



THE 29TH INTERNATIONAL CONFERENCE ON

ADVANCES IN CRITICAL CARE NEPHROLOGY

AKI & CRRT 2024

Jointly Provided by

UC San Diego
SCHOOL OF MEDICINE
and
CRRT, INC.

MARCH 12-15, 2024

MANCHESTER GRAND HYATT

SAN DIEGO, CALIFORNIA

Morning Symposium C – Optimization of the CRRT Program to Improve Outcomes

Harnessing Multimodal Data Streams to Improve CRRT Delivery



Oleksa G. Rewa MD MSc FRCPC
Associate Professor, Associate Chair
Department of Critical Care Medicine
University of Alberta



Disclosures (1)

- I have received consulting fees from Baxter Healthcare Inc.
- I have participate on advisory boards with Baxter Health Inc. and Leadiant Biosciences

Disclosures (2)

- I am not a nephrologist but an intensivist in critical care nephrology with a focus on acute dialysis
- I have not had any formal training in Quality Improvement but have a keen interest in Quality Metrics and Key Performance Indicators and am leading an implementation science based program to improve acute dialysis in Alberta

Outline

1. Discuss what data streams might be used to obtain the information necessary to improve CRRT delivery
2. Outline how these may be represented and reported
3. Examples of Dashboards used to to improve the performance of CRRT

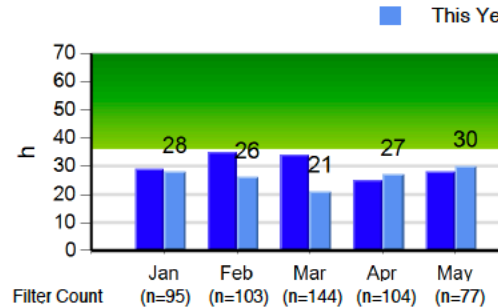
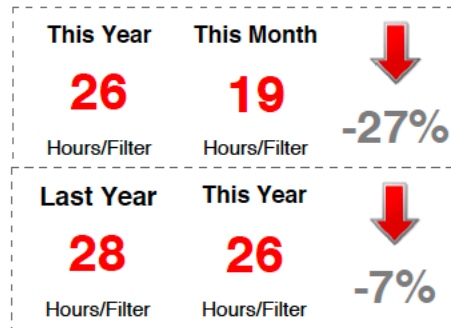
Where can data come from?

1. Machine data
2. EMR Data
3. Organizational data
4. Healthcare system data

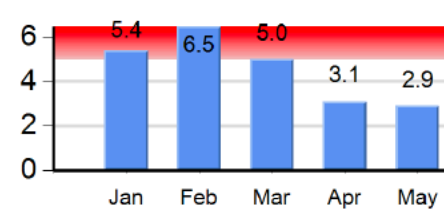
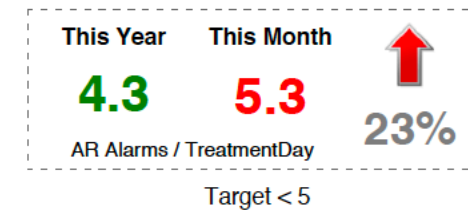


Machine Data

Average filter life (This Month **11** filters were used. The past rolling 12 months **898** filters were used.)

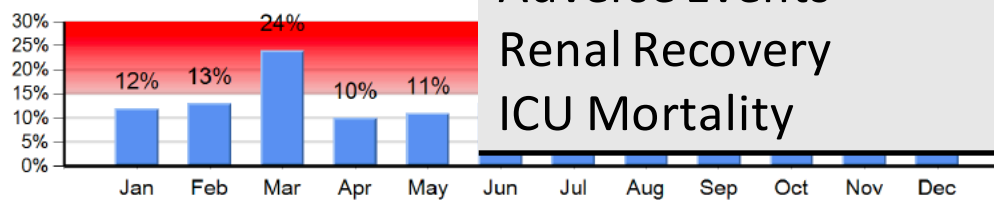
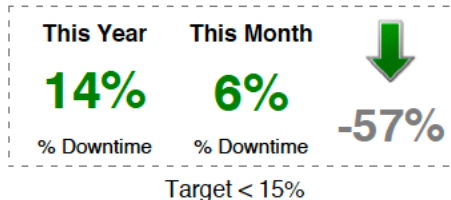


Note: Filter sets and nursing labor contribute to value over the past rolling 12 months. Arrows re arrows signify increased life. Red arrows indica



Rationale: Access issues are the most common problem with CRRT. Access alarms include both access to the blood pump so this affects filter life (decreases), fluid removal (decreases), and lost treatment time (increases) due to facility to reassess the catheter brand, placement procedure, and/or placement site.

