

Children's Mercy Kansas City

SHARE @ Children's Mercy

Presentations

1-2024

Improving Nutritional Delivery to Pediatric Patients on Continuous Renal Replacement Therapy

Jennifer Ruiz-Boada

Children's Mercy Kansas City

Sarah Brunner

Children's Mercy Kansas City

Tara Benton

Children's Mercy Hospital

Vimal Chadha

Children's Mercy Hospital

Let us know how access to this publication benefits you

Follow this and additional works at: <https://scholarlyexchange.childrensmercy.org/presentations>



Part of the [Critical Care Commons](#), [Nephrology Commons](#), and the [Pediatrics Commons](#)

Recommended Citation

Ruiz-Boada, Jennifer; Brunner, Sarah; Benton, Tara; and Chadha, Vimal, "Improving Nutritional Delivery to Pediatric Patients on Continuous Renal Replacement Therapy" (2024). *Presentations*. 85.

<https://scholarlyexchange.childrensmercy.org/presentations/85>

This Presentation is brought to you for free and open access by SHARE @ Children's Mercy. It has been accepted for inclusion in Presentations by an authorized administrator of SHARE @ Children's Mercy. For more information, please contact hlsteel@cmh.edu.

Improving Nutritional Delivery to Pediatric Patients While Using Continuous Renal Replacement Therapy

Jennifer Ruiz Boada, M.D.
Children's Mercy Hospital, Kansas City

Sarah Brunner, M.D.; Tara Benton, M.D.; Vimal Chadha, M.D.

Society of
Critical Care Medicine
The Intensive Care Professionals



CRITICAL CARE
CONGRESS.

Background



Children with acute and chronic renal failure face high rates of malnutrition with a higher deficit of protein intake when compared to caloric intake due to increased fasting rates while on therapy.

