Montefiore DOING MORE℠

EINSTEIN
Albert Einstein College of Medicine

CPRQ: 2019-2020 Annual Report

Center for Pharmacotherapy Research and Quality

The Center for Pharmacotherapy Research and Quality (CPRQ) aims to be the primary resource for Montefiore clinicians to engage in outcomes research and quality improvement initiatives involving medication use.

Table of Contents

Executive Summary

Financial Value Generation

The CPRQ has spearheaded initiatives which improved the financial health of the medical center. This includes additional revenue streams through secured research grants totaling $113,465 and the development of a data-driven approach to medication use. The CPRQ has developed and supported tools that measure the utilization and assess the value of pharmacotherapy. This has resulted in the avoidance of over $3,000,000 in unnecessary medication expenditures and a savings of $257,378 with the use of much less and equally safe and effective alternatives.

Patient-Centered Outcomes Research

Pharmacy-driven outcomes research initiatives seek to study and optimize the use of medications in hospitalized and ambulatory patients. The CPRQ ensures that medications used in the healthsystem achieve most optimal outcomes for Montefiore patients by overseeing research that is grounded on a relevant objectives and sound methodologies. The CPRQ has facilitated cross-disciplinary work on a dozen outcomes research projects that address the institution's mission, including Ambulatory Care, Cardiology Critical Care, Infectious Diseases, and Perioperative Services/Anesthesiology.

Performance Improvement Science

The science of improvement is an applied science that promotes innovation, repeated testing and tests of change in order to optimize a process or processes that lead to improvements. Applied to pharmacotherapy, a multidisciplinary approach can drive optimal outcomes for our patients – improvement in effectiveness, safety and decreased cost to patients and the health system. Modeled after principles derived from the Institute of Healthcare Improvement, performance improvement begins by identifying a clear aim for improvement and a measurement plan that focuses around specific tests of change that we think will lead to that improvement. We emphasize starting improvement efforts on a small scale and when appropriate, expanding to a larger patient population. CPRQ is currently overseeing 8 interdisciplinary performance improvement initiatives evaluating the use of several medications within the departments/divisions of Critical Care, Hematology, Medicine and Surgery.

Investigational Drug Service

The Investigational Drug Service (IDS) of the Pharmacy Department seeks to ensure that investigational drugs are prescribed, dispensed and administered in a safe, effective and efficient manner. The IDS make sure that investigational drug studies are carried out scientifically and comply with all applicable guidelines as required by the Food and Drug Administration and this institution. The CPRQ-supported IDS is currently involved with 124 studies or which 99 are industry sponsored, 8 are funded by the National Institutes of Health and 17 are investigator-initiated.

Purpose and Mission

The Center for Pharmacotherapy Research and Quality (CPRQ) aims to be the primary resource for Montefiore clinicians to engage in outcomes research and quality improvement initiatives involving medication use. The center is committed to supporting patient-centered medication use research and quality improvement initiatives that prioritize real-world clinical outcomes and patient experience. The center consists of clinical pharmacy faculty with backgrounds in research and quality improvement methodology and is governed by an inter-disciplinary steering committee.

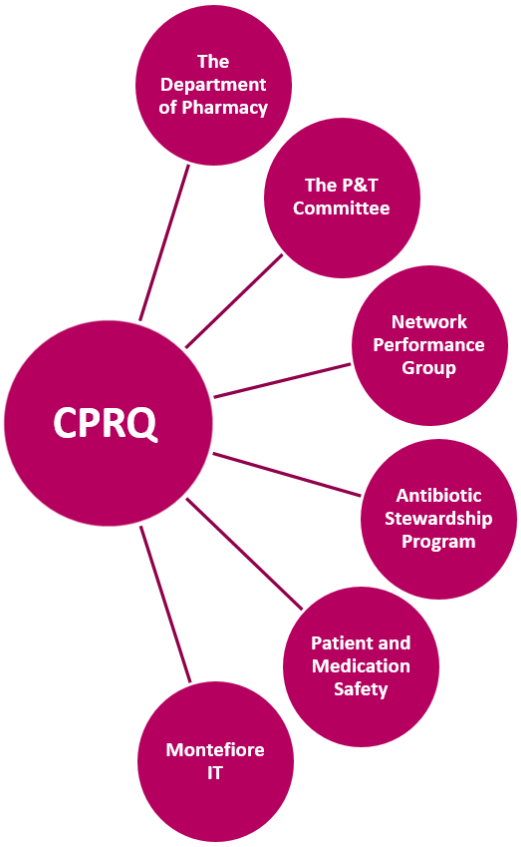
Mission

CPRQ aims to advance evidence-based use of pharmacotherapy and to support medication-related outcomes research and quality improvement initiatives at Montefiore.

Guiding Principles

The CPRQ seeks to achieve this mission though the following guiding principles:

- Develop a **data-driven** culture around pharmacotherapy utilization and formulary management decisions
- Generate **actionable** findings that are used to drive health system decisions and processes
- Provide **accountability and transparency** over the medication use processes and related patient outcomes
- Foster inter-departmental and inter-institutional **collaboration** by breaking down silos in medication use research and quality improvement initiatives
- Provide **education and training** in data-driven medication use, research methodology, and quality improvement science to Montefiore clinicians
- **Disseminate the knowledge** of medication use outcomes and best practices to all relevant stakeholders of the Montefiore Health System and the wider community of clinical practitioners



Programs and Processes

The center has developed a variety of educational programs, research tools and processes to help advance its mission. The center maintains an extensive, validated data mining tool that readily delivers information on nearly 30 million medication orders and related administrations at Montefiore. Members of CPRQ involved in teaching pharmacotherapy research and quality improvement methodology curriculum to pharmacy clinicians, residents and students to prepare them for a career in data-driven pharmacy practice. Additionally, the steering committee reviews all pharmacotherapy research and quality improvement projects to ascertain their feasibility, relevance to institutional goals, opportunity for cross-disciplinary collaboration, and methodological rigor. The following are select programs and processes that help CPRQ keep on track with its mission:

Education and Training

- Outcomes Research and Improvement Science curricula for pharmacy residency program
- "Lunch and Learn" sessions to assist clinicians with data procurement and analysis
- Educational sessions on research methodology via Pharmacotherapy Grand Rounds and Merck Academy
- Hands-on workshops on the use of R data analysis software

Data Access and Analytics

- Provisioning, maintenance, and training in the use of two pharmacy universes in Business Objects
- Membership on the advisory/focus group for Clinical Looking Glass (CLG) replacement
- Provisioning and training in the use of Premier Quality Advisor and Service Line Analytics, in collaboration with the Network Performance Group

Interdisciplinary Collaboration

- Research collaboration initiatives with Albert Einstein College of Medicine, University at Buffalo School of Pharmacy, and LIU School of Pharmacy
- Continued research engagement with pharmaceutical industry partners
- Multidisciplinary steering committee disseminates projects and helps build collaborative workgroups

