Karolinska intensive care nephrology group

Treatment monitoring and data collection

Vicenza IRRIV symposium 2019

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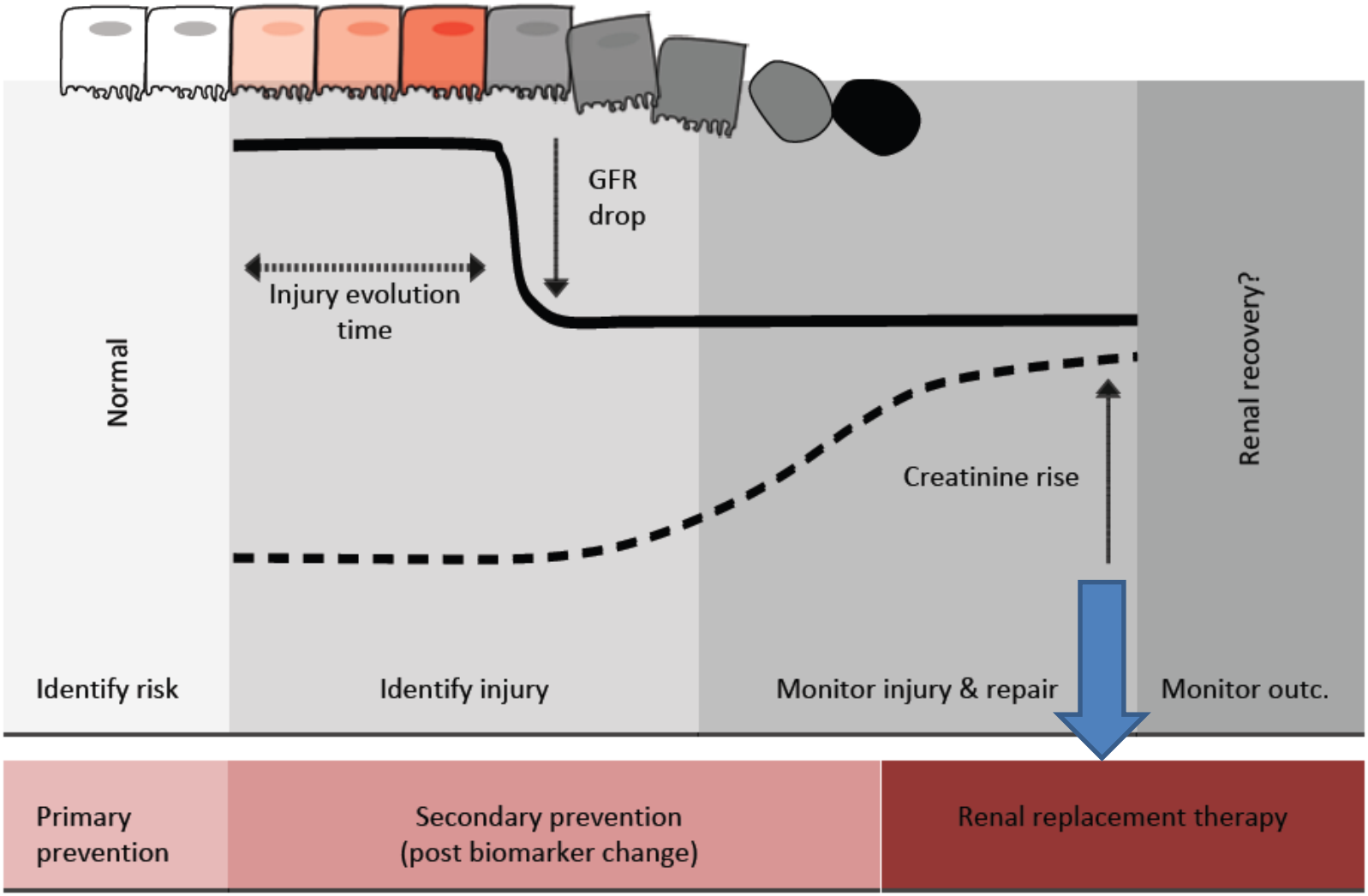
Disclosures

Baxter Medical

Fresenius Medical

Astute Medical

The AKI-CRRT conundrum




SORRY
I'M LATE
IT'S JUST
WHO I AM
AS A
PERSON

CRRT, (almost) always late

Earlier diagnosis and detection of AKI…could lead to….