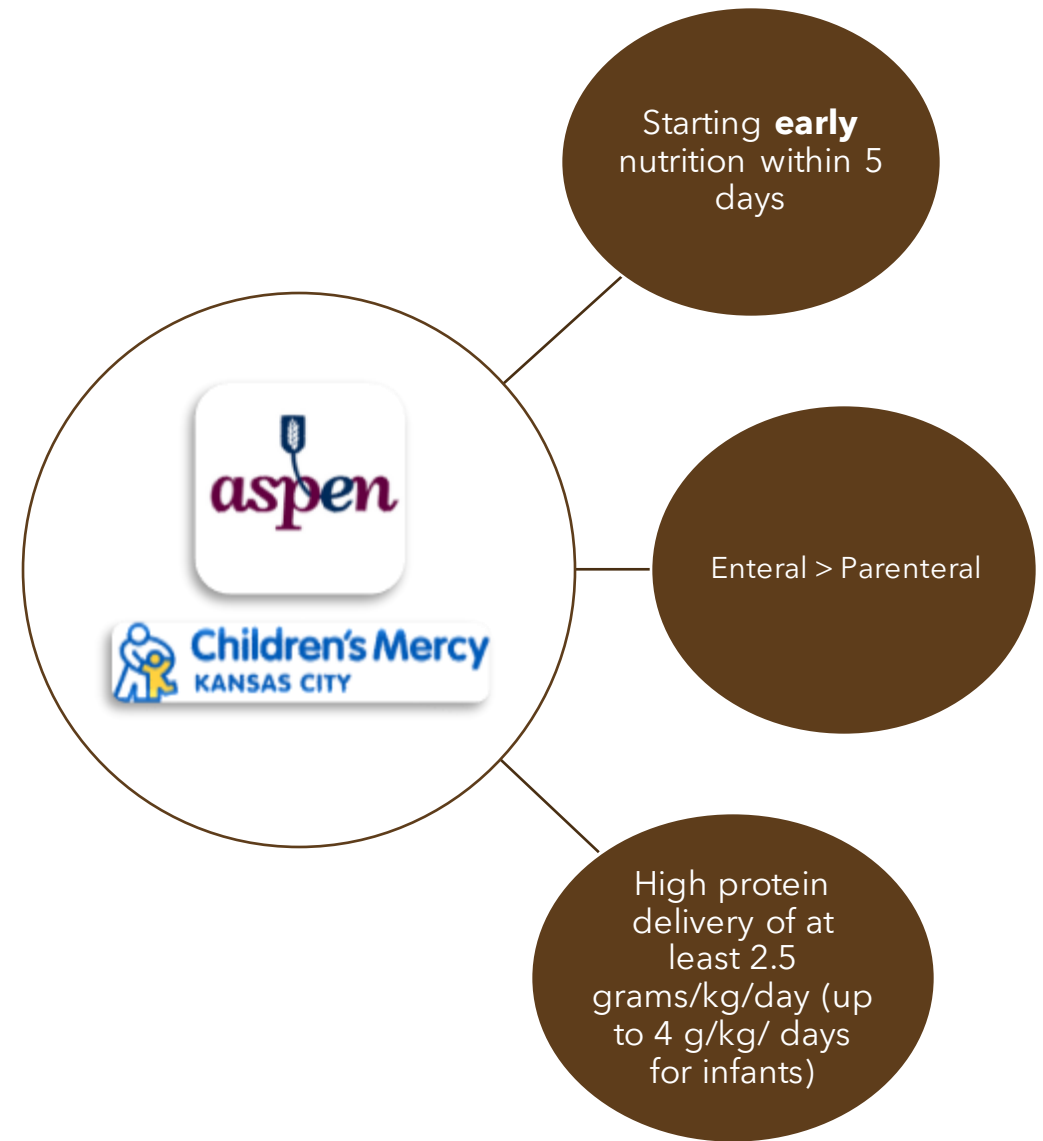


Use of CRRT is associated with increased risk of malnutrition by removal of essential proteins and micronutrients.



Malnutrition in critically ill children

↑ ICU stay
↑ Ventilation days
Mortality



Examination of nutrition delivery in CRRT patients at CMH in 2021 revealed **sub-optimal adherence to the guidelines**

Baseline Data

Baseline Patient Data (year 2021)

All CRRT \geq 5d 2021 (n = 18)

Parenteral Nutrition (PN) (n = 2), Enteral Nutrition (EN) (n = 2), PN + EN (n = 14)