Dissemination of Knowledge

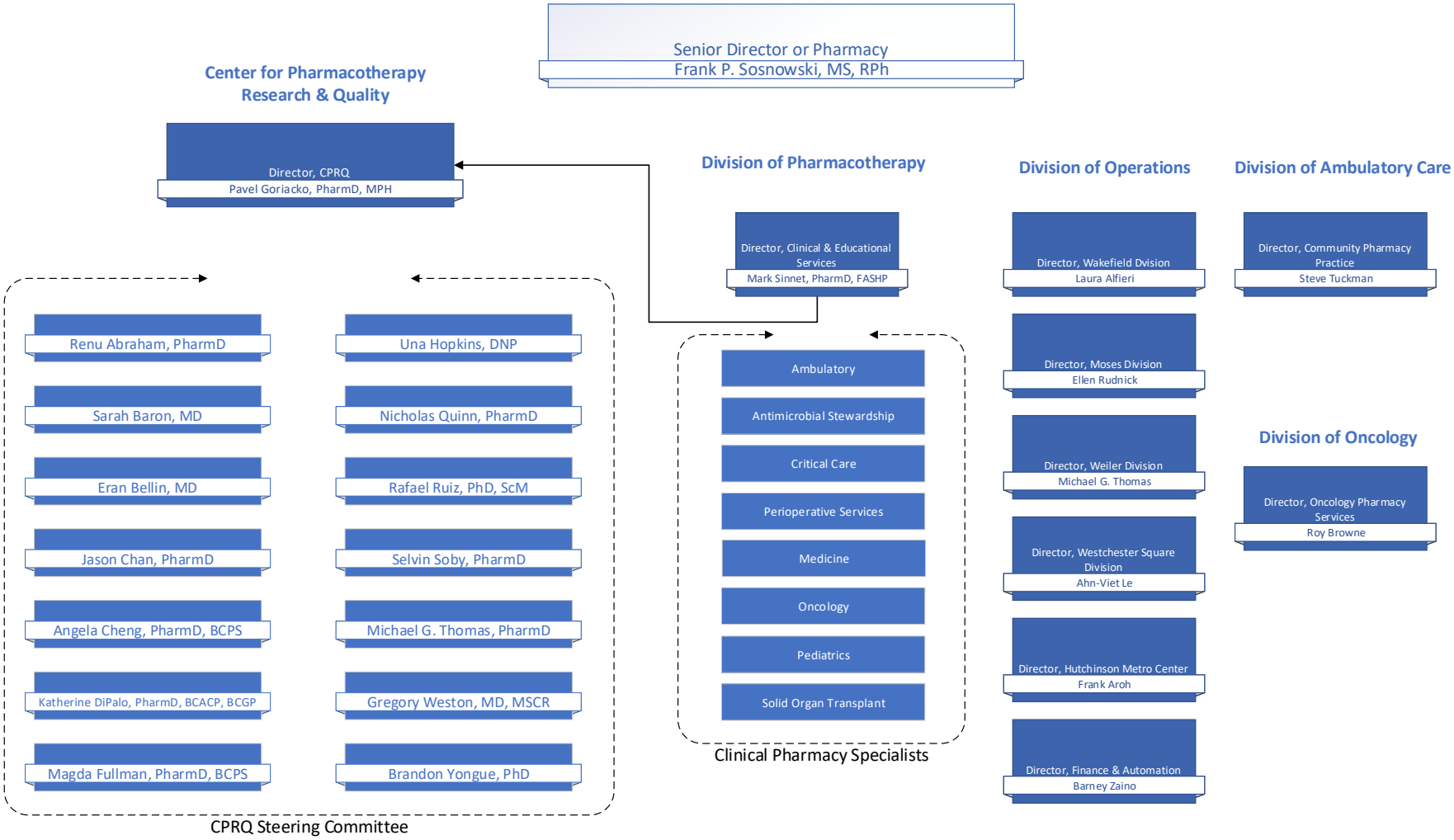
- Publication of CPRQ Annual Report which outlines the center's work and pertinent discoveries each year
- Programs to support faculty throughout publication process in peer-reviewed journals
- Presentation of findings at inter-disciplinary conferences including SAMBA, IDSA, and AJHP

Accountability and Transparency

- Submission of pharmacy quality indicators for inclusion in the network performance report
- Pharmacy dashboards which are reviewed daily and are accessible to clinicians

Organization and Leadership

CPRQ is guided by an interdisciplinary steering committee, which consists of members from the disciplines of pharmacotherapy, medicine, nursing, network performance, inpatient quality, and information technology. Multiple subcommittees report directly to the steering committee, including subcommittees on performance improvement, specialty pharmacy, and education/training. The steering committee meets monthly and reports out to the Pharmacy and Therapeutics committee quarterly. Additionally, CPRQ submits its quality indicators to the network Performance Report and presents annually at the Montefiore Quality Council.



Pharmacy Leadership

Frank Sosnowski, MS
Senior Director of Pharmacy
Montefiore Department of Pharmacy

Mark J. Sinnett, PharmD, FASHP
Director, Clinical and Educational Pharmacy Services
Director, CPRQ
Montefiore Department of Pharmacy

Steering Committee Leadership

Pavel Goriacko, PharmD, MPH, BCPS
CPM - Research and Quality Analytics
Chair, CPRQ Steering Committee
Montefiore Department of Pharmacy

Selvin Soby, PharmD
Technical Lead – Health Data Integration
Center for Health Data Innovations | Montefiore IT

Steering Committee Members

Renu Abraham PharmD
Patient Safety Manager, Network Performance Group

Sarah Baron MD
Associate Director for Inpatient Quality, Hospital Medicine

Eran Bellin MD
Vice President Clinical IT Research and Development
Montefiore IT

Jason Chan PharmD
Senior Application Analyst, EPIC Willow Inpatient

Angela Cheng PharmD, BCPS
Cardiology Clinical Pharmacy Manager, Pharmacy

Katherine DiPalo PharmD, BCACP, BCGP
Clinical Program Manager, Hospital Readmissions Reduction Program

Magda Fullman PharmD, BCPS
Assistant Director of Pharmacy Services, Nyack Hospital

Una Hopkins, DNP
Director of Nursing Research, Montefiore Health System

Nicholas Quinn PharmD
Critical Care Clinical Pharmacy Manager, Pharmacy

Rafael Ruiz, PhD, ScM
Director, Performance Informatics, Network Performance Group

Michael Thomas, PharmD
Director of Pharmacy Operations Einstein Campus

Gregory Weston, MD, MSCR
Physician Director of Infection Prevention and Control

Brandon Yongue, PhD
Director, Performance Analytics, Network Performance Group

Financial Value Generation

Direct Expense Reduction

The CPRQ Performance Improvement Subcommittee reviewed both and medication's efficacy when compared to either alternative treatments or its status in *Epic*. As a result, a medication (IV acetaminophen) was removed from formulary, further restricted (andexanet alfa) or edited in *Epic* (alteplase)

Initiative Name	Cost reduction
IV Acetaminophen Use in Hospitalized Patients Project	$20,500
Andexanet for the management of life-threatening or uncontrolled bleeding	$11,400
Alteplase for treatment of catheter occlusion	$272,091

Estimated Cost Avoidance

The CPRQ's involvement with the Pharmacy and Therapeutics Committee has been instrumental in avoiding future costs to the medical center. Of particular note is the formulary denial of IV angiotensin II and a cost-benefit analysis of *KitCheck* medication tracking software for the pharmacy.