% Treatment Time Lost (Downtime) (This month had **14 h** of downtime)



Rationale : Treatment time lost affects dosing and fluid removal. Filter life may also be decreased. The % treatment time lost is the ratio of total treatment time lost versus total treatment time. The arrow reflects the % change for this month relative to the average monthly % change for the past 12 months.

CKRT KPI

CKRT Leadership
CKRT Education

Filter Life
Delivered Dose
Downtime
Access Alarms

Adverse Events
Renal Recovery
ICU Mortality

Operational Definition

Presence of CKRT physician and nurse dyad
Number of CKRT providers with certified training

Number of filters lasting > 60 hours
Actual delivered dose of prescribed

Delivered time of prescribed
Number of alarms

Number of significant events
KRT liberation at ICU discharge
Patient survival to ICU discharge

EMR Data

- Vitals
- Neurological Status
- Ventilatory Status
- Hemodynamic Status

ICU Comprehensive Flowsheet

Go to now: 03/02/2024

Timeline: 24 Hrs 12 Hrs 8 Hrs 4 Hrs 1 Hr 15 Min | All

Time	08:23	08:30	08:44	08:45	08:59	09:00	10:00	10:02	11:00	11:44	12:00	12:20	12:52	12:59	13:00	13:45	13:52	
Vitals																		
Temperature											37.5							Temperature
Temp Source											Axill...							Temp Source
Heart Rate		94					87 88			85	77	87						Heart Rate
HR (ECG)		95					84 88			86	76	88						HR (ECG)
Rhythm										SR								Rhythm
Resp rate		23					25 22			27	25	25						26
BP (a-line)		150/55					141/50 137/52			159/69	164/56	184/64				186/60		BP (a-line)
MAP (a-line)		84					75 77			97	84	101				95		MAP (a-line)
GCS										11								GCS
Vitals Graphs cannot display in the current view																		
Pain Assessment																		
Critical-Care Pain Observation Sc...		2	0															Critical-Care Pain...
Neuro Status																		
Glasgow Coma Scale Score										11								Glasgow Coma Sca...
Level of Consciousness										Alert								Level of Conscious...
Cognition										Follo...								Cognition
R Pupil Size (mm)										3								R Pupil Size (mm)
R Pupil Reaction										React...								R Pupil Reaction
L Pupil Size (mm)										2								L Pupil Size (mm)
L Pupil Reaction										React...								L Pupil Reaction
Oxygenation																		
FiO2 (O2 Percent - Set on Device)		30					30	30										30
O2 Flow Rate																		35
SpO2		98					100 99	98	97		96	100				96		94
Oxygen Therapy												Suppl...						Suppl...
O2 Delivery Method												Heate...						Heate...
Respiratory																		
O2 Therapy												Suppl...						Suppl... O2 Therapy

Organizational Data

- Administration

- Prescription

- Provision

- Education

- Certification and Support

Table 2 Standardised elements of CRRT programmes

Programme element	Operational definition
CRRT leadership	Presence of both CRRT physician and clinical nurse educator
CRRT education	Number of CRRT providers with training/ total number of CRRT providers
Filter life	Number of filters lasting 72 hours/total number of filters used
Delivered dose	Actual delivered dose in mL/kg/hour/prescribed dose in mL/kg/hour
Downtime	Time CRRT not running per day/each day of CRRT prescription
Ultrafiltration	Actual ultrafiltration achieve in mL/kg/hour/prescribed ultrafiltration in mL/kg/hour
Access alarms	Number of alarms recorded per machine per day of therapy
Adverse events	Number of adverse events as per RLS per quarter
ICU mortality	Patient survival to ICU discharge
Renal recovery	Number of patients still requiring RRT at 90 days