72% (13/18) received 75% goal **protein** by day 5 of CRRT

61% (11/18) received 75% of goal **calories** by day 5 of CRRT

Project Goals & SMART Aim

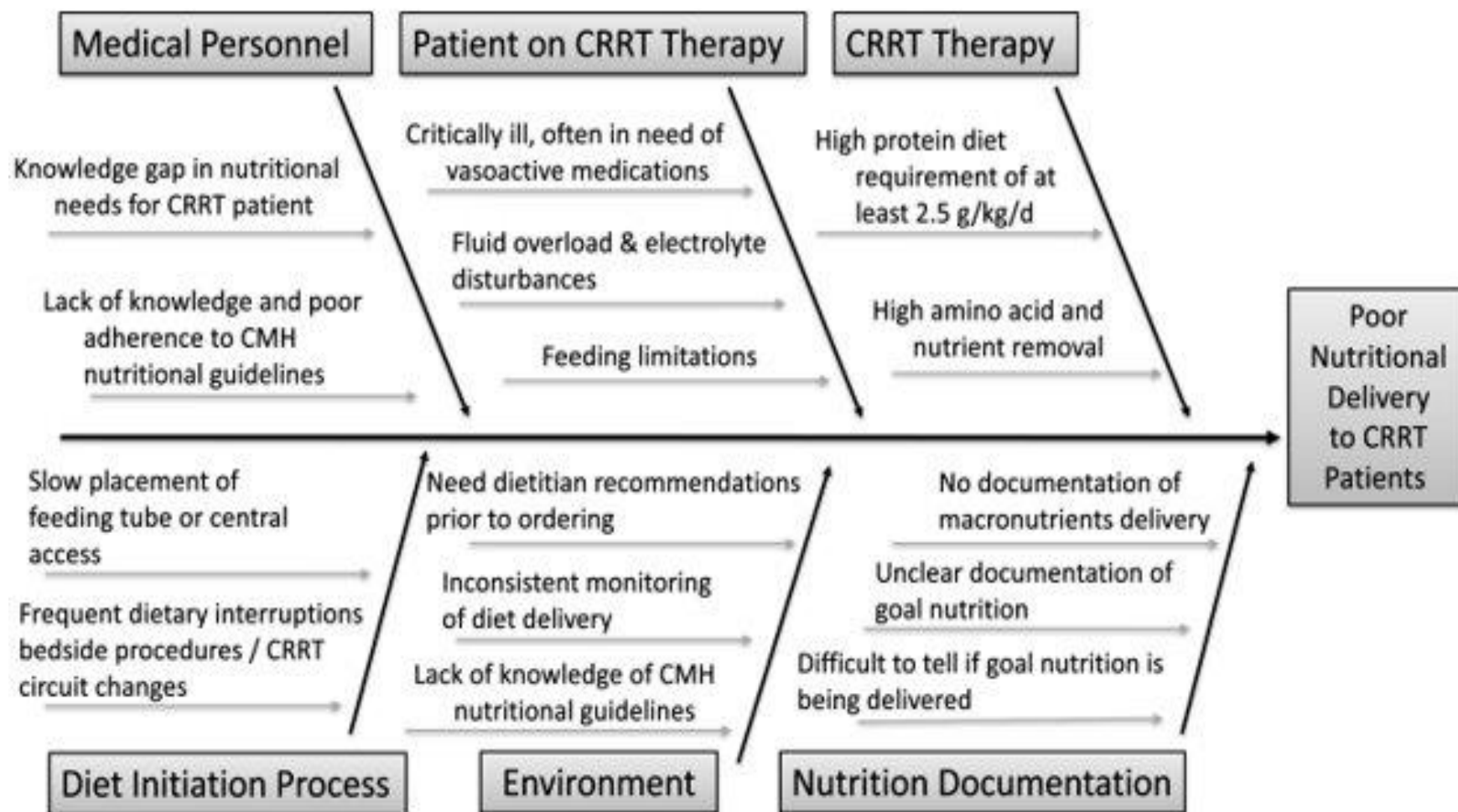
- The goal is to improve **early** nutrition by optimizing calories and protein delivered to CRRT patients in the first five days.
- **This QI project aims to increase the percentage of patients achieving 75% of their goal protein and caloric intake by day 5 of CRRT initiation by at least 15% by May 2024.**



Multidisciplinary Stakeholders: Dietitians, bedside nurses, CRRT specific nurses, nephrologists and intensivists

- **Biggest areas of opportunity:**

- Lack of knowledge about nutritional guidelines for CRRT patients.
- Difficulty understanding if goal nutrition is ordered and delivered to the CRRT patient by the clinical team.



Interventions



Intervention #1:

Education and Implementation of CRRT Nutrition Checklist



Intervention #2:

Implementation of new EMR documentation note completed by dietitian
"CRRT Nutrition Summary"

1st Intervention

Education and Implementation of CRRT Nutrition Checklist

Nutrition of Patients on Continuous Renal Replacement Therapy (CRRT)

Importance of Nutrition

- CRRT has a direct impact on the metabolism of calories, proteins, fats, and micronutrients.
- Children with AKI have a high prevalence of undernutrition and loss of muscle mass.
- CRRT patients require an adequate source of calories and protein to:
 - ↑ Improve Health
 - ↓ Decrease Infection rates, mortality rates and hospital stay

Nutritional Challenges

- **CRRT Advantages:** Offers a stable hemodynamic method to remove toxins and excess fluids from the body.
- **CRRT Disadvantages:** Removes essential nutrients such as proteins, vitamins, and trace elements.
- The patient's dry weight is difficult to estimate due to excess fluid.
- Critically ill patients with AKI are commonly underfed due to medical instability and frequent interruptions of nutrition for procedures or vasoactive medications.

