMELINE

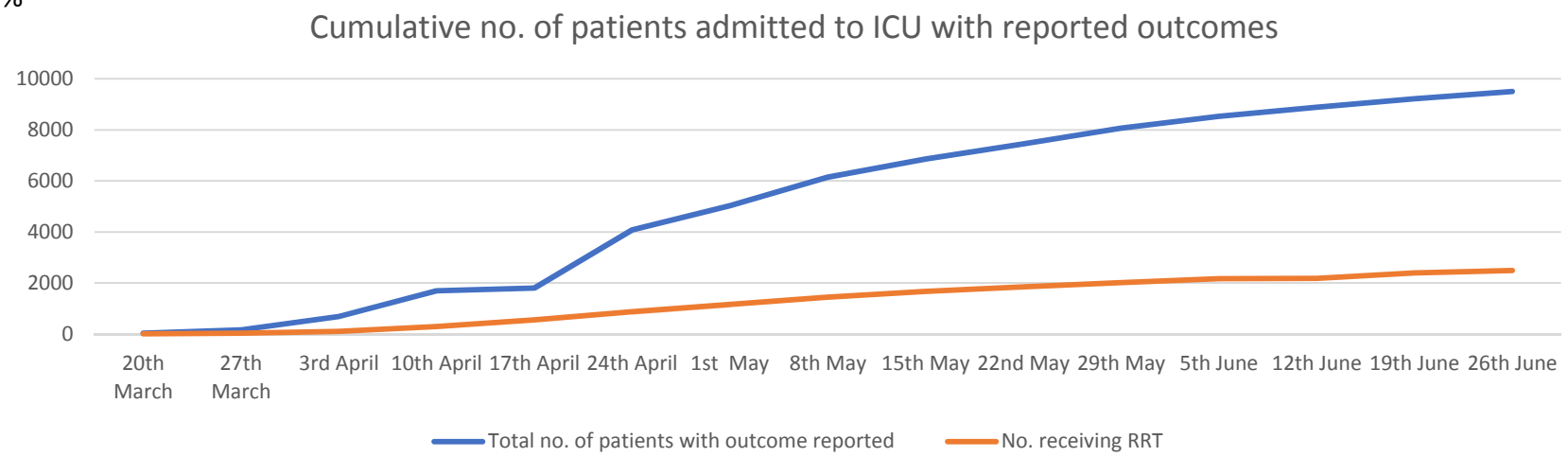


icnarc intensive care national audit & research centre
25 years and counting...
Napier House
24 High Holborn
London WC1V 6AZ
email: COVID-19@icnarc.org
www.icnarc.org

ICNARC report on COVID-19 in critical care

Mortality rate of those receiving renal replacement therapy up to 26th June 59%

Approximately 26% ICU patients have received RRT across the UK but this has ranged from 5% to 75% regionally.



No of patients admitted to ICU	196	775	2249	3883	5578	6720	7542	8250	8699	9026	9347	9623	9777	9949	10130
Total no. of patients with outcome reported	33	165	690	1689	1795	4078	5027	6143	6860	7447	8062	8533	8891	9217	9505
No. receiving RRT	4	28	107	294	558	870	1163	1448	1670	1848	2011	2164	2179	2393	2488

An Overlooked, Possibly Fatal Coronavirus Crisis: A Dire Need for Kidney Dialysis

The New York Times

18th April 2020

Ventilators aren't the only machines in intensive care units that are in short supply. Doctors have been confronting an unexpected rise in patients with failing kidneys.

NHS limits dialysis supplies for coronavirus patients

The Guardian

NHS England sends out emergency guidance following a shortage of dialysis fluids

23rd April, 2020

Given the high demand for renal replacement therapy in patients on ICU, how should we manage them?

Publications approval reference: 001559

Specialty guides for patient management during the coronavirus pandemic

Clinical guide for renal replacement therapy options in critical care during the coronavirus pandemic

15 April 2020 Version 1.1

"The need to provide renal replacement therapy (RRT) to an increasing number of critically ill patients is likely to exceed machine capacity."

The following options may be considered, based on local availability, equipment, supplies, staffing and local expertise.

	CRRT	Intermittent RRT	PD
Requirements	A machine Dual lumen venous access Anticoagulation Consumables Prepared fluids Trained staff	A machine Dual lumen venous access Anticoagulation Consumables Water via a RO (most HD equipment) Trained staff	A soft PD catheter An operator to place the PD tube Peritoneal dialysis fluid Optional – an automated PD machine with consumables Connection, shields Trained staff
Modes (see below)	CVVH CVVHD CVVHDF	IHD IHDF SLED PIRRT	CAPD (manual exchanges) APD
Access to circulation	Dual lumen Right then left internal jugular preferred	Dual lumen	Not required
Anticoagulation	Regional: citrate Regional/systemic: heparin Systemic: epoprostenol	Regional: citrate Regional/systemic: heparin/LMWH Systemic: epoprostenol	Not required