Better, more timely, and thus more effective intervention…

If that is targeted RRT, certain drugs (recAP) or avoidance of nephrotoxins does not really matter

With that in mind, how do we monitor CRRT?

How do we treat our monitoring?

AND how do we monitor our treatment?

Think of how CRRT monitoring differs from

A) How we monitor mechanical ventilation

B) How we monitor vasoactive or inotropic drugs

C) How we monitor (effects of) antibiotics

Monitoring: mechanical ventilation

Pressure, flow and volume in ventilator circuit

Calculated parameters

- Compliance
- Resistance
- MAP
- Time constraints

Waveform analysis – *measured* parameters

- Pressure
- Flow
- Volume

Treatment effects: FiO2/ABGs

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Monitoring: vasoactive and inotropic drugs

Blood pressure, on-line-monitoring – arterial cannulae

Lactate and other ABG data

Labdata, like TnT, proBNP

Invasive monitoring, from central lines, via PICO, to PA catheters

Echocardiography, transthoracic and/or TEE

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AND how do we monitor our treatment?

Think of how CRRT monitoring differs from

A) How we monitor mechanical ventilation

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Monitoring: antibiotics

C-reactive protein

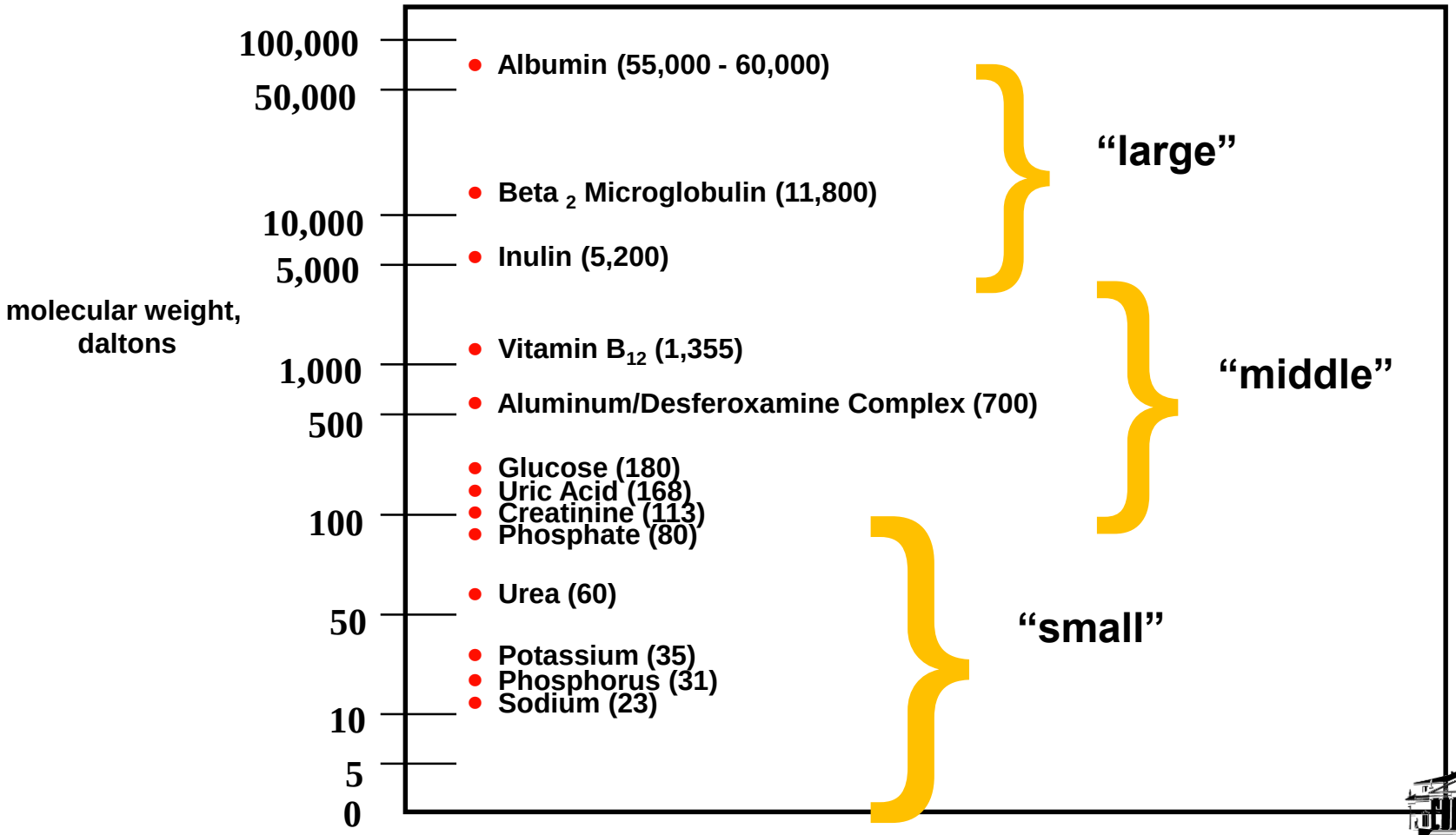
Temperature

Procalcitonin

SOFA score trends

Radiology, broncoscopy

How do we, or should we, monitor CRRT?



How do we, or should we, monitor CRRT (2)?

Ordinationsjournal för CVVHDF via Prismaflex

År			CDK		Pat id
Antikoagulantia		**Modalitet**		**Indikation**	
Citrat	☐	CVVHDF ☐		Uremi ☐	
Heparin	☐	CVVH ☐		Anuri ☐	
Ingen	☐	CVVHD ☐		Hypervolemi ☐	
Annat:		SCUF ☐		Elektrolytrubbning ☐	
				Acidos ☐	
				Sepsis ☐	
				Hypertermi ☐	

Startvärden	Datum				
	Tid				
	Aktuell vikt (kg)				
	P-Kreatinin (µmol/L)				
	P-Cystatin C (mg/L)				
	P-Urea (mmol/L)				
	Filter (ST150 el. Oxiris)				
	Ordinerad dos (mL/kg/h)				
	Heparin i primning Ja/Nej				
	Blodflöde (mL/min)				
	Citratdos (mmol/L) (vanligen 3 mmol/L)				
	Ca^{2+}-inf. ord i clinisoft	☐	☐	☐	☐

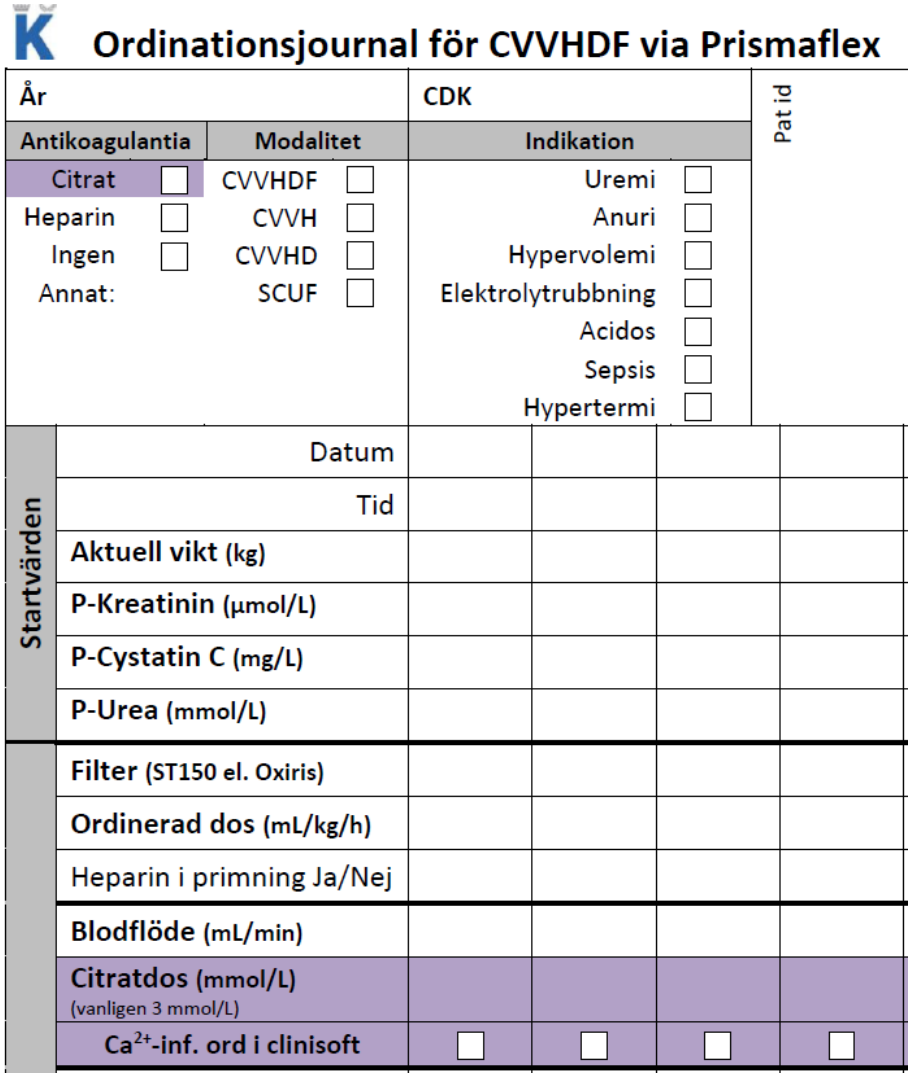
First: what is the indication?