Nutritional Guidelines

Patients require optimal nutritional delivery to improve clinical outcomes

- Maintain a dry weight within 5% of the admission weight.
- Start diet in the first 2 days and achieve total daily intake by day 5.
- An enteral diet is preferred, but a combination with parenteral nutrition is acceptable.

Proteins

- Amino acids are a crucial part of nutrition.
- Proteins are indirectly eliminated with CRRT therapy, but a high-protein diet is necessary to promote muscle recovery and reduce inflammation.
- **Protein Delivery should be at least 2.5 grams/kg/day**

Carbohydrates & Fat

- The remaining caloric needs are adjusted based on each patient's Resting Energy Expenditure (REE).
- There is no evidence of altered fat metabolism during CRRT

Trace Elements

- Aid the immune system but are also lost during CRRT. Replacement during parenteral nutrition is important.

Scan Me



CMH Nutritional Guidelines for CRRT

Printed Educational Material

CRRT Initiation Nutritional Checklist



Scan to access CRRT Nutrition Checklist

CRRT Nurses will encourage and assist in the completion of the CRRT Nutritional Checklist

**Nutritional Huddle before day 5 of CRRT Initiation – Can be completed by Dietitian, Intensivist, Residents/Fellow, Bedside nurses, and CRRT Nurses*

- Does the patient meet a high Protein Goal intake? (at least ≥ 2.5 g/kg/day)
- Does the patient meet their Caloric Goal intake required by age?
- Method of feeding (PN/EN)?
- Interruptions to nutrition (PN/EN)? Why?

2nd Intervention

New EMR documentation "CRRT Nutrition Summary"

Nutritional Goal	Nutrition Ordered	Nutritional Delivery
<ul style="list-style-type: none">• Total Caloric Goal Needs (Kcal/kg/d)• Total Proteins Goal Needs (g/kg/d)	<ul style="list-style-type: none">• Total, Enteral and Parenteral Ordered Protein (g/kg/d)• Total, Enteral and Parenteral Ordered Calories (Kcal/kg/d)	<ul style="list-style-type: none">• Protein Delivered Enteral, Parenteral & Total (g/kg/d)• Calories Delivered Enteral, Parenteral & Total (Kcal/kg/d)• Percentage of Protein Goal Delivered (Daily Protein Intake / Goal Protein) %• Percentage of Caloric Goal Delivered (Daily Caloric Intake / Goal Calories) %

Measures

- **Outcome:**

- Percentage of goal protein and calories delivered withing day 5 of CRRT initiation

- **Process:**

- Percentage completion of the Nutrition Checklist for CRRT Initiation
- Percentage completion of the CRRT Nutrition Summary Note as documented in the EMR

- **Balancing:**

- GI complications, Feeding Intolerance (i.e. Necrotizing enterocolitis or significant ileus requiring making the patient NPO).