Initiative Name	Cost avoidance
Angiotensin II injection (Giapreza)	$3,000,000
KitCheck in Wakefield Operating Rooms	$200,000

Direct Revenue Generation

Study Name	
Real World Effectiveness of Patiromer vs Sodium Polystyrene Sulfonate as an adjunct therapy in acute hyperkalemia *Investigator-initiated research grant by Relypsa*	$40,700
Real World Efficacy of Fidaxomicin in Patients at Risk of Recurrence *Investigator-initiated research grant by Merck*	$66,765
A retrospective study to evaluate the impact of direct pharmacist care on the readmission rates of heart failure patients in a collaborative drug therapy management clinic *Clinical Pharmacy Services Research Award by the New York State Council of Health-system Pharmacists*	$2,000
Comparison of Triple Therapy with Apixaban vs Rivaroxaban *Cardiology PRN Seed Grant by the American College of Clinical Pharmacy*	$4,000

Montefiore

Summary of Active Projects

Outcomes Research

Title	Investigator(s)
Real World Effectiveness of Patiromer as an Adjunct Therapy in Acute Hyperkalemia	Katherine E. DiPalo, PharmD, BCACP, BCGP Pavel Goriacko, PharmD, MPH, BCPS
Efficacy and Tolerability of Fidaxomicin versus Vancomycin in Patients at High Risk for Recurrent Clostridioides difficile Infection: A Quasi-Experimental Study	Victor Chen, PharmD, BPCS, BCIDP Yi Guo, PharmD, BCIDP
Real World Effectiveness of Patiromer versus Sodium Polysterene Sulfonate Therapy in Acute Hyperkalemia	Pavel Goriacko, PharmD, MPH, BCPS Sara Zouine, PharmD Katherine Di Palo, PharmD, BCACP, BCGP Mark Sinnett, PharmD, FASHP
Impact of Direct Pharmacist Care on Clinical Outcomes of Heart Failure Patients in a Collaborative Care Setting	Angela Cheng, PharmD, BCPS Jessica Cacace, PharmD, MBA Pavel Goriacko, PharmD, MPH, BCP Lendita Presli, PharmD, CCM Mark Sinnett PharmD, FASHP
The Impact of a Clinical Pharmacist in Hypertension Management of African American and Hispanic Patients within a Patient-Centered Medical Home	Christina Ng, PharmD, BCPS Pavel Goriacko, PharmD, MPH, BCPS Mariam Paracha, PharmD Mark Sinnett, PharmD, FASHP
Improving Quality and Access to Diabetes Care: The Role of PharmD Management in Achieving Quality Measures and Patient Outcomes	Danielle Garcia, PharmD, BCPS Pavel Goriacko, PharmD, MPH, BCPS William Smith, PharmD Mark Sinnett, PharmD, FASHP
Nephropathy Risk and Contrast Volume in Intact versus Ruptured Endovascular Aneurysm Repair in the Vascular Quality Initiative	Matthew Carnevale, MD Harshal Shukla, PharmD, BCPS Jeffrey Indes, MD Evan Lipsitz, MD Issam Koleilat, MD
The Incidence of Complications Associated with Parenteral Nutrition in Preterm Infants < 32 Weeks with a Mixed Oil Lipid Emulsion Versus a Soybean Oil Lipid Emulsion in a Level IV Neonatal Intensive Care Unit	Toshiba Morgan-Joseph, PharmD Pavel Goriacko, PharmD, MPH, BCPS Susannah Franco, PharmD Orna Rosen, MD
Safety of High-Dose Unfractionated Heparin for Prophylaxis of Venous Thromboembolism in Obese Patients	Nadia Ferguson, PharmD, BCPS, BCCCPPavel Goriacko, PharmD, MPH, BCPS Teresa Regis, PharmD
Case–control Study Evaluating the Risk of Stenotrophomonas maltophilia Pneumonia in Patients with Previous Exposure to Meropenem	Yi Guo, PharmD, BCPS, BCIDP Jasmine Chacko, PharmD Pavel Goriacko, PharmD, MPH, BCPS
Adherence Versus Non-adherence: Clinical Outcome of an Antimicrobial Stewardship Directed Treatment Protocol for Clostridioides difficile Infections	Yi Guo, PharmD, BCPS, BCIDP Brendan Begnoche, PharmD
Comparison of Triple Therapy with Apixaban vs Rivaroxaban	Maya Chilbert, PharmD, BCCP Ashley Woodruff, PharmD, BCPS David Jacobs, PharmD, PhD Pavel Goriacko, PharmD, MPH, BCPS Mark Sinnett, PharmD, FASHP

Performance Improvement Science

Title	Investigator(s)
IV Acetaminophen Use in Hospitalized Patients Project	Pavel Goriacko, PharmD, MPH, BCPS Mark Sinnett, PharmD, FASHP
Quality improvement project to improve glycemic control at Montefiore Medical Center	Sarah Baron, MD Rita Louard, MD Ann Levine, RN, CDE Mary McLoughlin, RN-BC, MSN Nisha Suda, MD Hanna Lee, MD Shirley Candelario, NP Mark Sinnett, PharmD Miriam Pappo, MS, RD, CDN Coleen Robinson-Cobblah, RN
Utilization of Aprepitant for the Use for Post-Operative Nausea and Vomiting (PONV) for High Risk Patients at the Ambulatory Surgery Center	Harshal Shukla PharmD, BCPS Vicken Yaghdjian PharmD Pavel Goriacko PharmD MPH, BCPS Frank Aroh PharmD, Sara Zouine PharmD Issam Koleilat MD Curtis Choice MD
Reducing Patient Exposure to Acid Suppressive Medications at Montefiore	Pavel Goriacko, PharmD, MPH, BCPS Jessica Cacace, PharmD
Reducing Perioperative Exposure to Opioids (Orthopedics, Ambulatory Surgery, Bariatric Surgery)	Harshal Shukla PharmD, BCPS Vicken Yaghdjian PharmD Pavel Goriacko PharmD MPH, BCPS Frank Aroh PharmD, Sara Zouine PharmD Issam Koleilat MD Curtis Choice MD
Andexanet for the Management of Life-Threatening or Uncontrolled Bleeding	Saira Khalique, PharmD Nadia Khalique, PharmD Nick Quinn, PharmD Henny Billet, MD Ava Lieberman, MD Carla Touzin, PharmD
The Utilization of Vasopressin in Critically Ill Patients	Nicholas Quinn, PharmD Nadia Ferguson, PharmD Saira Khalique, PharmD Pavel Goriacko, PharmD Michelle Gong, MD Lewis Eisen, MD Melba Garcia, RN
Dexmedetomidine: Improving Availability Without Increasing Costs	Nadia Ferguson, PharmD Saira Khalique, PharmD Pavel Goriacko, PharmD Will Smith, PharmD Nicholas Quinn, PharmD Michelle Gong, MD Sumit Kapoor, MD

* see appendix A for more details

Publications, Presentations, & Posters

Under the guidance of CPRQ, the Department of Pharmacy has been active in many research and quality improvement projects that have led to various peer-reviewed publications, platform and poster presentations at national conferences, and continuing education lectures.