Healthcare System Data

- ICU Length of Stay
- Hospital Length of Stay
- Mortality
- Renal Recovery

Table 2. Primary and Secondary Outcomes.*

	Accelerated Strategy (N=1465)	Standard Strategy (N=1462)	Relative Risk or Difference (95% CI)
Primary outcome			
Death from any cause at 90 days — no. (%)†	643 (43.9)	639 (43.7)	1.00 (0.93 to 1.09)‡
Secondary outcomes			
RRT dependence among survivors at 90 days — no./total no. (%)	85/814 (10.4)	49/815 (6.0)	1.74 (1.24 to 2.43)‡
Death or RRT dependence at 90 days — no./total no. (%)	728/1457 (50.0)	688/1454 (47.3)	1.06 (0.98 to 1.14)‡
Major adverse kidney events at 90 days — no./total no. (%)	867/1131 (76.7)	860/1115 (77.1)	0.99 (0.95 to 1.04)‡
Serum creatinine at 90 days — mg/dl§	1.20±1.00	1.23±1.00	-0.03 (-0.11 to 0.06)¶
Estimated glomerular filtration rate 			
At 90 days — ml/min/1.73 m ²	65±30	64±31	0.31 (-3.88 to 4.49)¶
Reduction of >25% from baseline at 90 days — no./total no. (%)	139/403 (34.5)	172/427 (40.3)	0.86 (0.72 to 1.02)‡
Death from any cause — no./total no. (%)			
At any time in the ICU	461/1464 (31.5)	468/1462 (32.0)	0.98 (0.88 to 1.09)‡
At 28 days	538/1465 (36.7)	523/1462 (35.8)	1.03 (0.93 to 1.13)‡
During hospitalization	552/1458 (37.9)	546/1459 (37.4)	1.01 (0.92 to 1.11)‡
Use of health services			
Median no. of days of use (IQR)			
RRT-free days at 90 days**	50 (0 to 87)	64 (0 to 90)	-2.62 (-5.66 to 0.42)¶
RRT††	4 (2 to 8)	5 (3 to 9)	-0.48 (-0.82 to -0.14)¶
Continuous RRT†††	4 (3 to 8)	5 (3 to 8)	-0.40 (-0.78 to -0.02)¶
Sustained low-efficiency dialysis††	2 (1 to 4)	2 (1 to 4)	0.15 (-0.65 to 0.96)¶
Intermittent hemodialysis††	2 (1 to 4)	3 (2 to 5)	-0.45 (-0.80 to -0.09)¶
Median length of stay in ICU (IQR) — days			
Survivors	9 (5 to 16)	10 (5 to 19)	-1.58 (-2.90 to -0.26)¶
Nonsurvivors	7 (3 to 13)	7 (4 to 15)	-1.33 (-2.56 to -0.09)¶
Median length of hospital stay (IQR) — days			
Survivors	28 (16 to 50)	29 (17 to 54)	-1.23 (-3.87 to 1.41)¶
Nonsurvivors	8 (3 to 18)	9 (4 to 19)	-0.99 (-2.66 to 0.67)¶
Median no. of ventilator-free days at 28 days (IQR)	13 (0 to 24)	12 (0 to 24)	0.50 (-0.34 to 1.35)¶
Median no. of days free of vasoactive agents at 28 days (IQR)	21 (0 to 26)	20 (0 to 26)	0.31 (-0.57 to 1.18)¶
Median no. of days out of ICU at 28 days (IQR)	8 (0 to 21)	4 (0 to 20)	0.69 (-0.06 to 1.43)¶
Median no. of days out of hospital at 90 days (IQR)	10 (0 to 65)	9 (0 to 64)	0.55 (-1.82 to 2.91)¶
Rehospitalization at 90 days — no./total no. (%)	191/913 (20.9)	156/916 (17.0)	1.23 (1.02 to 1.49)‡
Health-related quality of life			
Median score on EQ-5D-5L at 90 days (IQR)			
Descriptive system‡‡			
Mobility	2 (1 to 3)	2 (1 to 3)	-0.07 (-0.23 to 0.08)¶
Self care	1 (1 to 3)	1 (1 to 3)	-0.10 (-0.25 to 0.05)¶
Usual activities	2 (1 to 3)	2 (1 to 4)	-0.15 (-0.31 to 0.01)¶
Pain or discomfort	2 (1 to 3)	2 (1 to 3)	-0.04 (-0.17 to 0.08)¶
Anxiety or depression	1 (1 to 3)	2 (1 to 3)	-0.06 (-0.19 to 0.07)¶

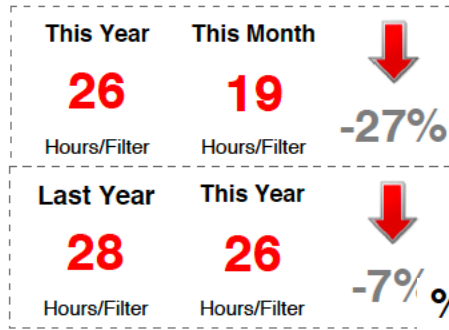
How may these be reported?

- Software generated computer reports
- Online Reports
- Audit & Feedback report cards

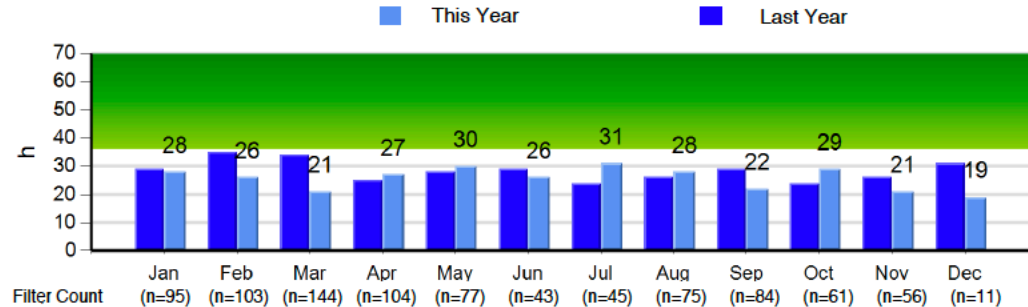


Software generated reports

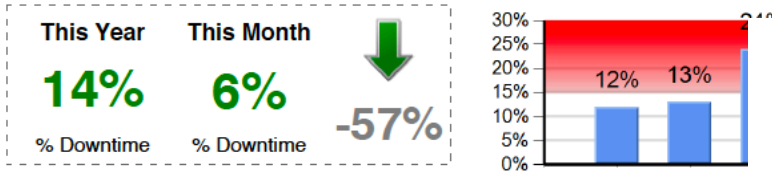
Average filter life (This Month 11 filters were used. The past rolling 12 months 898 filters were used.)