Demographics

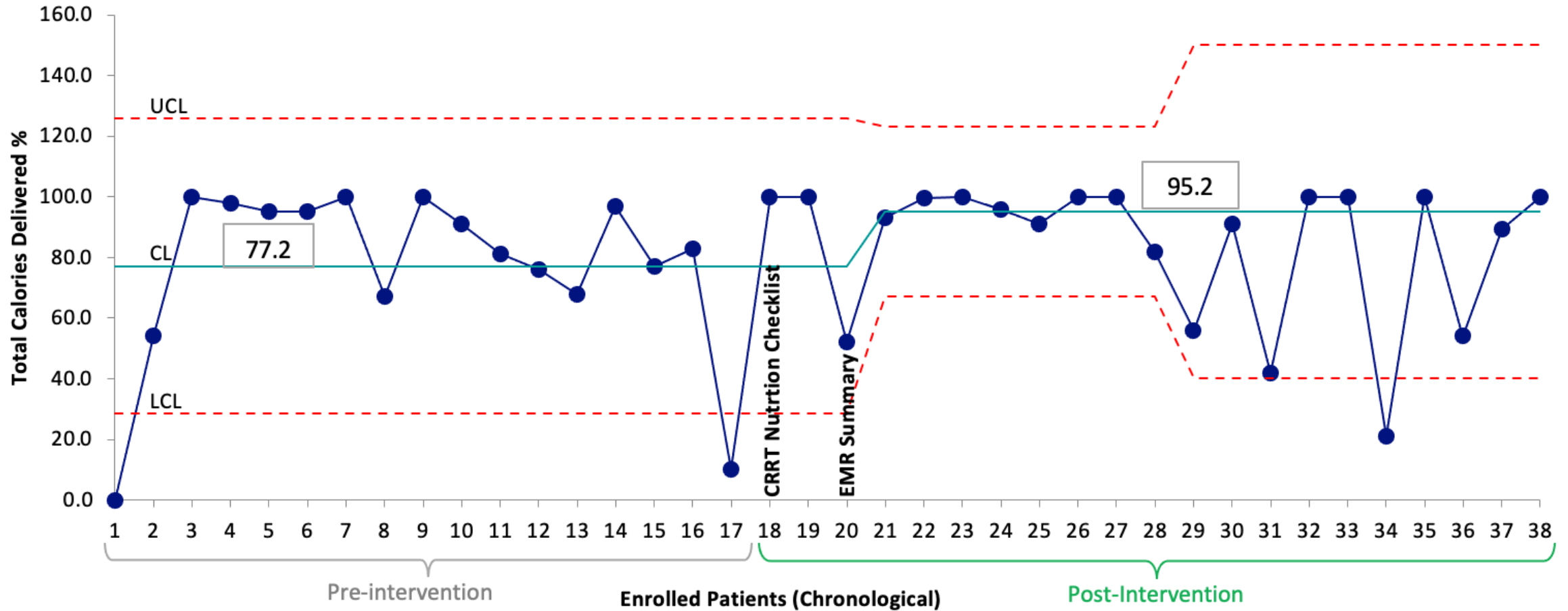
Patient Population Characteristics	Pre-Implementation	Post-Implementation
	January - December 2021	October 2022–December 2023
Patients on CRRT therapy > 5 days, n	18	20
Mean age, years (± SD)	6.4 (± 6.8)	5.2 (± 6.1)
Female (%)	33	30
CRRT indication, n		
Acute Kidney Injury	12	16
Fluid overload	3	10
Metabolic, Genetic, Liver Failure	3	6
Total days of CRRT, mean (± SD)	46 (± 76)	30 (± 24)
Feeding modality, n		
Parenteral (PN) only	2	12
Enteral (EN) Only	2	3
PN & EN	14	5

The post-intervention population is younger and has a prolonged median of ICU & hospital stay (45 days and 62 days, respectively).

- 95% of patients required mechanical ventilator support and 75% used vasoactive medications.
- 30% mortality
- 30% required ECMO support