Is this a **septic AKI case**, or a pure **hypervolemia**?

Maybe an outlier, like **hyperthermia** or a severe **electolyte imbalance**?

This, the indication of starting CRRT, ought to have an impact on how we monitor our treatment.

How do we, or should we, monitor CRRT (3)?



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<u>What is the status of the patient when you start the treatment?</u>

Body weight of patient?

Degree of fluid overload?

Creatinine/KDIGO-stage at CRRT initiation?

BUN at CRRT initiation?

Cystatin C at CRRT initiation?

How do we, or should we, monitor CRRT (4)?

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Heparin ☐	CVVH ☐	Anuri ☐		
Ingen ☐	CVVHD ☐	Hypervolemi ☐		
Annat:	SCUF ☐	Elektrolytrubbning ☐		
		Acidos ☐		
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	Ca^{2+}-inf. ord i clinisoft	☐	☐	☐	☐

(Maybe) the most important part:

How does (fluid balance and) body weight, creatinine, BUN and cystatin C **change over time?**

What is the trend over 12/24/48 hours?

This allows for correction of dose

This gives physicians and nurses insight into the impact of downtime…AND…

Actually tells us a something about rest-renal-function (together with urine output).

How do we, or should we, monitor CRRT (5)?

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<u>If the patient is septic:</u>

Follow the concentrations of Meropenem, Pip-Tazo and Vanco

Don't forget that CRRT can lower body temperature

Are levels of CRP and PCT lowered with CRRT? Does CVVHDF vs CVVH or CVVHD matter?

Creatinine, use with caution

TABLE 2. Crude Mortality and Adjusted Hazard Ratios for Death Over 90-Day and 1-Year Follow-Up After Critical Illness Associated With Plasma Cystatin C and Creatinine Measurements Near ICU Discharge

	Unadjusted Post-ICU Survival by Quartile of Cystatin C or Creatinine				Adjusted Hazard Ratio 75th Relative to 25th Centile
	Quartile 1	Quartile 2	Quartile 3	Quartile 4	
Cystatin C					
Values (mg/L)	0.20–0.80	0.80–1.10	1.10–1.63	1.63–8.48	1.63 vs 0.80
90-d mortality	2.6%	6.2%	11.8%	21.0%	2.23 (1.63–3.02)
365-d mortality	5.6%	11.0%	21.2%	32.0%	1.78 (1.46–2.18)
Creatinine					
Values (mg/dL)	0.1–0.63	0.63–0.83	0.83–1.20	1.20–11.55	1.20 vs 0.63
90-d mortality	8.4%	6.3%	9.9%	17.0%	1.09 (0.89–1.33)
365-d mortality	13.6%	12.4%	17.3%	26.7%	1.03 (0.87–1.21)

(*Crit Care Med* 2017; 45:e932–e940)

Superiority of Serum Cystatin C Over Creatinine in Prediction of Long-Term Prognosis at Discharge From ICU

Bo Ravn, MD[1]; John R. Prowle, MD[2,3]; Johan Mårtensson, MD[4]; Claes-Roland Martling, MD[1]; Max Bell, MD[1]

Creatinine, use with caution (2)