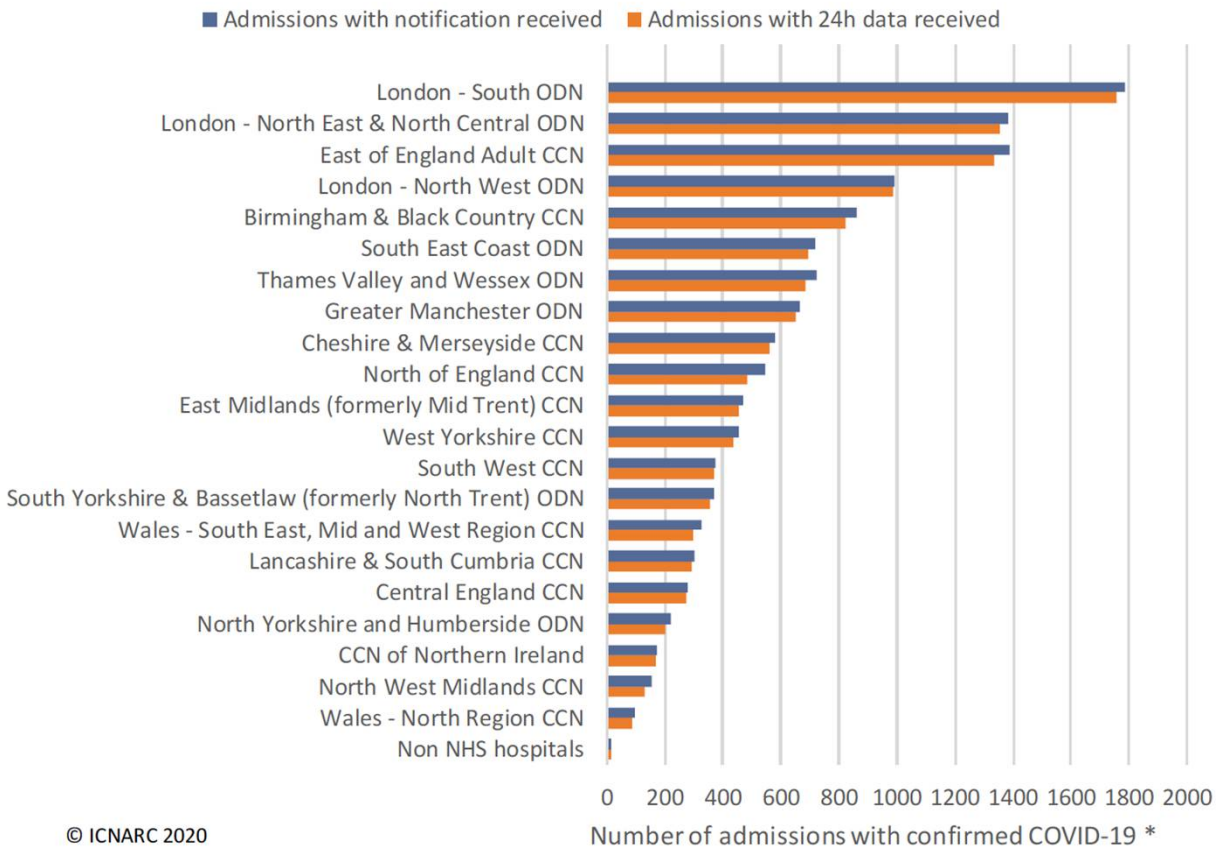


Figure 6 Number of admissions critically ill with confirmed COVID-19 by Critical Care Network *

Dr Daniel Jones
Dr Rafik Badair

St Georges Hospital

17th March

St George's Surge Planning for Renal Replacement Therapy

27th April

Renal replacement therapy assessment for St George's, predicted demand requirements and options appraisal for COVID 19 surge plan

Observations from limited reported data regarding kidney involvement in COVID 19 infected patients

The incidence of acute kidney injury stage 3 requiring renal replacement therapy (RRT) in COVID-19 infection has been estimated to be in the region of 3-15% in the more severe cases particularly in those requiring ventilation or heart failure. The mortality in this cohort has been high.

COVID-19 also is associated with a kidney injury causing proteinuria and non-visible haematuria without the need for renal replacement therapy but this is unlikely to cause an acute problem.

Current capacity at St George's to provide renal replacement therapy on critical care and wards

ITU capacity

If ventilator capacity on site is increased to 200 patients then you may estimate that an additional 6 patients would need RRT and this number would slowly grow. If this is increased to 400 ventilated beds, then it would be 12. There is no data to model the cumulative increase in the demand in RRT but it is likely that those who require such support will either deteriorate quickly and die or have a prolonged critical care admission.

Haemofiltration techniques are a continuous process so whilst there can be some temporary cessation of treatment the current capacity of 18 haemofiltration machines would only treat a similar number of patients and will be insufficient.

Assessment: Current critical capacity is insufficient to meet possible demand.

Step down (ward) capacity

A number of patients who recover respiratory independence and will continue to require r treatment therapy and to maximise access to ventilator capacity it will be important to s patients with renal failure to the renal service.

ities in the renal service are located on Champneys war stations which can treat 24 patients each day

Phased implementation of alternative renal replacement therapy in St George's critical care to mitigate risks of shortage in haemofiltration consumables

COVID-19 has placed a significant demand on renal replacement therapy in Critical Care units nationally. Critical Care departments across London have seen a substantial increase in the use of haemofiltration, with approximately 30% of critically ill COVID-19 patients needing renal replacement therapy. This rise in demand now outstrips:

- The total number of haemofiltration machines available
- Suppliers' ability to maintain supply of consumables

This risk was anticipated by the Renal and Critical Care teams at St. George's University Hospitals with support from Estates, Medical Physics and Procurement, steps have been taken to mitigat These steps include:

- Expansion of inpatient haemodialysis capacity through installation of a new ring main supply
- Securing additional reverse osmosis systems
- Ordering additional loan haemofiltration machines (existing capacity was 16 fix additional 16 have been ordered with staggered delivery expected)
- Installation of infrastructure to allow haemodialysis in Critical Care units (details

Expansion of intermittent haemodialysis capacity is seen as the most resilient option be dependent on proprietary consumables and has more reliable supply chains. Outlined of deployment of additional haemodialysis capacity for both immediate and longer-te

Technical developments:

Phase 1 (Current position)

The following work has already completed this month:

1. Renal unit has increased dialysis capacity to manage those with single kidney injury requiring intermittent haemodialysis to be managed units. This is for both COVID-19 positive and negative patients. Th patients with kidney failure alone to enter critical care and provid those who recover from a critical illness and require on-going rena

Additional capacity for non-ITU patients – up to 15 stations (up to 45 patient treatments per day).

2. The Trust has supported the Critical Care units with the installation of four Thames Water points and the Renal service has provided two intermittent haemodialysis machines and portable water treatment systems to provide intermittent haemodialysis to patients in the critical care unit (currently CTICU). The first patient received treatment on Sunday 19th April.

Additional ITU capacity – 4 stations up to 12 patients treatments per day (current use only in region of 2-3 patient treatments per day). Rotating patients to these points is proving difficult and therefore alternatives that allow extension of the hosing and movement of the equipment to more bed spaces have been considered and developed.

Phase 2 (Softened Water at source and portable reverse osmosis at bed sides in CTICU and Neuro ICU) – operational from 27th April 2020

At present water treatment is provided at the bedside but the ability to upscale this is limited and therefore the Thames Water source will receive pre-treatment centrally for this next phase of expansion allowing critical care to utilise intermittent haemodialysis with portable reverse osmosis machines to more bedsides.

Additional ITU capacity – 8 haemodialysis machines (4 haemodialysis machines in each of CTICU and Neuro ICU (treats 12 patients without rotation daily or 24 patients with rotation of beds).

Phase 3 (Non-COVID-19 General ICU) – operational w/c 27th April

Portable softener systems and the use of portable reverse osmosis machines already acquired in phase 1 will be installed in GICU to allow intermittent haemodialysis to be performed in GICU to meet the needs for those patients in the region who require renal support within a critical care environment who do not have COVID-19.

Additional capacity – 1-3 systems providing 3-9 treatments daily

Phase 4 (Reverse osmosis and softened water in AMW wing plant room) – operational in approx. 4 months

The installation of a large reverse osmosis machine to service in the region of 15-20 dialysis points (can be increased) in CTICU, Neuro ICU and [redacted] ward provides better long-term resilience and reduces the need for portable reverse osmosis units in the Critical Care setting. Installation of such systems requires around 12-16 weeks of works and water testing and therefore provides a sustainable future solution rather than an immediate one.