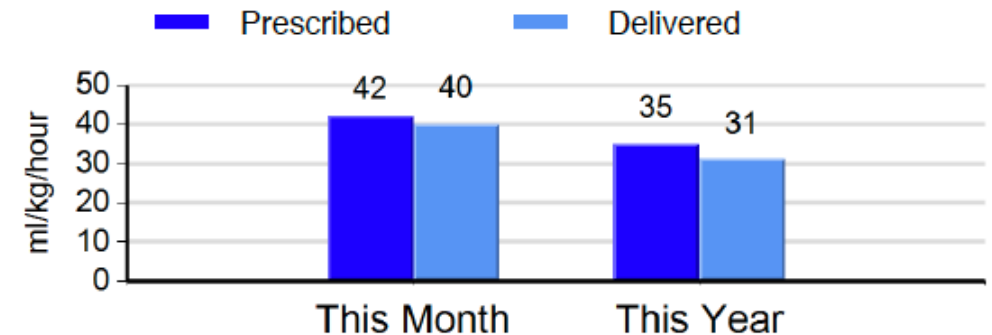
Target filter life > 36 hours



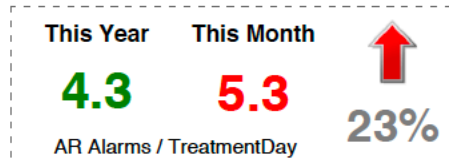
% Treatment Time Lost (Downtime) (This month had 14 h of downtime and 215 h of treatment time.)



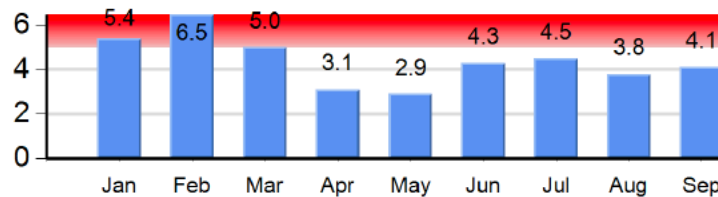
Dose (ml/kg/hour)



Number of Access Alarms



Target < 5



Rationale: Access issues are the most common problem with CRRT. Access alarms include both access and return pressure alarms. Access alarms typically stop the blood pump so this affects filter life (decreases), fluid removal (decreases), and lost treatment time (increases). A high number of access alarms may induce the facility to reassess the catheter brand, placement procedure, and/or placement site.

Online Reports



Continuous Renal Replacement



Thera CRRT CRRT Graph

Type (All)

Zone (All)

04-Jan-23



Continuous Renal Replacement Therapy



Type (All)

Zone (All)