Publications

Torabi J, Konicki A, Rocca JP, Ajaimy M, **Campbell A**, Azzi Y, Pynadath C, Liriano-Ward L, Akalin E, Kinkhabwala M, Graham J. Utilization of LCP-tacrolimus (Envarsus XR) in simultaneous pancreas and kidney (SPK) transplant recipients. *Am J Surg*. 2020 (2): 1-4.

Torabi J, **Campbell A**, Nair G, Patel GL, Miura Y, Graham JA. Dapsone-induced methemoglobinemia in two renal transplant recipients. *Prog Transplant.* 2019 (3): 290-290.

Goriacko, P. (2020). Evaluating the safety of anticoagulant medications from electronic medical record data: A case study of observational cohort designs with survival analysis. *SAGE Research Methods Cases.* doi:10.4135/9781529735291

Goriacko P., Veltri K.T. (2020) Adverse Drug Effects Involving the Gastrointestinal System (Pharmacist Perspective). In: Pitchumoni C., Dharmarajan T. (eds) *Geriatric Gastroenterology*. Springer, Cham

Al-Bawardy R, **Cheng-Lai A**, Prlesi L, Assafin M, Xu S, Chen K, Tandan S, Aneke CS, Murthy S, Piña IL. Heart Failure Postdischarge Clinic: A Pharmacist-led Approach to Reduce Readmissions. *Curr Probl Cardiol.* 2019 Jan 5. pii: S0146-2806(18)30226-3. doi: 10.1016/j.cpcardiol.2018.12.004.

Veltri KT, Olsufka WA. Bleeding and Elevated INR Secondary to Concomitant Tramadol and Warfarin Administration. *P&T*. September 2019, Vol. 44 No. 9.

Veltri KT, Freel M, Arce V, **Ng C**. Novel Agent, Sacubitril-Valsartan: Prescribing Patterns and Perceived Barriers to Hospital Formulary Inclusion. *J Clin Stud Med Case Rep.* 2019; 6: 062.

Jakubowski A, Pappas A, Isaacsohn L, Castillo F, Masyukova A, Silvera R, Holaday L, Rausch E, Farooq S, **Veltri K**, Cunningham C, Bachhuber M: Development and evaluation of a pilot overdose education and naloxone distribution program for hospitalized general medical patients. *J Substance Abuse*. 2019;40(1):61-65

Shah DD, Shah KJ, Kakwani A, Bloomstein D. Comparison of a predefined dose increment nomogram with a percentage adjustment nomogram in patients receiving argatroban therapy. *J Am Pharm Assoc.* Feb 2020.

Villegas SC, Thielet N. Methadone Prescribing Caveats for Chronic Pain and Opioid Use Disorder. *J Nurse Pract*. 2020;16(3):176-180.

Ferenchick H, Cemalovic, N, **Ferguson N**, Dicpinigaitis PV. Diabetes Insipidus after discontinuation of vasopressin infusion for the treatment of shock. *Crit Care Med*. 2019 Dec;47(12).e1008-e1013

Khalique S, Ferguson N. Angiotensin II (Giapreza): A Distinct Mechanism for the treatment of Vasodilatory Shock. *Cardiology in Review.* 2019; 27(3):1-3.

Quinn NJ, Sebaaly JC, Patel BA, Weinrib DA, Roshdy DG. Effectiveness of oral antibiotics for definitive therapy of non-Staphylococcal Gram-positive bacterial bloodstream infection. *Ther Adv Infect Dis*. 2019; 6 (1-12).

Quinn NJ, Hohlfelder B, Wanek MR, Duggal A, Torbic H. Evaluation of Valproic Acid for Agitation and Delirium in the Intensive Care Unit. *Ann Pharmacother*. Accepted July 2020.

Latev A, Friedman BW, Irizarry E, **Solorzano C**, Restivo A, Chertoff A, Zias E, Gallagher EJ. A Randomized Trial of a Long-Acting Depot Corticosteroid Versus Dexamethasone to Prevent Headache Recurrence Among Patients With Acute Migraine Who Are Discharged From an Emergency Department. Ann Emerg Med. 2019 Feb;73(2):141-149. doi: 10.1016/j.annemergmed.2018.09.028. Epub 2018 Nov 16. PubMed PMID: 30449536.

Formal Presentations

E. Messing E. Impact of Drug Shortages on Medication Safety. New York State Council of Health-system Pharmacists. New Practitioner Webinar. Aug 2019.

Cheng A. Essential Updates from the 2018 ACC/AHA Cholesterol Guideline The New York City Society of Health-System Pharmacists and the Westchester County Society of Health-System Pharmacists. Bronx, NY, March 2019 (CE Lecture)

Goriacko P. Study Designs and Statistical Inference. BCPS Review Program by the New York City Society of Health System Pharmacists. NYU Langone Medical Center, New York, NY January 2020

Soby, S, Amin V. Medication Safety and Pharmacy Informatics. The New York City Society of Health-System Pharmacists and the Westchester County Society of Health-System Pharmacists. Bronx, NY, May 2020. (CE Lecture)

Shah DD. Medical Marijuana: A Blunt Update on Epidiolex. Garden State Pediatric Pharmacy Advocacy Group Chapter Meeting Ernest Mario School of Pharmacy, Rutgers University, The State University of New Jersey February 2019 (CE Lecture)

Shah DD, Kuzmov A, Clausen DM, Robinson CA, Siu A, Shah P, Kimler K, Meyers RS. Osmolality of commonly used oral medications in the neonatal intensive care unit. The 2019 Pediatric Pharmacy Advocacy Group Annual Meeting. Oklahoma City, Oklahoma: April 2019 (CE Lecture)

Ng, Christina. The Role of the Pharmacist in Transitions of Care. New York City Society of Health System Pharmacists. November 2019 (CE Lecture)

Abstracts & Poster Presentations

Cacace J, **Goriacko P**. Reducing patient exposure to acid suppressive medications at Montefiore Medical Center. ASHP Midyear Clinical Meeting, December 2019, Las Vegas, NV. Poster Presentation