Final CT ICU & Neuro ICU capacity – 16 stations capable of delivering a maximum of 48 treatments per day with bed rotations

Dr Daniel Jones, Renal Consultant
21st April 2020

27th March
Models became available from Renal Alliance collaboration with Public Health England & London School of Hygiene and Tropical Medicine

Haemodialysis COVID19 Progression modelling: Higher Transmission Scenario

Current and projected COVID19+ HD Patients

	Observed	Model				
	Mon 23rd March	**Monday 30th March**	**Monday 6th April**	**Monday 13th April**	**Monday 20th April**	**Monday 27th April**
COVID19+ Inpatient HD patients	4	13	33	46	41	32

Confirmed our local concern that iHD capacity would be overwhelmed

St George's Renal Team

Managing existing chronic iHD population

Supporting an expanding critical care with their RRT plans

Rapid flexible phased response

Phase 1

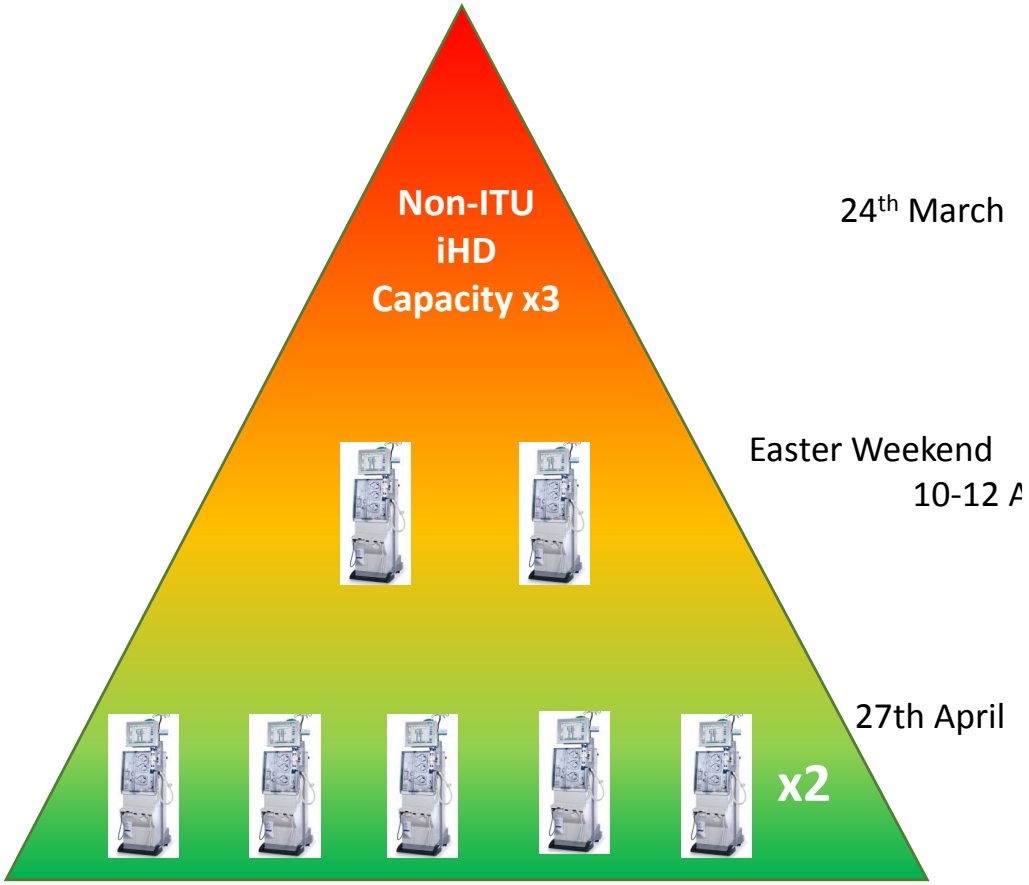
- Secure additional portable RO units
- Expand soft water loop in renal ward

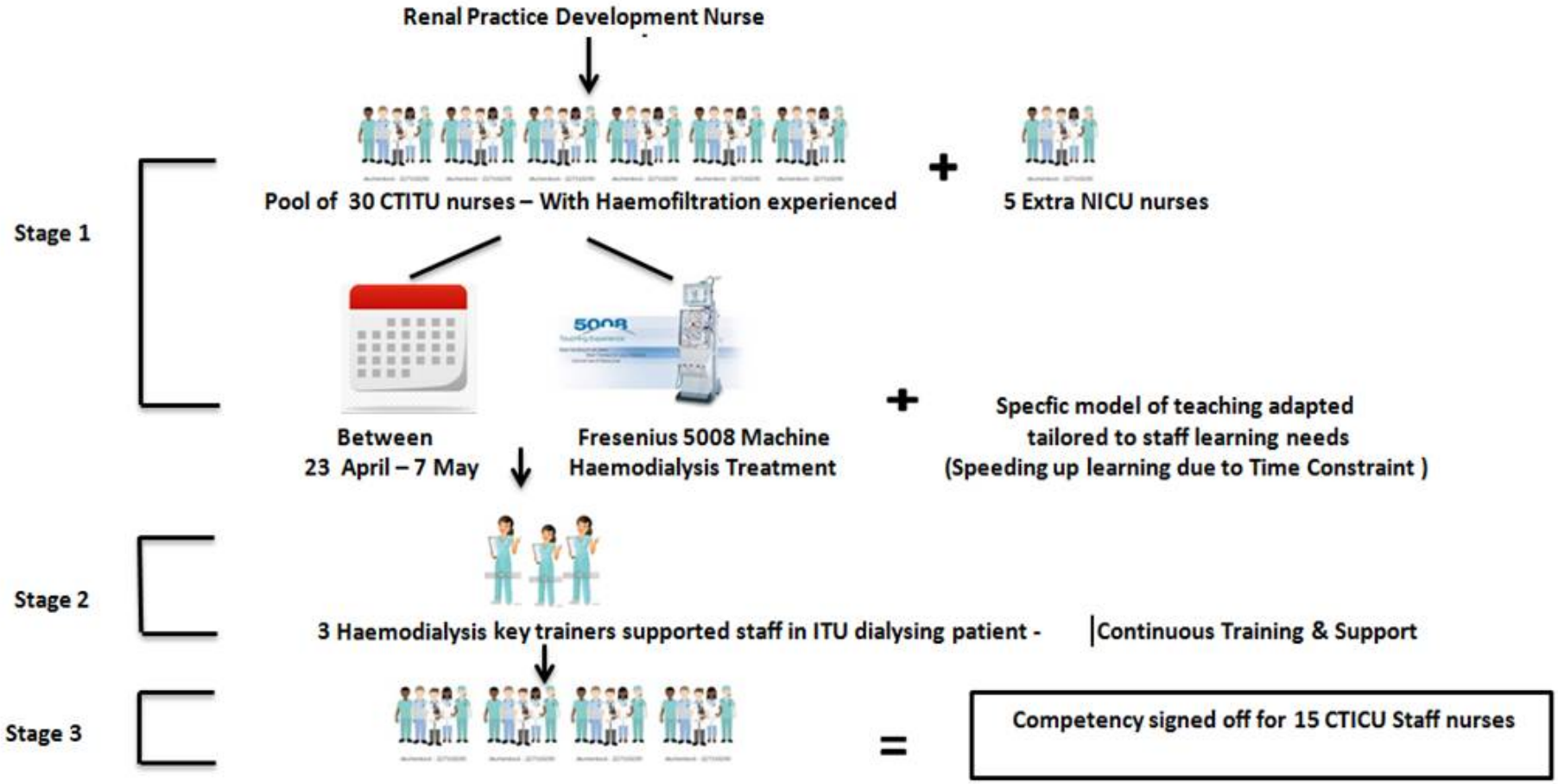
Phase 2

- Thames Water supply to ITU
- Drain
- Portable iHD water system

Phase 3

- Softened water to ITU
- Multiple/flexible RO units in ITU across 2 floors




Renal Practice Development Nurse
Stage 1
Pool of 30 CTITU nurses – With Haemofiltration experienced
5 Extra NICU nurses
Between
23 April – 7 May
Fresenius 5008 Machine
Haemodialysis Treatment
Specfic model of teaching adapted
tailored to staff learning needs
(Speeding up learning due to Time Constraint)
Stage 2
3 Haemodialysis key trainers supported staff in ITU dialysing patient -
Continuous Training & Support
Stage 3
Competency signed off for 15 CTICU Staff nurses

How did we select patients for intermittent HD?