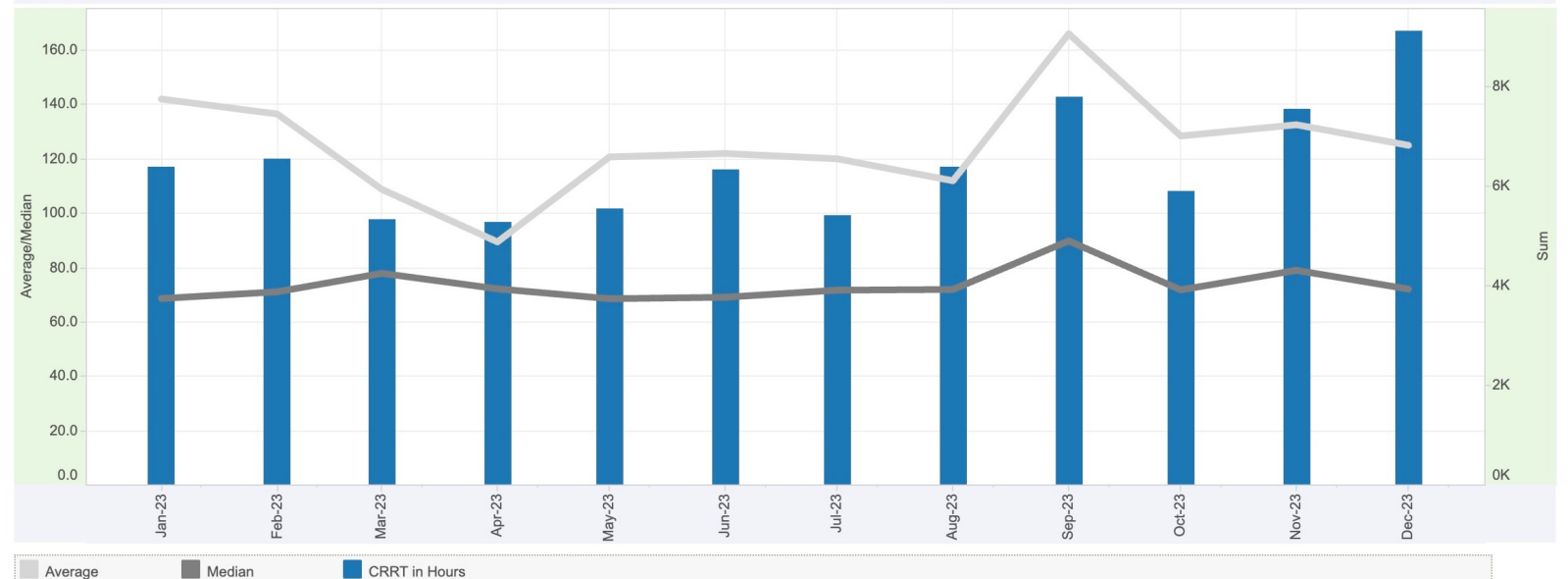
Site (All)

04-Jan-23

31-Dec-23

- Discharges
- CRRT Discharges %
- Patient Days Standard
- Patient Actual Hours
- CRRT Patient Days %
- CRRT Days Standard
- CRRT in Hours
- Sex (Male)
- Sex (Male) %
- Sex (Female)
- Sex (Female) %
- Average Age
- Acute Renal Failure (ARF)
- Acute Renal Failure (ARF) %
- Average Hours of ARF from Time of Admission
- Average CRRT Days Per Patient
- Average Hours of CRRT Initiation from Time of Admission
- Average APACHE II
- Average First SOFA
- Average First Renal SOFA
- Average SOFA on CRRT Onset
- Average Renal SOFA on CRRT Onset
- Average LOS
- Median LOS

CRRT Hours



CRRT Discharges %



Data Details

Data Details View: Original Watch Share



Audit & Feedback Reports

Purpose

The Dialyzing Wisely pathway is for clinicians in intensive care units (ICUs) to improve the delivery of acute dialysis to critically ill adult patients in Alberta.

Accelerated Starts Showed:

- No reduction in mortality
- 74% increase in long-term dialysis
- Higher occurrence of adverse events

References & Resources



Renal Replacement Therapy (RRT) Initiation

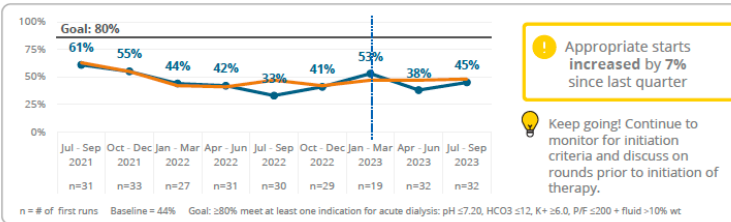
Excludes chronic dialysis and overdose.

Consider RRT for one or more of these potentially life-threatening complications of stage 2 or 3 AKI, but only if refractory to medical management.

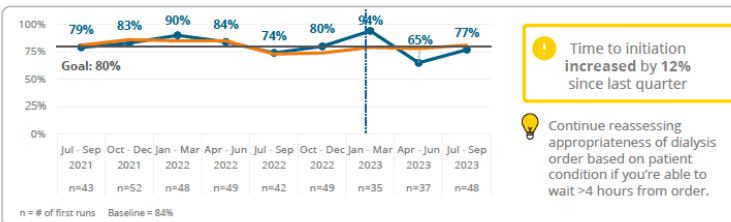
- Metabolic Acidosis → pH of 7.20 or less **OR** serum bicarbonate of 12 mmol/L or less
- Hyperkalemia → K+ of 6.0 mmol/L or greater
- Impaired Oxygenation → P/F ratio of 200 or less and clinical perception of fluid overload (cumulative fluid balance > 10% from ICU admission)

- Legend:**
- Your Site
 - Province
 - - - Implementation (Feb 23)
 - ✔ Meeting goal or significant improvements
 - ⚠ Not meeting goal, minimal progress
 - ❌ Below baseline or significant regression