Torabi J, **Campbell** A, Ajaimy M, Azzi Y, Pynadath C, Liriano-Ward L, Rocca JP, Akalin E, Graham JA. Utilization of LCP-tacrolimus (Envarsus XR) in simultaneous pancreas and kidney (SPK) transplant recipients. *Am J Transplant*. 2019; 19 (suppl 3). [Abstract]

Nair G, Ajaimy M, Graham JA, Liriano-Ward L, **Campbell** A, Pynadath C, Azzi Y, Andacoglu S, Greenstein S, Kinkhabwala M, Rocca JP, Akalin E. A safe anti-A2 titer for a successful A2 incompatible kidney transplantation. *Am J Transplant*. 2019; 19 (suppl 3). [Abstract]

Liriano-Ward L, Barbachane Silva M, Azzi Y, Ajaimy M, **Campbell** A, Graham JA, Pynadath C, Nair G, Andacoglu O, Greenstein S, Rocca JP, Akalin E. Infectious complications in kidney transplant recipients age 65 and older. *Am J Transplant*. 2019; 19 (suppl 3). [Abstract]

Ahmed S, Seethamraju H. CYP3A5 Polymorphisms and Conversion to Once-Daily, Extended-Release Tacrolimus in Lung Transplant. *J Heart Lung Transplant*. 2020. [Abstract]

Ahmed S, Philippsborn P, Seethamraju H. Pre-Transplant Immunosuppression is a Risk Factor for Hyperammonemia Syndrome after Lung Transplant. *J Heart Lung Transplant*. 2020. [Abstract]

Patel A, **Ahmed S,** Soto-Arenall M, Patel P, Yip D. Association of Time to Therapeutic Calcineurin Inhibitor Level to Biopsy Proven Acute Rejection after Heart Transplantation. *J Heart Lung Transplant*. 2019; 38(4):S306 [Abstract]

Zouine S, Choice C, Yedlin A, Koleilat I, Wang E, Aroh F, **Goriacko P, Yaghdjian V, Shukla H**. Utilization of aprepitant for post-operative nausea and vomiting for high risk patients at an ambulatory surgery center. SAMBA 2020, June 2020 (virtual).

LaFontaine S, **Goriacko P**, Carnevale M, **Shukla HP**, Indes J, Lipsitz E, Koleilat I. Nephropathy Risk and Contrast Volume in Intact versus Ruptured Endovascular Aneurysm Repair in the Vascular Quality Initiative. SAMBA 2020, June 6-7,2020 (virtual).

Aksoy T, Gillespie L, Sponholz L, Rodriguez M, Tajdharry A, **Cheng A**, Lezama K, Baron S, Southern W, Ceresnak J, Dekhtyar J, Michael B, Weiss J, Pina I, Katz N. Using Quality Improvement Methodologies to Reduce Heart Failure Readmissions. Society of Hospital Medicine Annual Conference. National Harbor, MD. March 2019. Poster Presentation

Spektor A., Wells I and **Veltri, K**. Rare case of endocarditis due to Pseudomonas aeruginosa. American Society of Health-systems Pharmacists. Las Vegas, NV. December 2019. Poster Presentation

Yamout N., ArceV. Sow M., Wells I. and **Veltri K**. Ferric carboxymaltose: more than transient and asymptomatic hypophosphatemia. American Society of Health-systems Pharmacists. Las Vegas, NV. December 2019. Poster Presentation

Kaur M., Arce V. and **Veltri K**. Statin therapy for the treatment of cardiovascular event prevention in patients with low LDL-C levels. American Society of Health-systems Pharmacists. Las Vegas, NV. December 2019. Poster Presentation

Kleyn E., Garcia V. and **Veltri K.**, The role of buspirone in gastroparesis accompanied with excessive vomiting/dyspepsia. American Society of Health-systems Pharmacists. Las Vegas, NV. December 2019. Poster Presentation

Messing E, Muller R, Chan A, Malhotra V, Poon KH. Impact of intravenous drug shortages on prescribing patterns and practice in a comprehensive cancer center. ASHP Summer Clinical Meeting, Medication Safety Collaborative; June 2019; Boston, MA. Poster presentation

Smith, W, **Goriako P, Khalique S, Ferguson N**. Improving Availability without increasing inappropriate use of Dexmedetomidine. American Society of Health-System Pharmacists (ASHP) Annual Midyear Meeting. Las Vegas, NV. December 2019. Poster Presentation

N. Cemalovic, H. Ferenchick, **N. Ferguson**, P. Dicpinigaitis. Diabetes Insipidus after discontinuation of vasopressin infusion for treatment of shock: increased incidence after cardiothoracic intervention. American Thoracic Society (ATS) International Conference. Dallas, Tx. May 2019. Poster Presentation

Nnani D, Campbell A, Ajaimy M, Saeed O, Patel S, **Ahmed, S**, Goldstein D, Graham J, Jorde U. Effect of glecaprevir/pibrentasvir on weight-adjusted tacrolimus trough/dose ratios in heart and kidney transplant recipients. *American Journal of Transplantation.* 2020 [Abstract]

Shah, A, **Nnani, D,** Murthy, M, Shin, J, O, Saeed, Sims, D, Vukelic, S, Goldstein D, Jorde, U, Patel, S. Calcineurin inhibitor-induced pain syndrome, a consequence of transplant immunosuppression. *ISHLT.* April 2019 [Abstract]

Shah, K, Sims, DB, Forest, S, Chinnadura, T, Xia, Y, Luke, A, **Nnani, D,** Castillo, C, Taveras, M, Vukelic, S, Patel SR, Shin, J, Goldstein, DJ, Jorde, UP, Saeed, O. Comparison of unfractionated heparin and bivalirudin for treatment of suspected device thrombosis during heart mate II support. *ISHLT*. April 2019. Poster Presentation.

Shah D, Kuzmov A, Greenberg P, Robinson CA, Kimler K, Shah P, Siu A, Meyers R. Medication preparation and administration in the pediatric population: the nurses's perspective. *J Pediatr Pharmacol Ther.* 2019 Jul-Aug; 24(4):354-355. [Abstract]

Shah D, Kuzmov A, Clausen DM, Siu A, Robinson CA, Kimler K, Meyers R, Shah P. Osmolality of commonly used oral medications in the neonatal intensive care unit. *J Pediatr Pharmacol Ther.* 2019 Jul-Aug; 24(4):354. [Abstract]

Cho A, **Shah D**, Meyers R. Comparison of oral liquid medication measurements when using an oral syringe with and without an oral syringe adapter. *J Pediatr Pharmacol Ther.* 2019 Jul-Aug; 24(4):330. [Abstract]

Saraiya N, Chacko J, **Goriacko P**. Case–control Study Evaluating the Risk of Stenotrophomonas maltophilia Pneumonia in Patients with Previous Exposure to Meropenem, *Open Forum Infectious Diseases*, Volume 6, Issue Supplement 2, October 2019, Pages S236–S237. [Abstract]

Appendix A: Outcomes Research Project Spotlights

Efficacy and Tolerability of Fidaxomicin versus Vancomycin in Patients at High Risk for Recurrent *Clostridioides difficile* Infection: A Quasi-Experimental Study

Investigators

Victor Chen, PharmD, BCPS, BCIDP
Yi Guo, PharmD, BCIDP

Summary

This study aims to characterize the efficacy and tolerability of fidaxomicin and vancomycin in high-risk patient populations with at least 1 recurrence of C. difficile. The primary efficacy outcome is to measure the global cure rate, defined as the resolution of diarrhea without recurrence. Important secondary outcomes are the percent clinical cure (resolution of symptoms and no need for further therapy for C. difficile infection as of the second day after the end of the course of therapy, recurrence (diarrhea and a positive result on a stool toxin test within 4 weeks after treatment completion) and readmissions within 90 days. We expect patients treated with fidaxomicin to have significantly higher global cure rates compared to those treated with oral vancomycin.