- ICU Consultant already in place as a clinical lead for renal replacement therapy (RRT)
- 3 Main ITU's, 3 Cultures/comfort in practices
- 3 Renal consultants provided daily input into decisions for RRT initiation
- HD Nurse trainers supported decision making and patient selection in ITU
- Noradrenaline < 0.2mcg/kg/min or need for vasopressin
- Majority already had CVVH(D)F
- Anticoagulation - 5000 units single IV bolus injection dalteparin

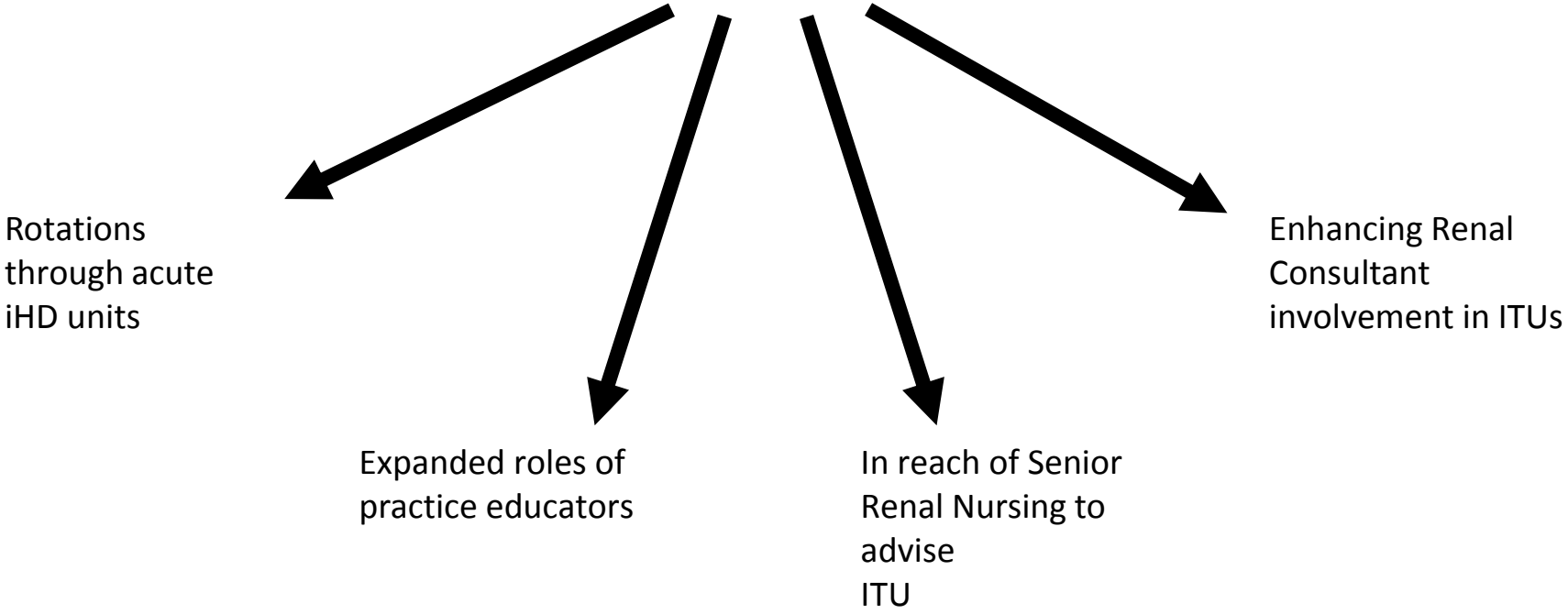
What else did we do?

ITU teams use many infusion pumps, with a change from their normal techniques to intermittent therapies there was a potential for drug clearances to be altered and be at risk toxic levels. Therefore, we provided expert remote Renal pharmacy oversight of all patients who started on iHD to support critical care pharmacists

Haemofiltration

Intermittent Haemodialysis

Developing a plan to maintain ITU iHD competency



Dr Chris Kirwan

Consultant Critical Care & Renal Medicine

Royal London Hospital, Barts Health NHS Trust

Dr Marlies Ostermann - Consultant Nephrologist

Guys and St Thomas'