RRT: Initiation

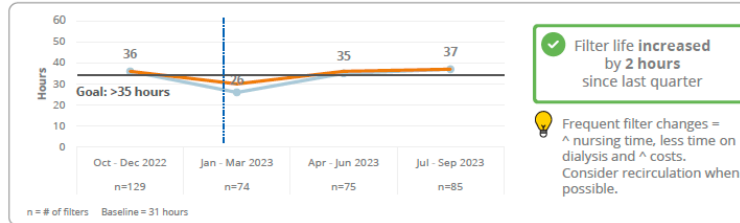


RRT: Time to Initiation <4 hours



- Legend:**
- Your Site
 - Province
 - - - Implementation (Feb 23)
 - ✔ Meeting goal or significant improvements
 - ⚠ Not meeting goal, minimal progress
 - ❌ Below baseline or significant regression

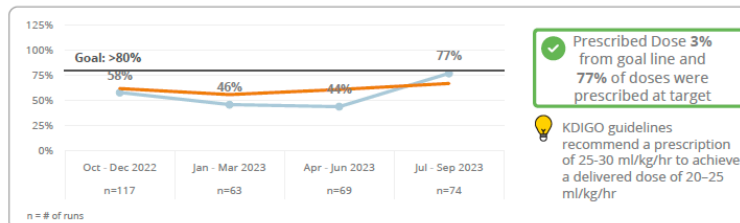
CRRT: Filter Life >35 hours



CRRT: Downtime

Coming Soon

CRRT: Prescribed Dose



Dashboards

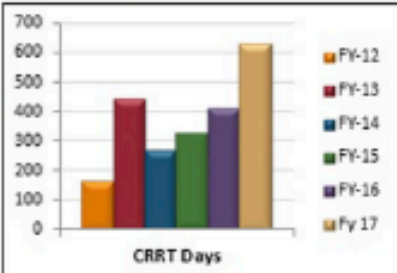


Center for Acute Care Nephrology

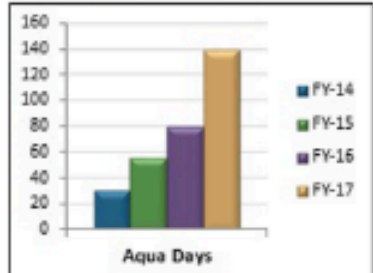
2017 - Q4

Summary Unit Activity Patient Treatment Program

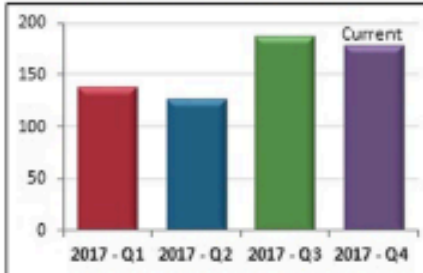
CRRT ACTIVITY (FY)