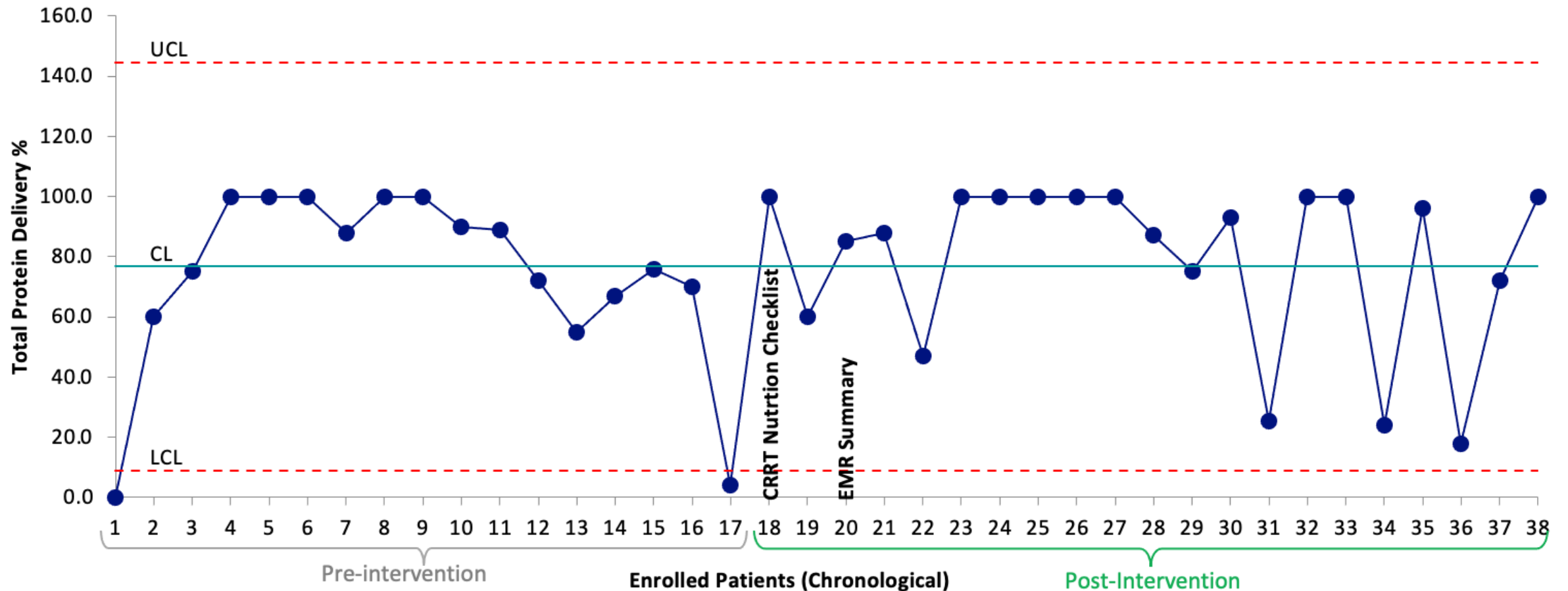
Results

Total Percentage of Calories Delivered (%)



Results

Total Percentage of Protein Delivery (%)



Process Measures Results



The CRRT Initiation Nutritional Checklist was completed 76% of time.



The CRRT EMR Nutrition Summary Documentation completed 100% of the time.

Conclusion

- This project highlights the positive impact of multidisciplinary discussion and the active role of a dietitian in the ICU.
- **Caloric Delivery:** Significant center line shift from 77% to 95% for total caloric goal delivery.
 - This showcases the positive influence of a dietitian who fosters multidisciplinary dietary discussion by utilizing a CRRT initiation checklist. The EMR-specific documentation helps providers understand the actual nutritional delivery for quick interventions.
- **Protein Delivery:** No center line change for total protein goal delivery.
 - Common obstacles identified include heavy reliance on enteral nutrition and dependence on dextrose-containing fluids during up-titration of such.
- Increasing protein intake will be our focus for future interventions
 - Interruptions of Enteral and Parenteral nutrition for surgical interventions
 - Escalation of enteral nutrition with just dextrose-containing fluids