Guy's and St Thomas'
NHS Foundation Trust

Renal support in Critical Care at GSTT

Marlies Ostermann
on behalf of a wide multidisciplinary team

Pre-COVID

54 Critical Care beds

>250 patients treated with RRT / year

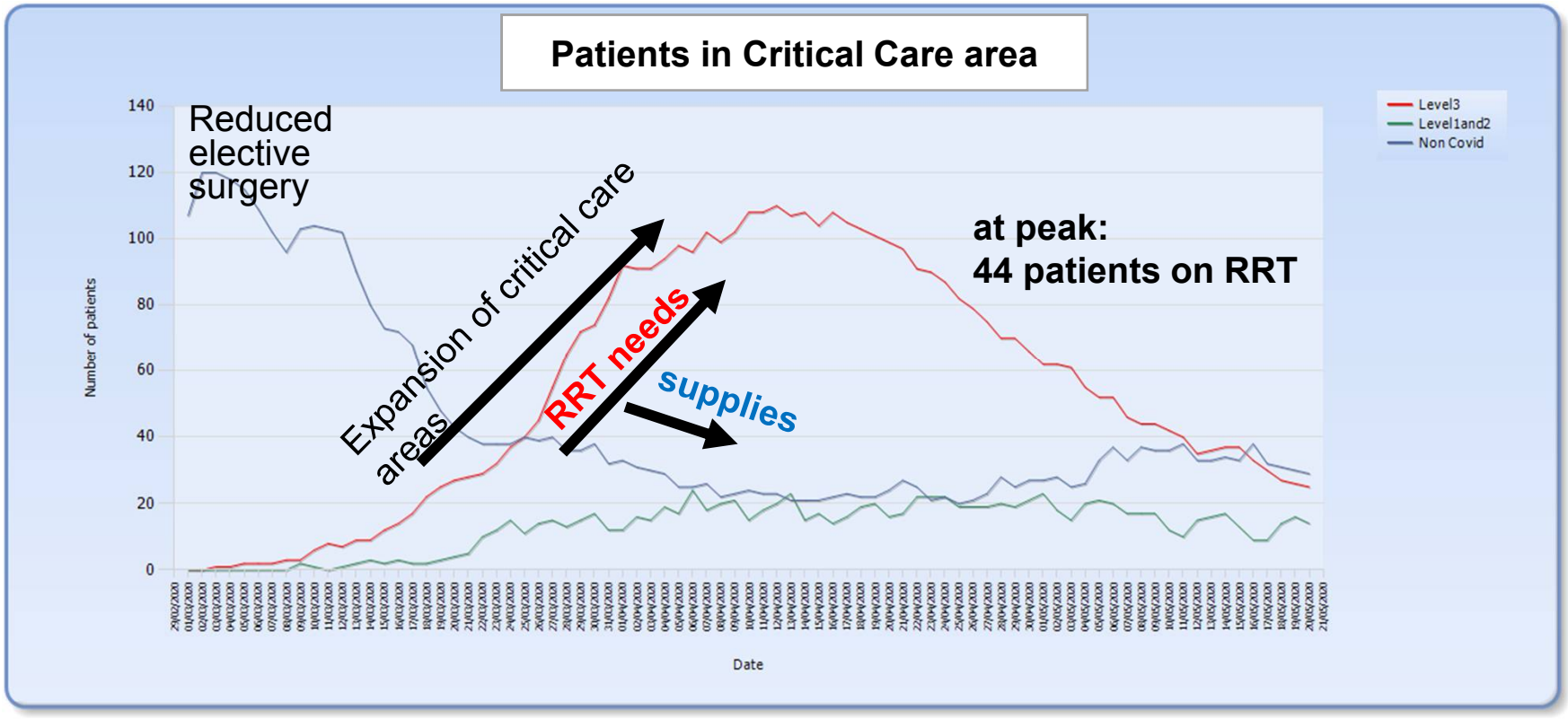
26 CRRT machines

Usual RRT: CVVHD, occ CVVHF

occ IHD in Critical Care at Guy's

citrate anticoagulation

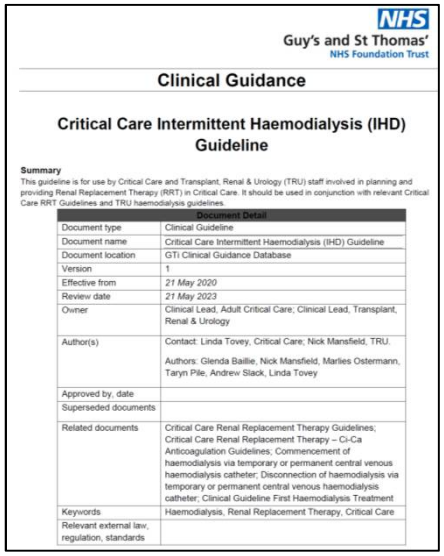
During COVID pandemic



Strategies to overcome RRT challenges

Gradual increase to 36 CRRT machines

Close collaboration with Renal: use of IHD where possible



NHS
Guy's and St Thomas'
NHS Foundation Trust

Clinical Guidance

Critical Care Intermittent Haemodialysis (IHD) Guideline

Summary

This guideline is for use by Critical Care and Transplant, Renal & Urology (TRU) staff involved in planning and providing Renal Replacement Therapy (RRT) in Critical Care. It should be used in conjunction with relevant Critical Care RRT Guidelines and TRU haemodialysis guidelines.

Document Detail	
Document type	Clinical Guideline
Document name	Critical Care Intermittent Haemodialysis (IHD) Guideline
Document location	GTi Clinical Guidance Database
Version	1
Effective from	*21 May 2020*
Review date	*21 May 2023*
Owner	Clinical Lead, Adult Critical Care; Clinical Lead, Transplant, Renal & Urology
Author(s)	Contact: Linda Tovey, Critical Care; Nick Mansfield, TRU. Authors: Glenda Baillie, Nick Mansfield, Marlies Ostermann, Taryn Pile, Andrew Slack, Linda Tovey
Approved by, date	
Superseded documents	
Related documents	Critical Care Renal Replacement Therapy Guidelines; Critical Care Renal Replacement Therapy – Ci-Ca Anticoagulation Guidelines; Commencement of haemodialysis via temporary or permanent central venous haemodialysis catheter; Disconnection of haemodialysis via temporary or permanent central venous haemodialysis catheter; Clinical Guideline First Haemodialysis Treatment
Keywords	Haemodialysis, Renal Replacement Therapy, Critical Care
Relevant external law, regulation, standards	

Nephrology consultant present at STH site

step down to Renal ward as early as possible

training programme in IHD for critical care nurses

joint guidelines

Strategies to overcome RRT challenges

Management of supply problems:

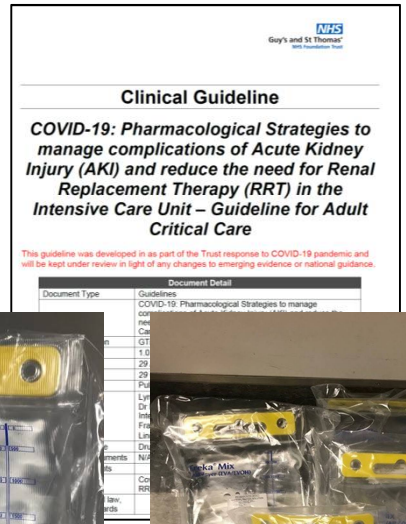
increasing use of IHD

reduction of waste (ie. change of anticoagulation)

strategies to manage AKI medically

in-house production of dialysis fluid

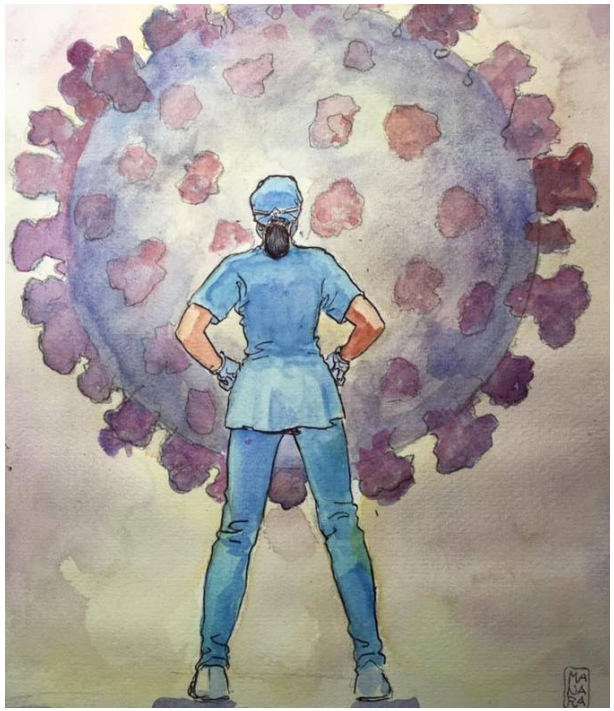
total 880 bags (3L and 3.6L bags)


Clinical Guideline

COVID-19: Pharmacological Strategies to manage complications of Acute Kidney Injury (AKI) and reduce the need for Renal Replacement Therapy (RRT) in the Intensive Care Unit – Guideline for Adult Critical Care

Evaluation

- Collaboration with Renal was crucial
- Pharmacy input was potentially life saving
- Role of IHD in Critical Care recognised
- Training programme in IHD for critical care nurses
- Plans for RO in Critical Care



