

Timely Dialysis for Haemodialysis Patients who Present to Emergency Department with Severe Hyperkalemia

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Mission Statement

Initiation of dialysis within 3 hours from receipt of critical lab result to increase from 48% to 90% of End-Stage Renal Disease (ESRD) Patients on Haemodialysis who Present to Emergency Department (ED) with Severe Hyperkalemia ($K \geq 6.5$ or with physician defined hyperkalemic ECG changes) within 6 months.

Team Members

	Name	Designation	Department
Team Leaders	Dr Benjamin Khoo	Consultant	RM
	Dr David Teng	Consultant	ED
Team Members	Ms Zhao Xiaoli	Nurse Clinician	MICU
	Dr Tee Kuan Sen	Consultant	
	Ms Grace De Suyo Idagdag	Nurse Clinician	AHU
	Ms Arockkiasamy Suganthi	Nurse Clinician	
	Ms Lin Kaizhen	Nurse Clinician	
	Dr Kristy Beckwith	Senior Resident	ED
	Dr Michelle Cruz Dizon	Resident Physician	
Sponsors	Adj Asst Prof Yeo See Cheng (HOD of RM) Adj Asst Prof Ang Hou (HOD of ED)		
Mentors	Adj Asst Prof Justina Tan Wei Lynn & A/Prof Alan Ng Wei Keong		

MICU: Medical Intensive Care Unit | AHU: Acute Haemodialysis Unit

Evidence for a Problem Worth Solving

- Hyperkalemia is universally accepted to require urgent dialysis, particularly in the ESRD population where dialysis facilitates potassium clearance.
- Unfortunately, there have been patients who have had dialysis delayed, resulting in adverse outcomes, including cardiovascular collapse and demise.
- There is no specific guidelines for this
- Expert evidence: delays between recognition and initiation of dialysis

Acute Treatment of Hyperkalemia

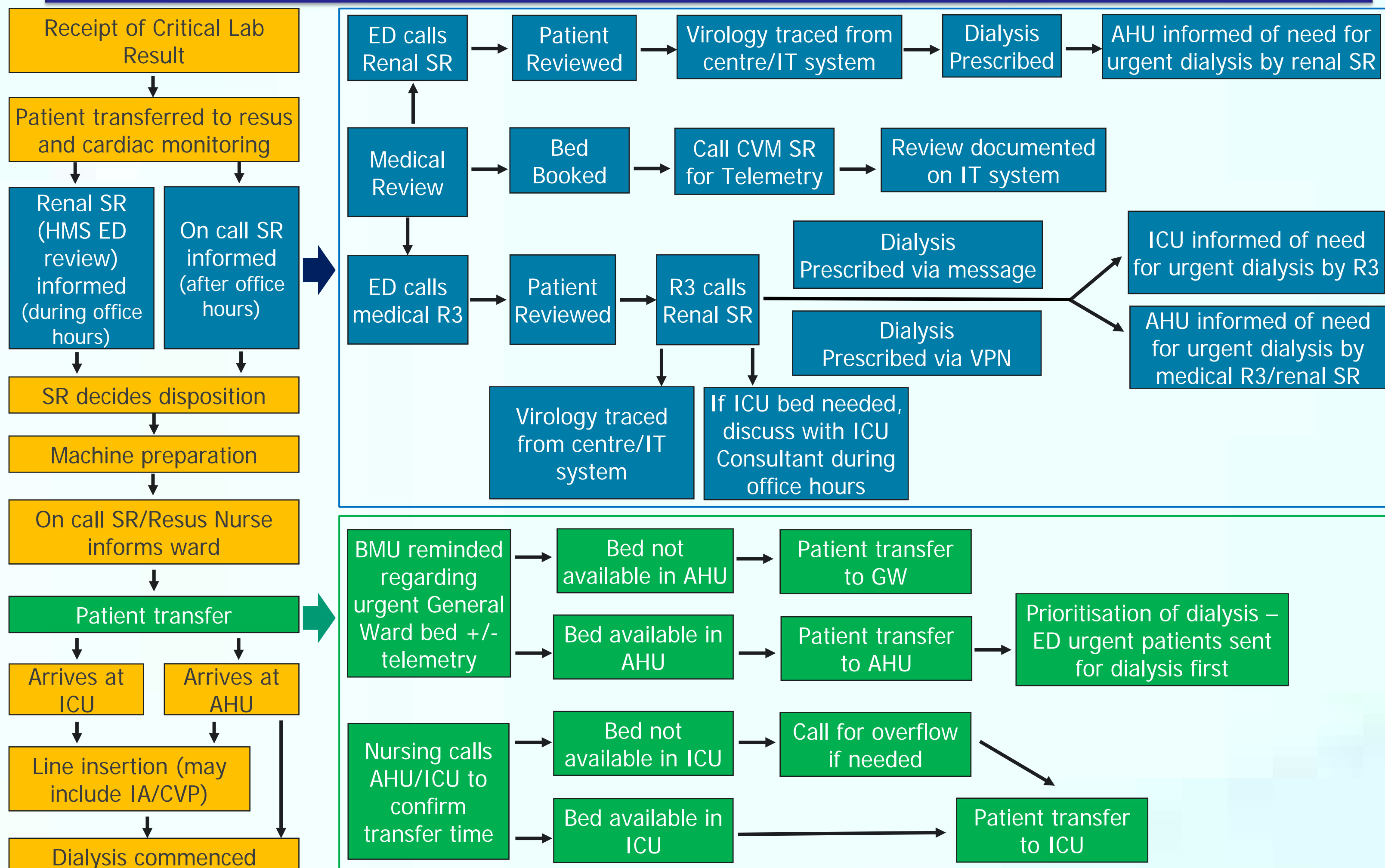
The definitive treatment of severe hyperkalemia in a patient with end-stage renal disease is to remove potassium from the body. Hemodialysis is the most effective regimen for the acute lowering of plasma potassium concentration [31]. However, because there is often a two or three hour delay between recognition of the hyperkalemia and institution of dialysis