❖❖❖

Real World Effectiveness of Patiromer versus Sodium Polystyrene Sulfonate Therapy in Acute Hyperkalemia

Investigators

Pavel Goriacko, PharmD, MPH, BCPS
Sara Zouine, PharmD
Katherine Di Palo, PharmD, BCACP, BCGP
Mark Sinnett, PharmD, FASHP

Summary

This is a single center, retrospective, observational cohort study comparing the real-world effectiveness of patiromer versus sodium polystyrene sulfonate in the treatment of acute hyperkalemia compared to sodium polystyrene sulfonate. The primary outcome was the absolute blood serum potassium reduction between 0-6 h, 6-12h and 12-24h post administration. Preliminary results in 100 patients suggest that patiromer was not superior in decreasing blood potassium levels as rapidly as SPS. The study will continue to meet the required sample size (n=350)

Impact of Direct Pharmacist Care on Clinical Outcomes of Heart Failure Patients in a Collaborative Care Setting

Investigators

Angela Cheng, PharmD, BCPS
Jessica Cacace, PharmD, MBA
Pavel Goriacko, PharmD, MPH, BCP
Lendita Presli, PharmD, CCM
Mark Sinnett PharmD, FASHP

Summary

This was a retrospective cohort study evaluating 1,446 heart failure (HF) patients. Half received care from a pharmacist care at a CDTM HF clinic and half who received the standard of care. The primary objective of this research was to determine if direct pharmacist care at a CDTM HF clinic results in a reduction in 30-Day all cause HF hospital readmission rates. Clinic visit with PharmD scheduled upon inpatient discharge. Direct pharmacist care after discharge for HF hospitalization was associated with a potential absolute risk reduction of 8.6% in 30-day all cause readmission.

❖❖❖

Nephropathy Risk and Contrast Volume in Intact versus Ruptured Endovascular Aneurysm Repair in the Vascular Quality Initiative

Investigators

Pavel Goriacko, PharmD, MPH, BCPS
Samantha LaFontaine
Matthew Carnevale, MD
Harshal Shukla, PharmD, BCPS
Jeffrey Indes, MD
Evan Lipsitz, MD
Issam Koleilat, MD

Summary

The objective was to retrospectively evaluate the risk of acute kidney injury (AKI) and the association with contrast administration in 38,775 patients treated for ruptured (rEVAR) and intact (iEVAR) aneurysm repair in the Vascular Quality Initiative (VQI). While contrast volume independently affects the risk of post-EVAR nephropathy, aneurysm rupture remains the single-most important predictor of AKI. When adjusting for cofounders, contrast volume remained a significant risk factor for nephropathy, but the effect size decreased from 12% to a 4% increase in risk per 25 mL of contrast. With the development of AKI, postoperative survival was reduced regardless of indication. Further studies should evaluate methods of preventing AKI for the post-EVAR patient.

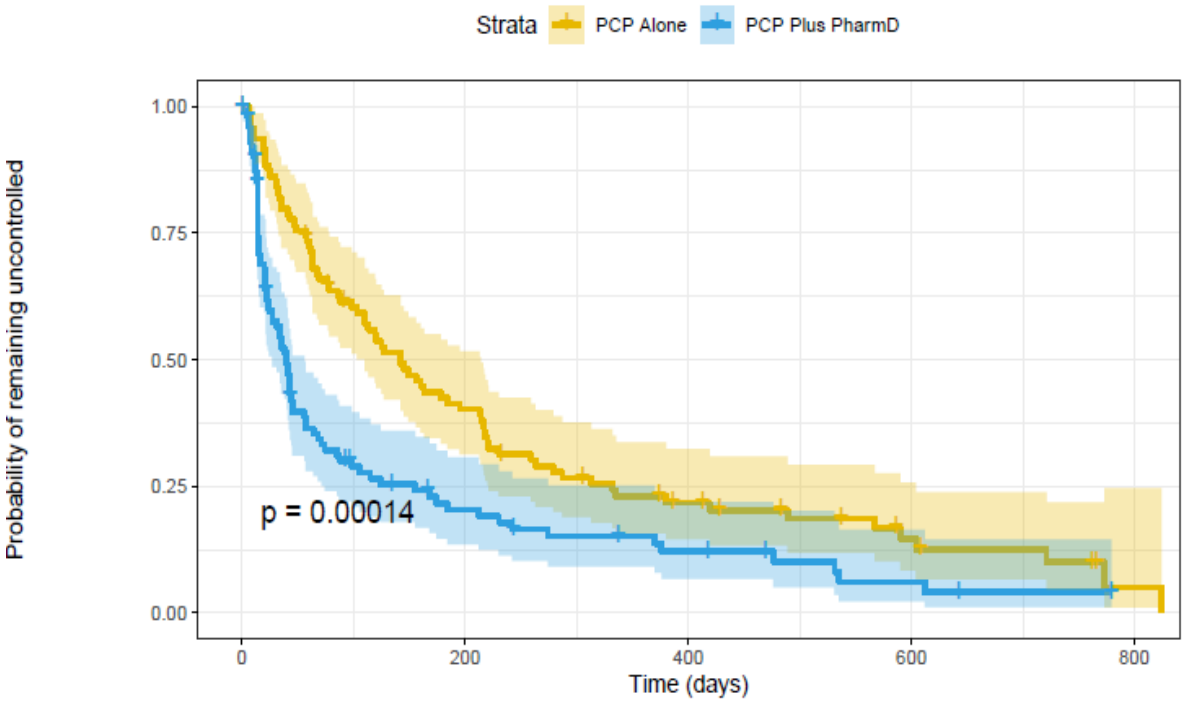
The Impact of a Clinical Pharmacist in Hypertension Management of African American and Hispanic Patients within a Patient-Centered Medical Home

Investigators

Christina Ng, PharmD, BCACP
Pavel Goriacko, PharmD, MPH, BCPS
Mariam Paracha, PharmD
Mark Sinnett, PharmD, FASHP

Summary

The goal of this research was to evaluate the impact of a clinical pharmacist practicing under collaborative drug therapy management on hypertension control, in addition to standard of care within a patient-centered medical home. The primary objective was to determine the time to 1st controlled blood pressure in an outpatient setting. 104 patients referred to a clinical pharmacist for hypertension management were compared to 104 patients managed by a PCP alone. Patients who were seen by pharmacists in addition to standard of care achieved faster BP control. The rates of sustained control were similar between groups once patients were discharged from pharmacist clinic.