Dr Hugh Cairns

Consultant Nephrologist

Ms Elaine Bowes

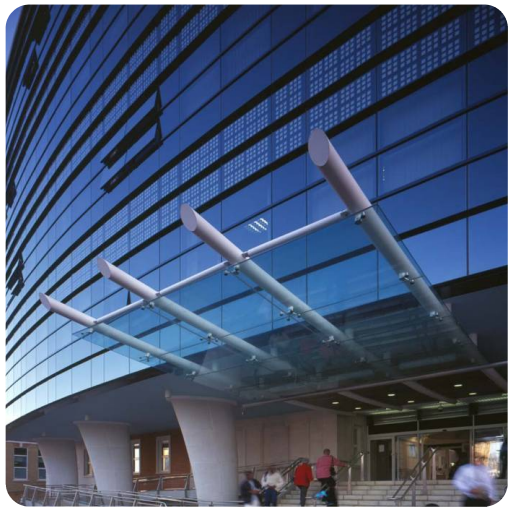
Renal CNS

Kings College Hospital

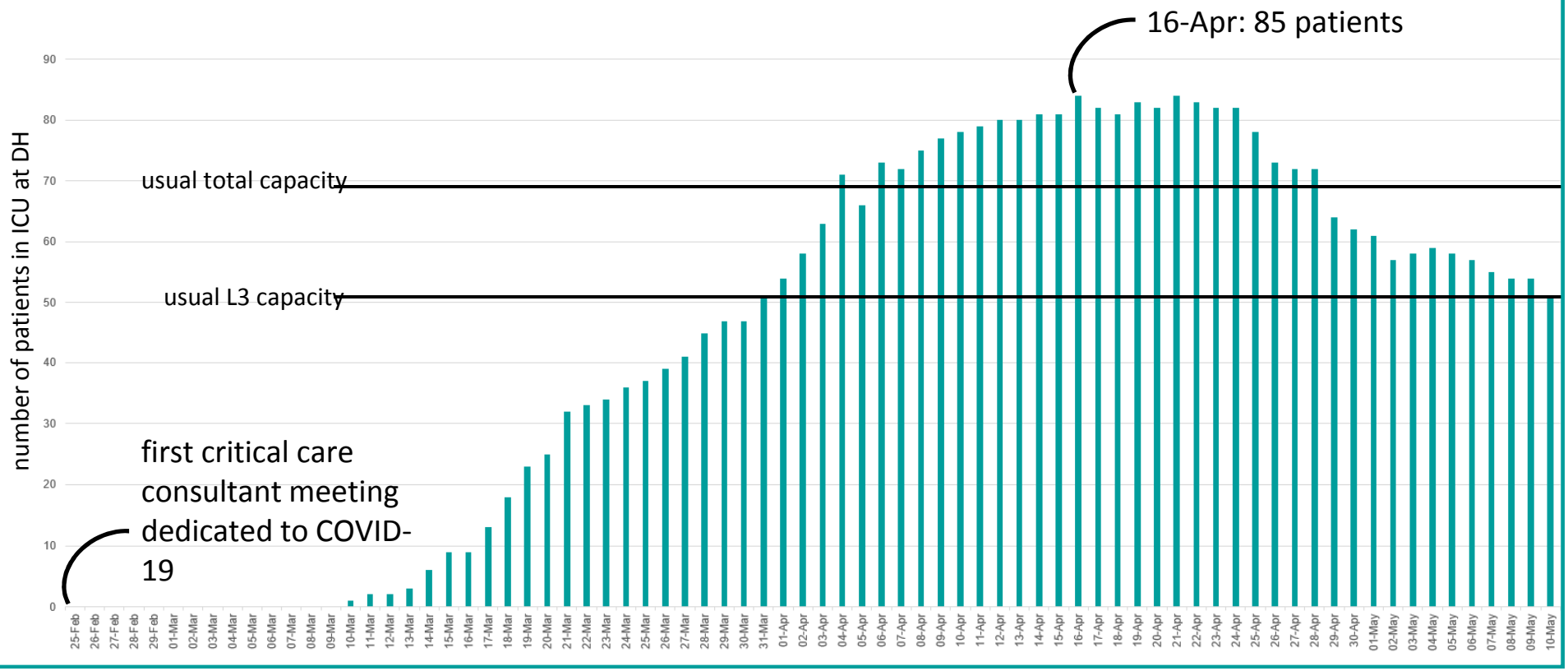
King's College Hospital Experience of acute PD for COVID-19 positive patients on ITU

Elaine Bowes & Hugh Cairns

Renal Unit King's College Hospital London UK



Bed occupancy (COVID-19 patients only)



AKI and COVID

- AKI commoner in COVID than originally thought
- 25 – 50% in COVID ITU patients
- Initial shortage of CVVH machines
- Developed shortage of CVVH consumables – local / national / international
- Consideration of alternative forms of RRT

PD for AKI

PD catheter insertion

- LA blind Seldinger technique vs GA direct vision or laparoscopy
- KCH – long Hx of LA insertion ~ 85%

- Inserted at bedside under LA
  - Senior PD nurse, nephrologist, interventional radiologist
- Selection criteria
  - Exclusion criteria of significant previous abd surgery, marked obesity
- All patients had APD

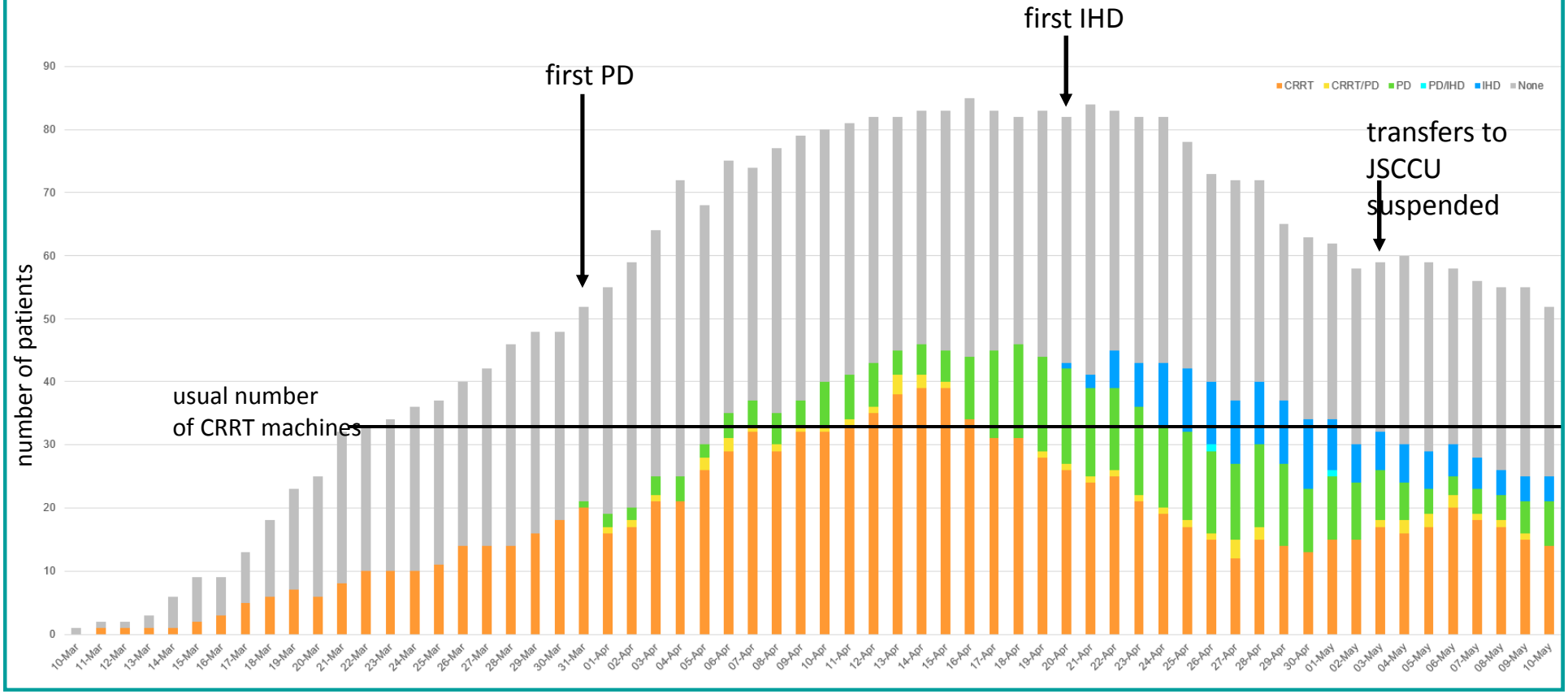
Catheter Outcomes:

- Attempted insertion in 43 patients
- Successful in 36 – 37 catheters (86%)
- Failures –
  - 2 patients into peritoneum, unable to advance wire, one aspirated air probable bowel puncture, abandoned, no sequelae.
  - 5 patients unable to reach peritoneum with standard needle 5 cm(obesity)

Catheter Complications:

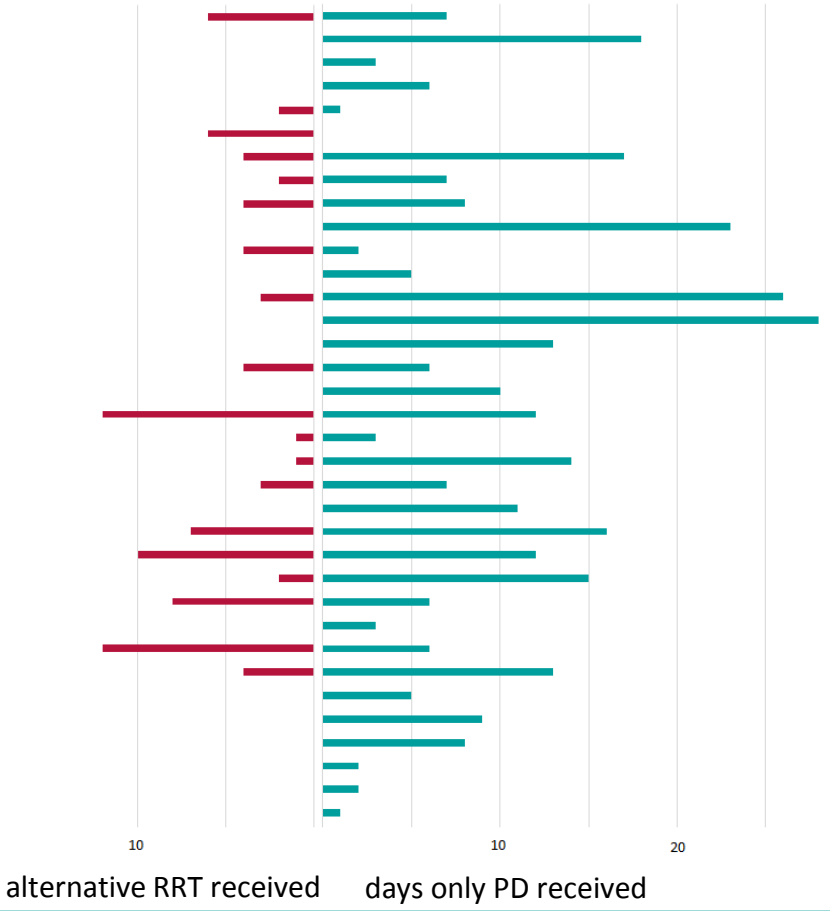
- No abdominal wall leaks
- No exit site or tunnel infection
- No episodes of PD peritonitis
- One scrotal leak after 3 days – switched to CVVH, catheter removed
- 2 patients minor bleeding from PD exit site
- Minimal problems with PD drainage – one patient profound ileus, resolved after 3 – 4 days, PD continued

RRT usage over time

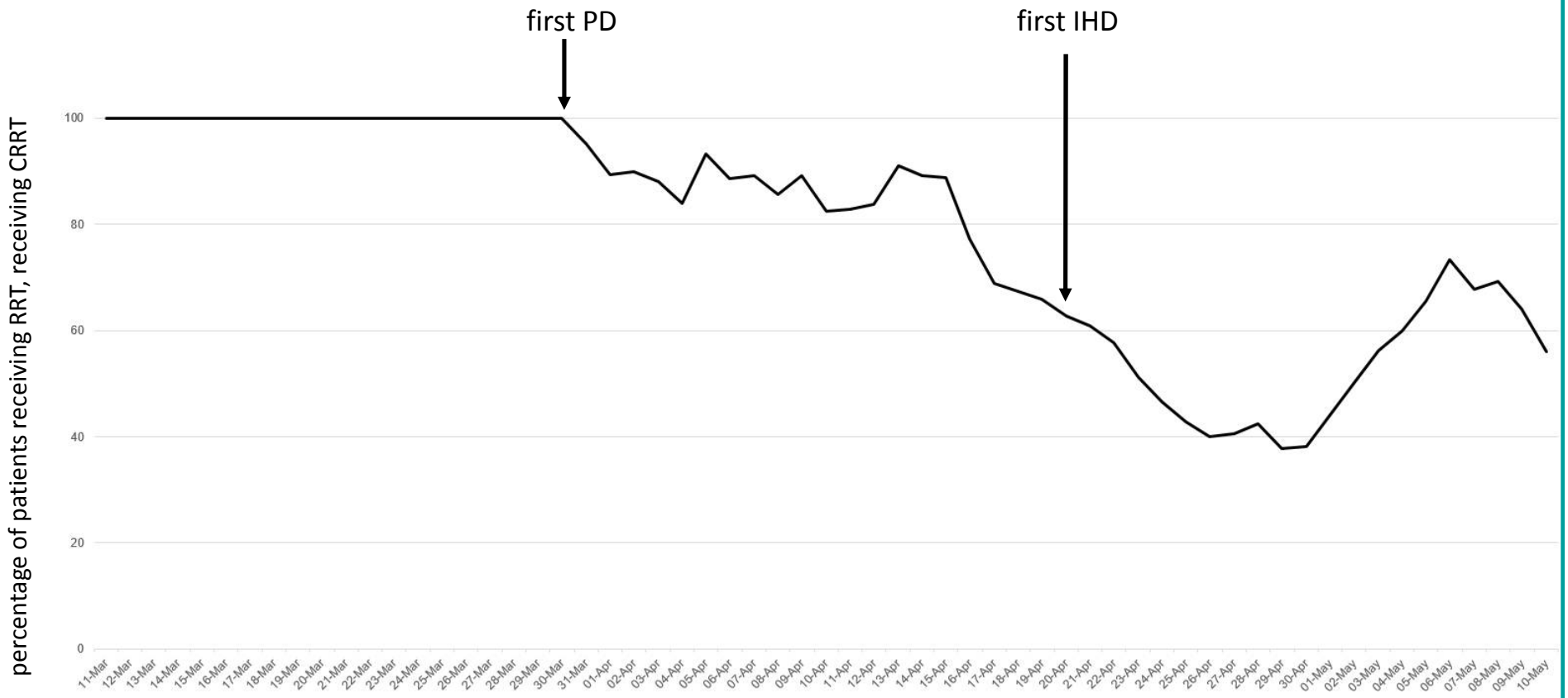


CRRT usage following introduction of PD

- 36 patients received PD on ICU.
- After commencing PD 16 patients did not receive any other modality of RRT on ICU (42.9%).
- PD was the sole modality of RRT on 325/420 patient days (77.4%) once a patient was established on PD.
- With time, ITU staff more accepting of limitations of PD vs CRRT