Review article: Treatment and Prevention of Hyperkalemia in ESRD
Allon M et al. Kidney Int. 1993 Jun;43(6):1197-209

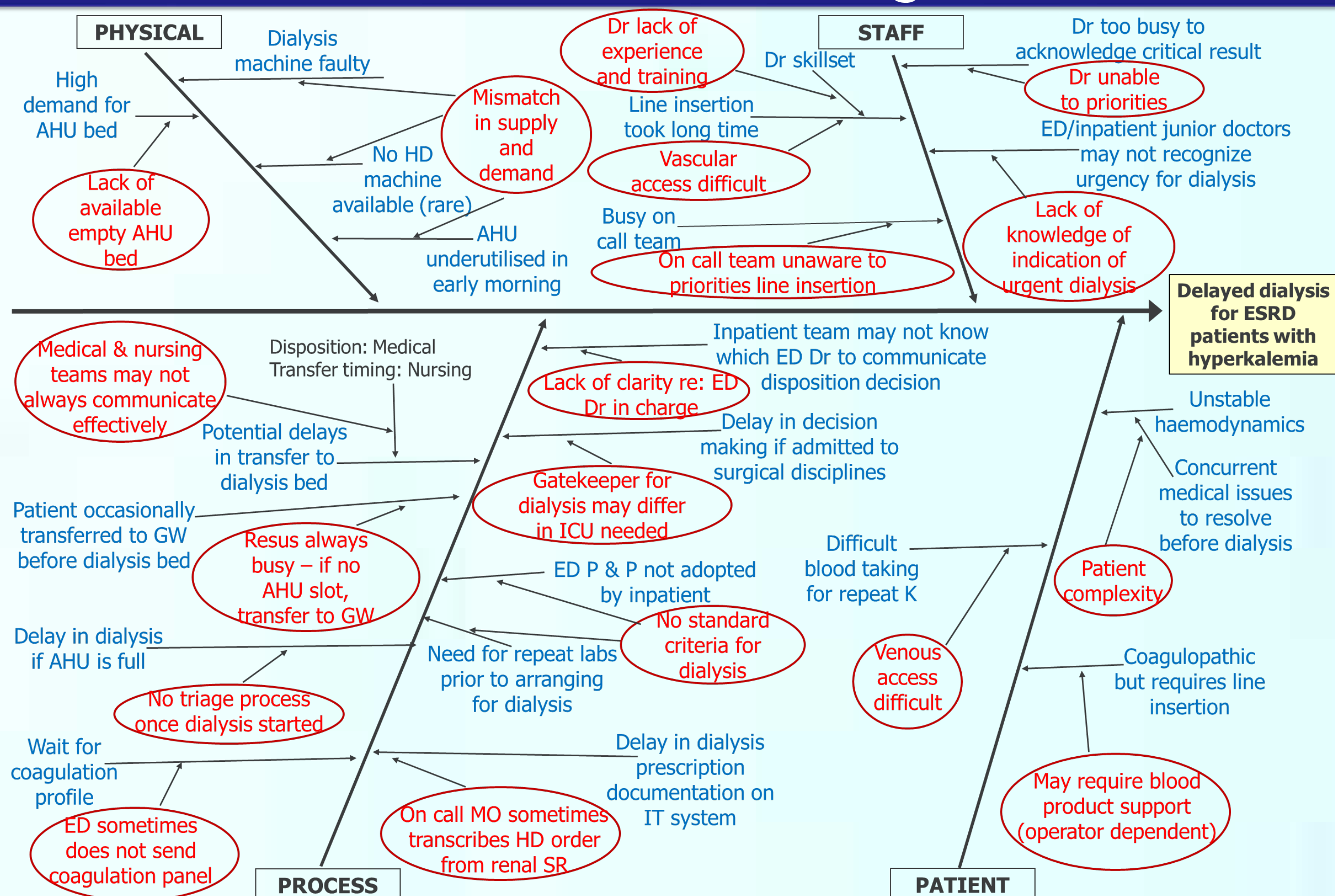
The criteria for early initiation of RRT and delayed initiation of RRT existed differences among the studies. Due to the different criteria of initiating RRT, the time of initiating RRT was different. The median time of RRT initiation across studies ranged from 2 to 7.6 h in the early RRT group and 21 to 57 h in the delayed RRT group.