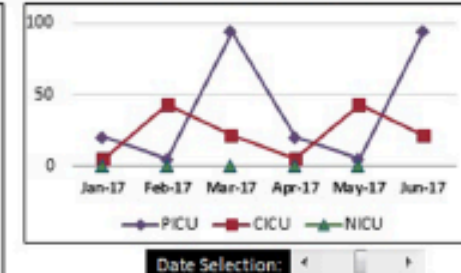
AQUAPHERESIS ACTIVITY



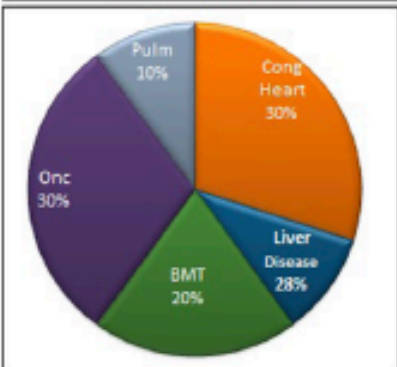
CRRT ACTIVITY BY QUARTER



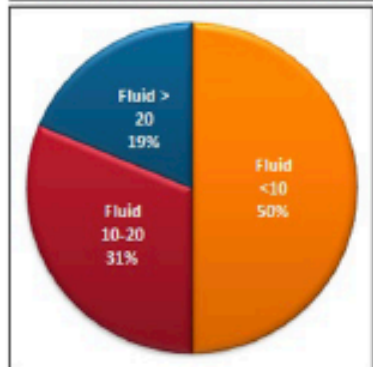
CRRT ACTIVITY BY UNIT



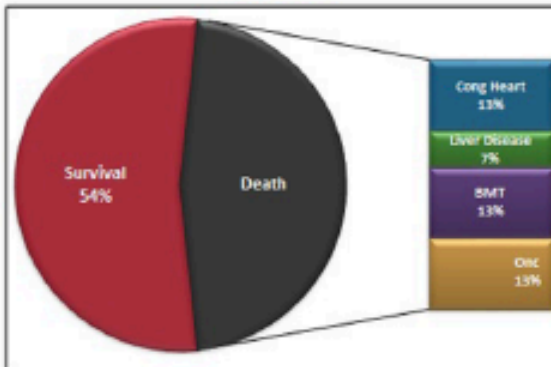
PRIMARY DISEASE



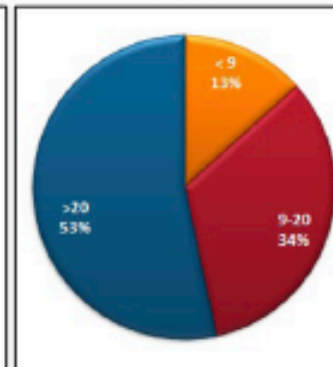
FLUID STATUS - INITIATION



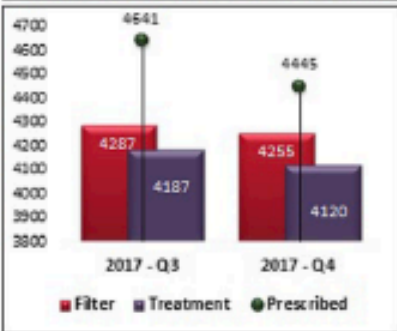
SURVIVAL



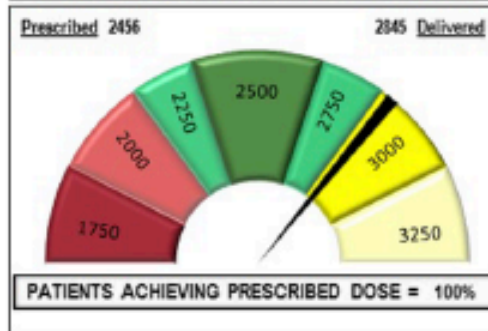
WEIGHT



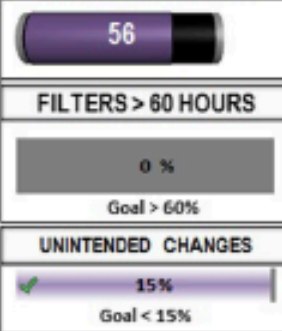
AVERAGE TREATMENT TIME (HR)



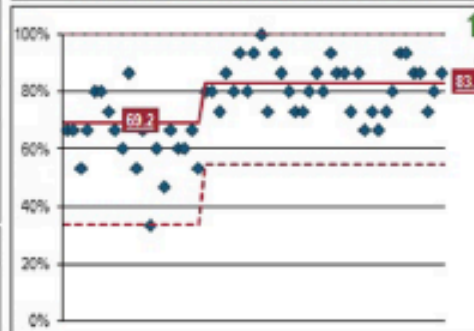
AVERAGE DIALYSIS DOSE (mL/hr/1.73m²)



AVERAGE FILTER



ACHIEVED FLUID GOAL (± 10%)