RRT usage over time



Outcomes:

- PD worked in all patients
- 20 patients had CVVH at some point post starting PD
  - Concern over high urea concentration by ITU team
  - Progressive acidosis prior to end of life
  - Hyperkalaemia, poor flow due to constipation
  - Post myocardial infarct, scrotal leak
- No ventilation issues leading to PD therapy suspension
- No patients have required proning after PD catheter insertion

Outcomes:

- 23 patients have recovered renal function (64%)
- 12 patients have died (33%) – all COVID
- 1 patient still on RRT
- At peak ‘renal COVID’, 40 patients on ITU with COVID requiring RRT – 15 on CVVH, 10 on intermittent HD and 15 on PD

Issues:

- Reviewing patients and inserting catheters on ITU relatively time consuming
  - Catheters can be inserted by whatever method the local renal team has experience
- Workload for PD staff
  - physically demanding environment
  - time consuming, communication can be difficult
  - moving volumes of PD fluid around the hospital (runners to help)
- Education of and liaison with ITU staff
  - Multiple ITUs, many staff
  - Issues with machine alarms, drainage and lack of staff experience
  - Used to CVVHDF – biochem, fluid removal

Conclusions:

- PD on ITU works and is safe for AKI in COVID positive patients on ITUs
- Can reduce CVVH use (machines and consumables)
- No ventilation issues from PD vs CVVH
- Coagulation benefits of using PD in some patients
- Change of practice for the ITU team – less control than with CVVHF
- ITU nurses pleased to be freed up from running the CVVH
- Major workload for the whole PD team

Thanks:

ITU staff

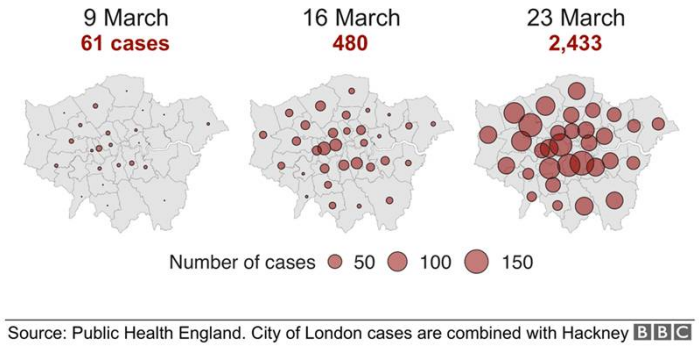
Renal consultants and junior doctors

PD team including staff who came back to PD from other areas / hospitals

Dr Neil Duncan

Consultant Nephrologist

Imperial College – Hammersmith Hospital



West London Renal Team supporting AKI in the Critically Ill Patient – response to COVID-19

Dr Neill Duncan

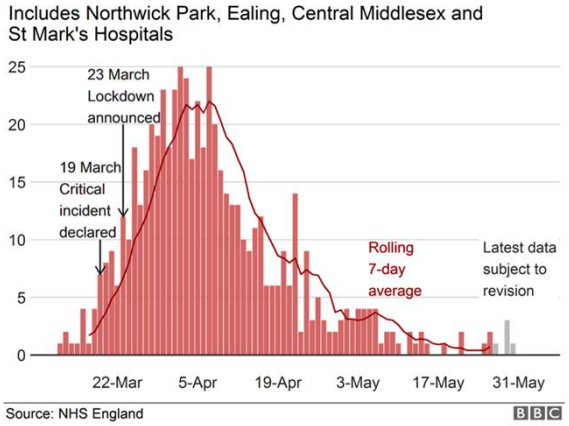
Renal Consultant

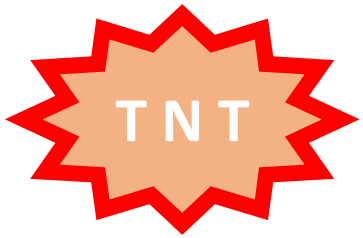
Clinical Lead for Dialysis

On behalf of all members of the teams at Harefield, Watford, Hillingdon, West Middlesex, Ealing, Northwick Park, Central Middlesex, Hammersmith, Charing Cross, St Mary's, Chelsea and Westminster, Royal Brompton Hospitals

Putting patients at the HEART of everything we do

NHS
London North West University Healthcare
NHS Trust





Home HD NxStage Machines Repurposed

First ever use
10 patients > 45 iHD
8/10 patient survival
5/8 ICU discharge
4/5 No RRT

NHS
Imperial College Healthcare
NHS Trust

Hammersmith ICU
2 dialysis water stations
2 portable ROs

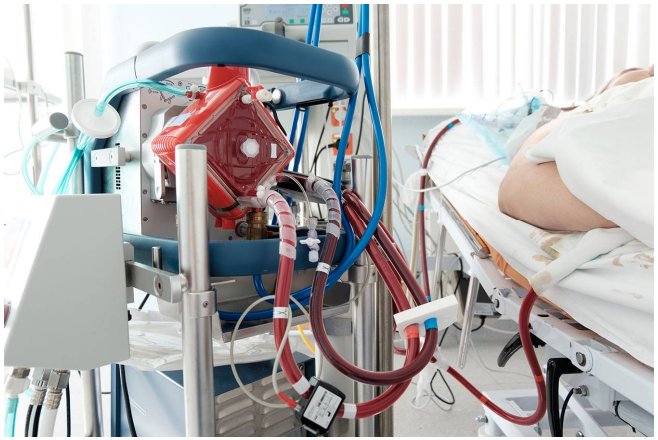
2 Acute PD Patients

Hammersmith DeWardener HDU absorbed in Surge capacity
12 dialysis water stations

Dialysis Nursing Support 12h/7day

Nephrologist rounds

NHS
Royal Brompton & Harefield
NHS Foundation Trust



Royal Brompton – Adult Intensive Care and Paediatric Intensive Care Surge capacity
ECMO and CVVHF

Nephrologist rounds MS Teams

Rapid Repatriations

PISCES

Psychological
Investigation of
Severe
COVID requiring
Enhanced
Support

NHS
Imperial College Healthcare
NHS Trust

Questions for the panel

Dr Rafik Bedair & Dr Daniel Jones (STG)
Dr Chris Kirwan (Barts)
Dr Marlies Ostermann (GSTT)
Elaine Bowes & Dr Hugh Cairns (KCH)
Dr Neil Duncan (Imperial)
Dr Jenny Scott (RFH)
Dr Ginny Quan (ESTH)

Moderator: Dr Rob Elias

Summing Up

Professor Claire Sharpe