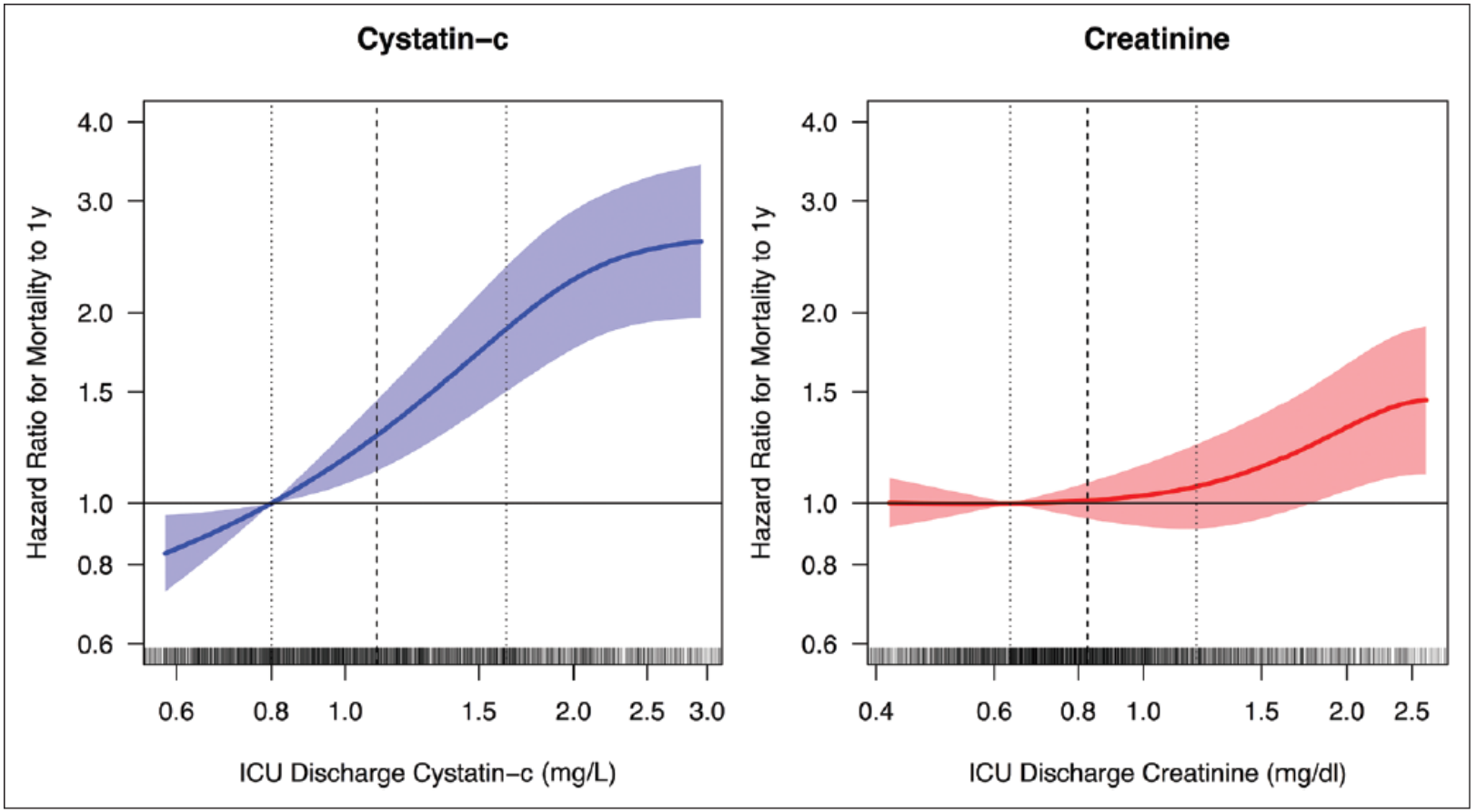

Figure 2. Age- and sex-adjusted hazard ratios for survival in the year after ICU discharge fitted with penalized spline regression for ICU discharge creatinine and cystatin C. Stratified Cox model (strata: comorbidity index category [0, 1–2, 3–4, 5–6, and > 6] and octiles of age). Values plotted from the fifth to 95th centiles the predictor variable and distribution of values within this range are marked above the *x*-axis. Reference is 25th centile value set hazard ratio equals to 1st, 25th, 50th, and 75th centiles are marked with vertical lines.