Meta-analysis of RCTs investigating timing dialysis in AKI
Li X et al. Crit Care. 2021 Jan 6;25(1):15

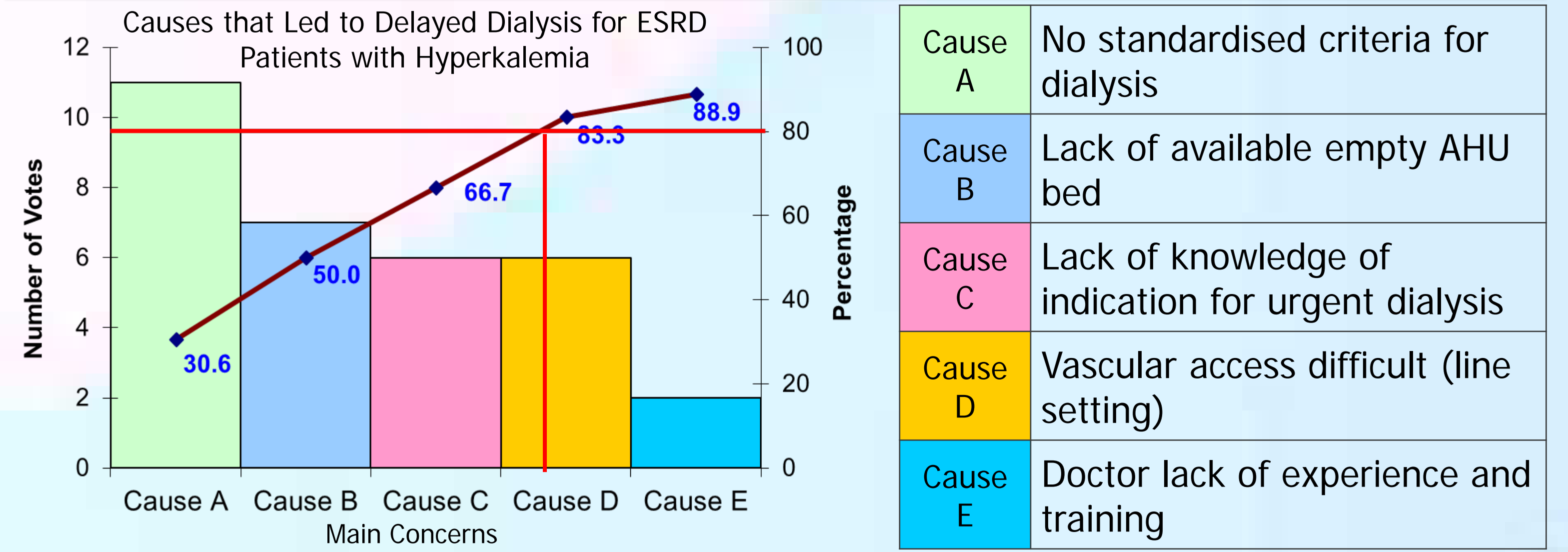
Flow Chart of Process



Cause and Effect Diagram



Pareto Chart

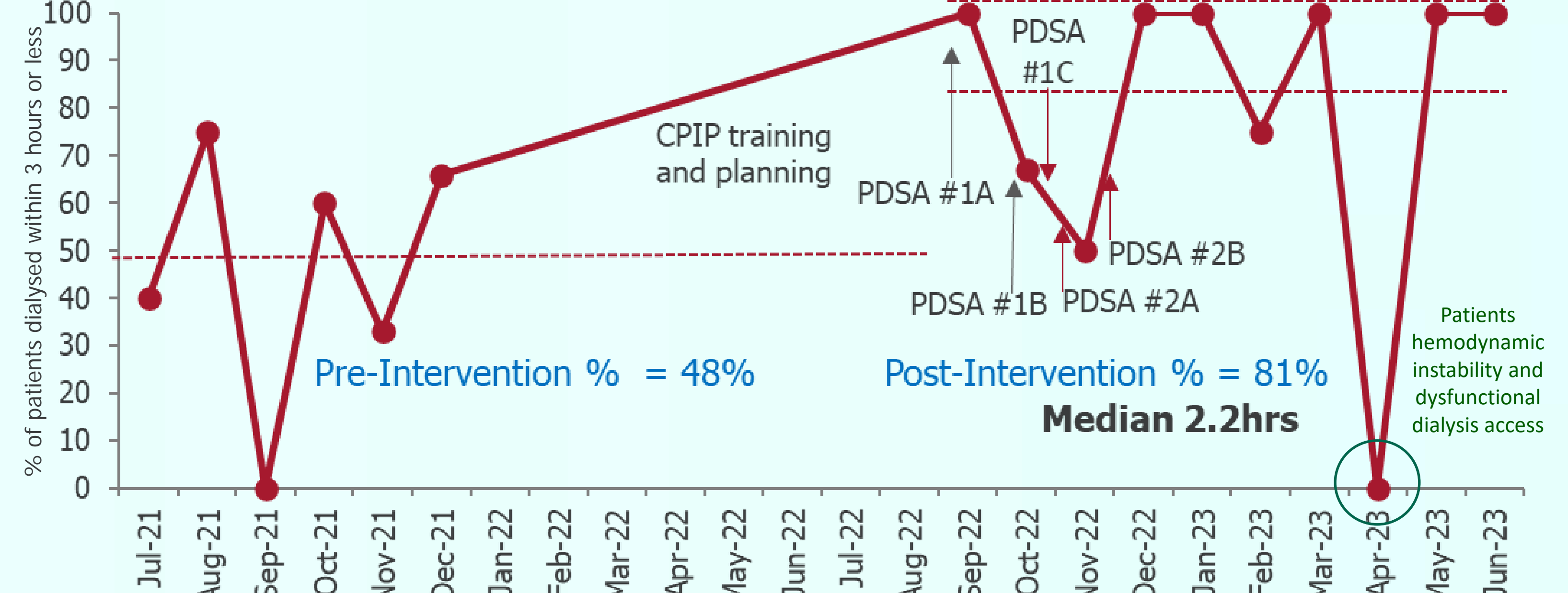


Implementation

CAUSE / PROBLEM	INTERVENTION	DATE OF IMPLEMENTATION
Cause A: No standardised criteria for dialysis	PDSA #1A: Standardised criteria sent out to ED + RM (doctors and nurses) and RM Senior Residents (SRs)	16 Sep 2022
Cause C: Lack of knowledge of indication for urgent dialysis	PDSA #1B: Optimal transfer of patients between ED and AHU and ICU	5 Oct 2022
	PDSA #1C: Standardised criteria disseminated to medical SRs via email	10 Oct 2022
Cause B: Lack of available empty AHU bed	PDSA #2A: Prompt decantment of patients who completed dialysis in AHU	17 Oct 2022
	PDSA #2B: Decantment of machines for disinfection in isolation room to free up AHU space for dialysis	14 Nov 2022

Results

Percentage of Patients Dialysed Within 3 hours or Less



Period	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sep 22	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23	Apr 23	May 23	Jun 23	
No. of Patient	5	4	0	6	3	3	1	3	2	4	4	4	1	2	2	3									
Median time (h)	6.3	2.3	N/A	3.3	3.6	2.7	0.9	2.4	3.4	2.1	1.4	2.6	3	4.0	2.1	1.8									

Cost Savings

Item	Pre-Intervention	Post-Intervention
Average Length of Stay in ED Resuscitation Room (hour)	3.0	2.1
Time Saved per Patient (hour)	3.0 - 2.1 = 0.9	
Hourly Manpower Costs	\$94.65	
Costs Saved per Patient	\$94.65 x 0.9 = \$85.19	
Total Cost Savings (Annualised)	21 patients (6 months) x 2 x \$85.19 = \$3,577.98	

Problems Encountered

- Time taken from notification of lab result to start of dialysis involved multiple small steps added together, and we required a deep dive to understand this. Each member of the team were experts in their own area and helped us to understand the process comprehensively, thus allowing us to implement strategies to improve timely dialysis for our patients.
- It was challenging to manage change among stakeholders – support from our sponsors to make changes in our areas of work was helpful and key to allowing successful implementation.
- There were many stakeholders that we had to communicate with. To streamline communications, we had to simplify our message depending on the target audience.

Strategies to Sustain

- Formalisation of CPIP workflows into a simple, easily accessible document common to ED and inpatient.
- Promote awareness of this to include new joiners for different clinical areas.