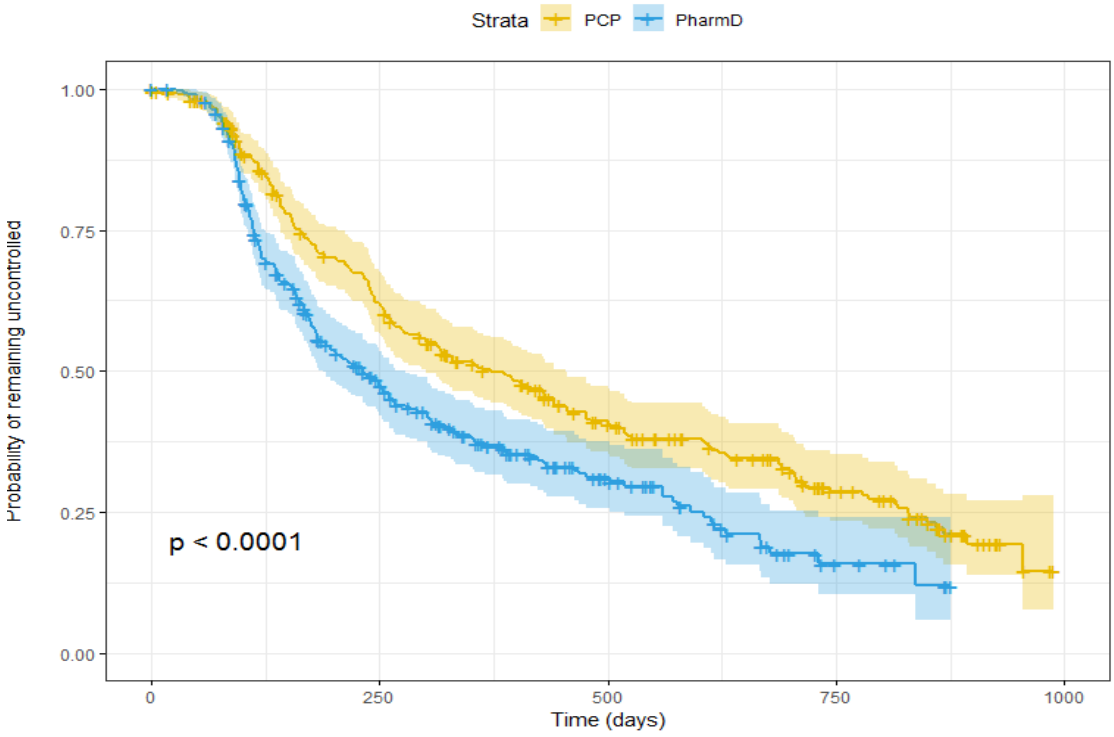
Improving Quality and Access to Diabetes Care: The Role of PharmD Management in Achieving Quality Measures and Patient Outcomes

Investigators

Danielle Garcia, PharmD, BCPS
Pavel Goriacko, PharmD, MPH, BCPS
William Smith, PharmD
Mark Sinnett, PharmD, FASHP

Summary

This was a retrospective, matched-cohort study examining the effects of PharmD management of patients with uncontrolled Type 2 diabetes mellitus compared to standard PCP care. The primary outcome was time to achieve HgbA1c goal of < 8, which was achieved faster in the PharmD cohort ($p < 0.0001$) compared to standard care. Secondary outcomes included change in HgbA1c at 3, 6, 9 and 12 months, percentage of patients achieving HgbA1c goal, as well as incidence of emergency room visits or hospitalizations during the study period; secondary outcome results are in progress.



The Incidence of Complications Associated with Parenteral Nutrition in Preterm Infants < 32 Weeks with a Mixed Oil Lipid Emulsion Versus a Soybean Oil Lipid Emulsion in a Level IV Neonatal Intensive Care Unit

Investigators

Toshiba Morgan-Joseph, PharmD
Pavel Goriacko, PharmD, MPH, BCPS
Susannah Franco, PharmD
Orna Rosen, MD

Summary

This is a retrospective, quasi-experimental cohort study of 215 VLBW neonates comparing changes in direct bilirubin concentration between a mixed oil lipid emulsion and a soybean oil lipid emulsion. Secondary outcomes included change in total bilirubin concentration and incidences of cholestasis and other disease states associated with PN and prematurity. Change in direct bilirubin concentration and the incidence of cholestasis was not different between groups. Non-stage-0 ROP, sepsis and NEC were all lower in the mixed oil lipid emulsion (SMOF lipid) group, which remained significant after adjustment for differences in gestational age, birth weight, and PN duration. While mixed oil lipid emulsion was not found to be associated with a lower risk of cholestasis, it may decrease risks of other disease states associated with PN therapy.

❖❖❖

Case–control Study Evaluating the Risk of *Stenotrophomonas maltophilia* Pneumonia in Patients with Previous Exposure to Meropenem

Investigators

Nidhi Saraiya, PharmD, BCPS, AAHIVP
Jasmine Chacko, PharmD
Pavel Goriacko, PharmD, MPH, BCPS

Summary

This was the first study published in literature to evaluate meropenem as a risk factor for developing SM pneumonia. Cases defined by a positive SM respiratory culture at admission were compared to controls defined by a respiratory culture negative for SM during the same period. The primary endpoint was to evaluate the exposure to at least 48 hours of meropenem between cases and controls. Exposure to meropenem of at least 48 hours was associated with a 5 times greater likelihood of developing SM pneumonia (OR = 5.6, P < 0.001). As one of the few modifiable risk factors for SM infection, judicious use of meropenem may reduce the incidence of SM infection and associated mortality.

Safety of High-Dose Unfractionated Heparin for Prophylaxis of Venous Thromboembolism in Obese Patients

Investigators

Nadia Ferguson, PharmD, BCPS, BCCCP
Pavel Goriacko, PharmD, MPH, BCPS
Teresa Regis, PharmD

Summary

The purpose of this study was to evaluate the safety of the use of 7500 units q8h of subcutaneous heparin compared to the use of 5000 units q8h of subcutaneous heparin for thromboprophylaxis in obese patients (defined as BMI ≥30 kg/m²). This was a retrospective cohort study of 326 adult patients with a BMI ≥30 kg/m² and received either 7500 units of subcutaneous heparin or 5000 units of subcutaneous heparin every 8 hours for at least 48 hours. The primary endpoint was the incidence rate of bleeding events defined as a ≥2-g/dl fall in hemoglobin level or receipt of transfusion of 2 or more units of packed red blood cells). The incidence rate of bleeding was significantly higher in those who received high-dose heparin (43%) compared to those who received standard dose heparin (29%). This raises safety concerns of utilizing subcutaneous heparin 7500 units every 8 hours for VTE prophylaxis in the obese patient population.