(*Crit Care Med* 2017; 45:e932–e940)

Creatinine, use with caution (3)

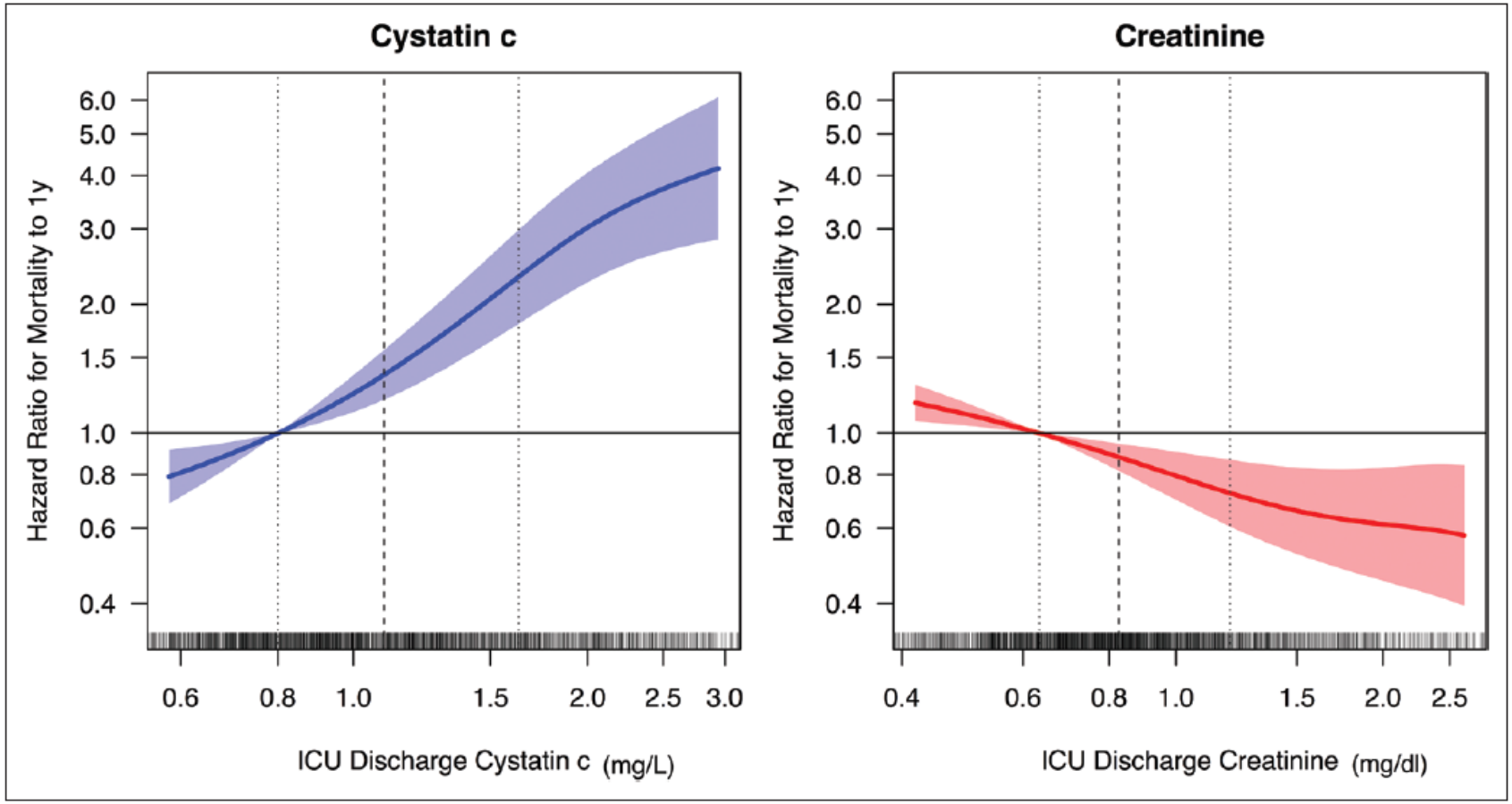

Figure 3. Including cystatin C and creatinine together in a single Cox proportional hazard survival model, age- and sex-adjusted hazard ratios for survival in the year after ICU discharge fitted with penalized spline regression for ICU discharge creatinine adjusted for cystatin C and cystatin C adjusted for creatinine. Stratified Cox model (strata: comorbidity index category [0, 1–2, 3–4, 5–6, and > 6] and octiles of age). Values plotted from the fifth to 95th centiles the predictor variable and distribution of values within this range is marked above the *x*-axis. Reference is 25th centile value set to hazard ratio equals to 1st, 25th, 50th and 75th centiles are marked with vertical lines.

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In summary

Try to follow CRRT treatment, just like we do with other means of organ support in the ICU

Novel biomarkers of injury are likely to gain clinical traction in the near future

Old school functional biomarkers like creatinine, BUN, cystatin C and urine output still important; follow the trends!

Consider monitoring of antibiotic levels in plasma (especially with regards to septic AKI)