References

- Gundogan K, Yucesoy FS, Ozer NT, Temel S, Sahin S, Sahin GG, Sungur M, Esmoğlu A, Talih T, Yazici C, Griffith DP, Ziegler TR. Serum micronutrient levels in critically ill patients receiving continuous renal replacement therapy: A prospective, observational study. *JPEN J Parenter Enteral Nutr.* 2022 Apr 5. doi: 10.1002/jpen.2378. Epub ahead of print. PMID: 35383966.
- Lion RP, Vega MR, Smith EO, Devaraj S, Braun MC, Bryan NS, Desai MS, Coss-Bu JA, Ikizler TA, Akcan Arıkan A. The effect of continuous venovenous hemodiafiltration on amino acid delivery, clearance, and removal in children. *Pediatr Nephrol.* 2022 Feb;37(2):433-441. doi: 10.1007/s00467-021-05162-0. Epub 2021 Aug 12. PMID: 34386851.
- Wong Vega M, Juarez Calderon M, Tufan Pekkucuksen N, Srivaths P, Akcan Arıkan A. Feeding modality is a barrier to adequate protein provision in children receiving continuous renal replacement therapy (CRRT). *Pediatr Nephrol.* 2019 Jun;34(6):1147-1150. doi: 10.1007/s00467-019-04211-z. Epub 2019 Mar 6. PMID: 30843114.
- Guo J, Jin Z, Cheng Y, Su J, Li Z, Jin Z. Effect of Early Nutritional Assessment and Nutritional Support on Immune Function and Clinical Prognosis of Critically Ill Children. *J Healthc Eng.* 2022 Jan 7;2022:7100238. doi: 10.1155/2022/7100238. PMID: 35035853; PMCID: PMC8759854.
- Kyle UG, Akcan-Arıkan A, Orellana RA, Coss-Bu JA. Nutrition support among critically ill children with AKI. *Clin J Am Soc Nephrol.* 2013 Apr;8(4):568-74. doi: 10.2215/CJN.05790612. Epub 2013 Jan 4. PMID: 23293125; PMCID: PMC3613953.
- Nystrom EM, Nei AM. Metabolic Support of the Patient on Continuous Renal Replacement Therapy. *Nutr Clin Pract.* 2018 Dec;33(6):754-766. doi: 10.1002/ncp.10208. Epub 2018 Oct 15. PMID: 30320418.
- Jonckheer J, Vergaelen K, Spapen H, Malbrain MLNG, De Waele E. Modification of Nutrition Therapy During Continuous Renal Replacement Therapy in Critically Ill Pediatric Patients: A Narrative Review and Recommendations. *Nutr Clin Pract.* 2019 Feb;34(1):37-47. doi: 10.1002/ncp.10231. Epub 2018 Dec 20. PMID: 30570180; PMCID: PMC7379206.
- Sethi SK, Maxvold N, Bunchman T, Jha P, Kher V, Raina R. Nutritional management in the critically ill child with acute kidney injury: a review. *Pediatr Nephrol.* 2017 Apr;32(4):589-601. doi: 10.1007/s00467-016-3402-9. Epub 2016 Jun 20. PMID: 27324472.
- Zappitelli M, Goldstein SL, Symons JM, Somers MJ, Baum MA, Brophy PD, Blowey D, Fortenberry JD, Chua AN, Flores FX, Benfield MR, Alexander SR, Askenazi D, Hackbarth R, Bunchman TE; Prospective Pediatric Continuous Renal Replacement Therapy Registry Group. Protein and calorie prescription for children and young adults receiving continuous renal replacement therapy: a report from the Prospective Pediatric Continuous Renal Replacement Therapy Registry Group. *Crit Care Med.* 2008 Dec;36(12):3239-45. doi: 10.1097/CCM.0b013e31818f3f40. PMID: 18936697.
- Kamel AY, Dave NJ, Zhao VM, Griffith DP, Connor MJ Jr, Ziegler TR. Micronutrient Alterations During Continuous Renal Replacement Therapy in Critically Ill Adults: A Retrospective Study. *Nutr Clin Pract.* 2018 Jun;33(3):439-446. doi: 10.1177/0884533617716618. Epub 2017 Dec 18. PMID: 28727945.
- Vega MW, Juarez M, Lee JY, Srivaths P, Williams E, Akcan Arıkan A. Quality Improvement Bedside Rounding Audits Enhance Protein Provision for Pediatric Patients Receiving Continuous Renal Replacement Therapy. *Pediatr Crit Care Med.* 2018 Nov;19(11):1054-1058. doi: 10.1097/PCC.0000000000001698. PMID: 30059478.
- Sgambat K, Moudgil A. Carnitine deficiency in children receiving continuous renal replacement therapy. *Hemodial Int.* 2016 Jan;20(1):63-7. doi: 10.1111/hdi.12341. Epub 2015 Aug 11. PMID: 26265013.

Thank you for your time!

Special Thanks to the Dietitians at CMH for their help in this project.