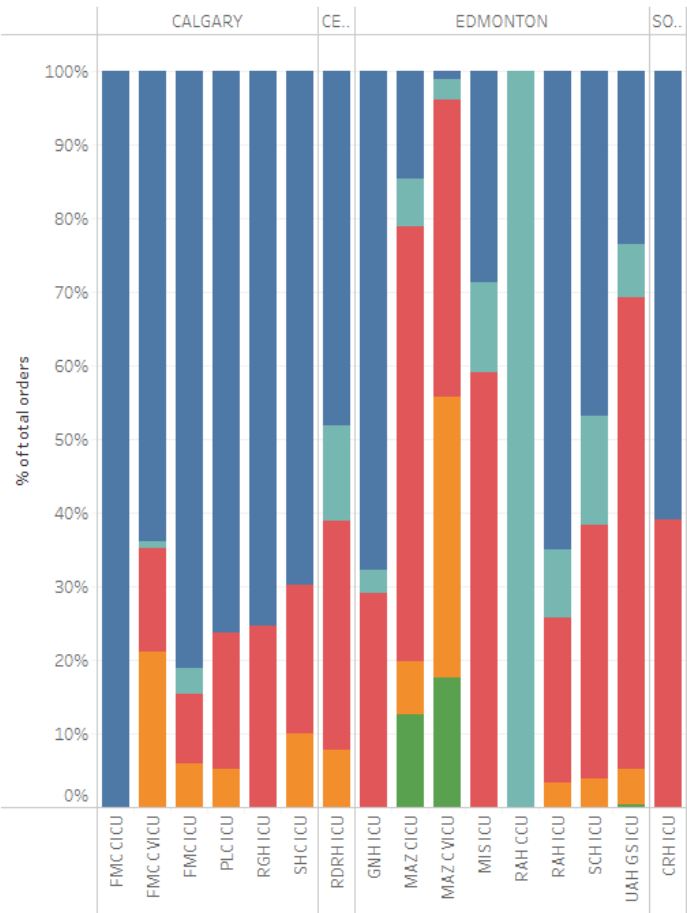


Dialyzing Wisely CRRT Prescriber Dosing

Dialyzing Wisely

Filter Life Ordering Practices

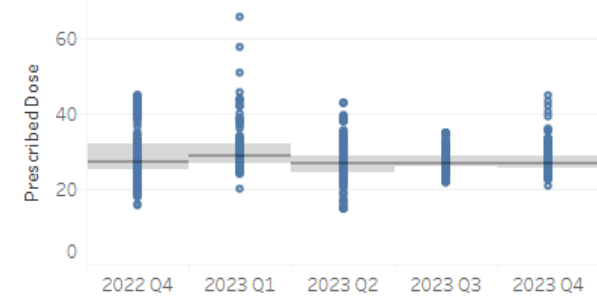
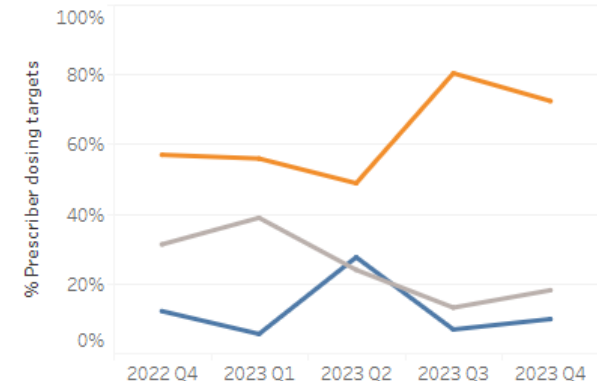
Orders by Anticoagulation Type



Filter Life by A...

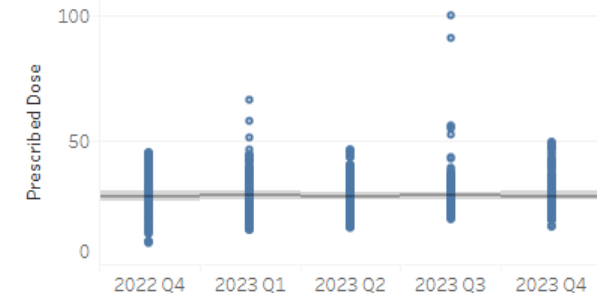
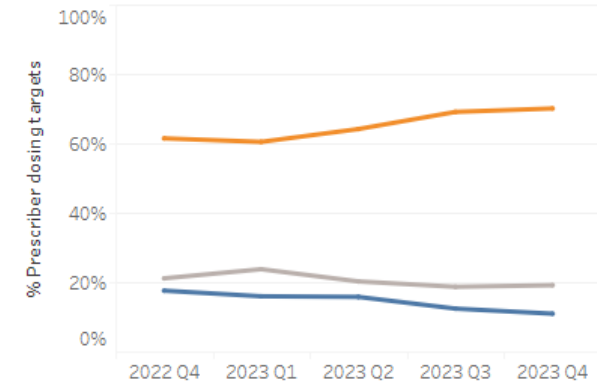


Selected Site(s) Values



Prescribed Dose Range (5 levels)	2022 Q4	2023 Q1	2023 Q2	2023 Q3	2023 Q4
In target range (25-30)	56.9%	55.8%	48.7%	80.3%	72.3%
Above target (30-35)	14.3%	24.5%	14.0%	11.7%	15.4%
Above target (>35)	16.9%	14.3%	9.8%	1.3%	2.6%
Below target (20-25)	8.3%	5.4%	19.7%	6.7%	9.7%
Below target (<20)	3.7%		7.8%		

Provincial Values



Prescribed Dose Range (5 levels)	2022 Q4	2023 Q1	2023 Q2	2023 Q3	2023 Q4
In target range (25-30)	61.4%	60.4%	64.1%	69.0%	70.0%
Above target (30-35)	12.1%	18.9%	15.9%	14.9%	15.5%
Above target (>35)	9.0%	4.8%	4.3%	3.7%	3.6%
Below target (20-25)	12.7%	11.4%	13.1%	11.7%	9.7%
Below target (<20)	4.8%	4.5%	2.6%	0.6%	1.2%

Site: UAH GS ICU

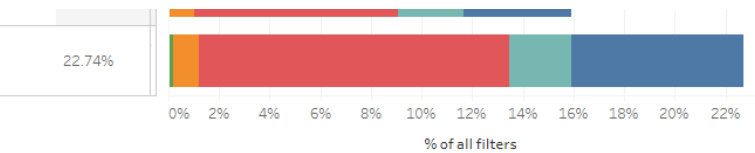
Select Aggregation: Quarter

Prescribed Dose Range: Above target (>30), Below target (<25), In target range (25-30)

Average by CRRT run?: No

Select Date Range: 10/4/2022 to 12/31/2023

Q4



Citr
Hepa
No ATC Syste
No ATC Syste
Regic

QUESTIONS/COMMENTS

rewa@ualberta.ca