Overall Incidence of Outcomes

Outcome	High-dose heparin group (n=162)	Standard dose heparin group (n=164)	Risk ratio (95% CI)	p-value
Primary outcome				
Bleeding events	69 (43)	47 (29)	1.49 (1.10-2.00)	0.008
Secondary Outcomes				
≥2 g/dL hemoglobin drop	63 (39)	46 (28)	1.39 (1.02-1.89)	0.038
≥2 units of packed red blood cells transfused	16 (9.9)	6 (3.7)	2.70 (1.08-6.73)	0.025
Venous thromboembolism events	6 (3.7)	3 (1.8)	2.03 (0.52-7.96)	0.304

Data are no. (%) patients

Adherence Versus Non-adherence: Clinical Outcome of an Antimicrobial Stewardship Directed Treatment Protocol for *Clostridioides difficile* Infections

Investigators

Yi Guo, PharmD, BCIDP
Brendan Begnoche, PharmD

Summary

In this study, we retrospectively compared the clinical cure rate, 30-day recurrence rate, and global cure rate in 188 patients who are adherent and non-adherent to our institutional protocol for CDI treatment. The overall clinical cure rate was higher in the adherent group (89% vs. 78%, p = 0.048), while no significant differences were observed in recurrence (2% vs. 1%, p = 1.000) and global cure rates (87% vs. 77%, p = 0.08) between the two groups. The overall protocol adherence rate was 53%, consistent with previous published literature. An updated ASP directed CDI treatment protocol was successfully implemented at our institution. Patients treated according to our institutional protocol resulted in a higher overall cure rate than those non-adherent patients.

❖❖❖

Comparison of Triple Therapy with Apixaban vs Rivaroxaban

Investigators

Maya Chilbert, PharmD, BCCP
Ashley Woodruff, PharmD, BCPS
David Jacobs, PharmD, PhD
Pavel Goriacko, PharmD, MPH, BCPS
Mark Sinnett, PharmD, FASHP

Summary

The overall goal of this proposal is to determine the safety and effectiveness of antithrombotic triple therapy regimens including commonly utilized direct acting oral anticoagulants (DOACs), a P2Y12 inhibitor, and aspirin. A retrospective cohort design will be utilized to estimate treatment effects of triple therapy regimens in patients with atrial fibrillation or venous thromboembolism (VTE). Patients will be included from Montefiore and the Kaleida Health System in the Buffalo/Niagara region

The results of this study will provide guidance to practitioners for selecting the best strategy to balance safety and effectiveness for triple therapy regimens.

This research is a collaboration between the CPRQ and the University at Buffalo School of Pharmacy.

Appendix B: Performance Improvement Project Spotlights

IV Acetaminophen Use in Hospitalized Patients Project

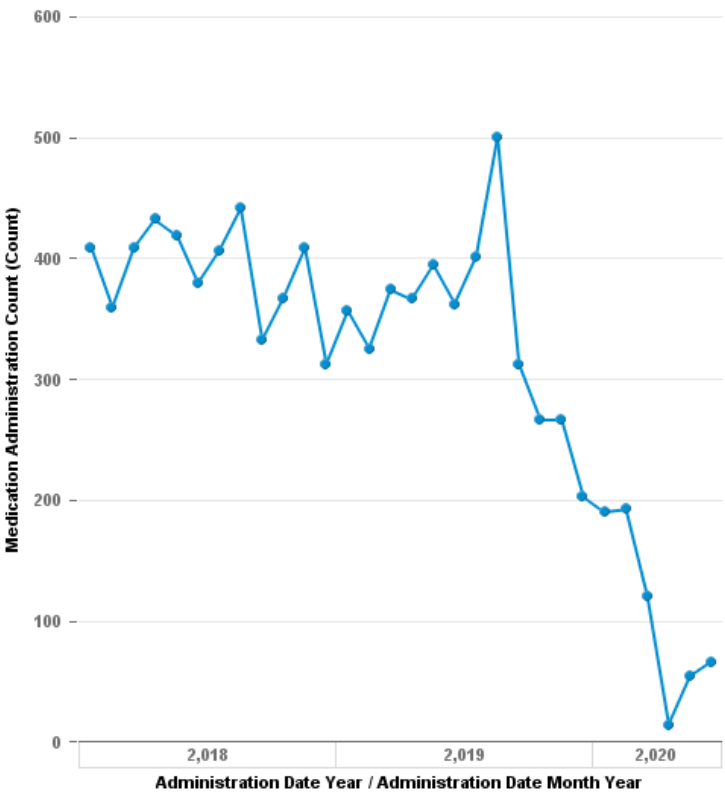
Investigators

M. Sinnett, PharmD, FASHP
P. Goriacko, PharmD, MPH, BCPS

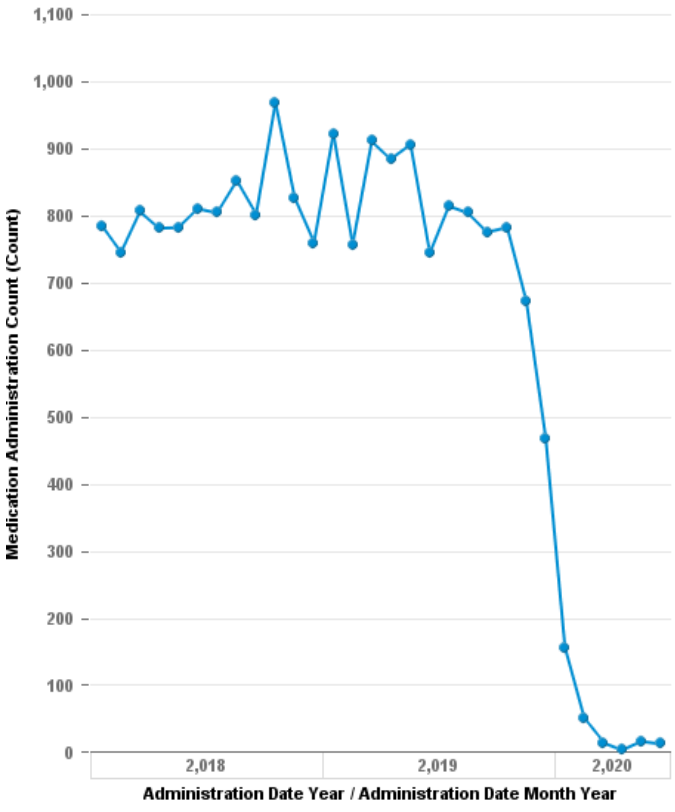
Summary

To restrict the use of IV acetaminophen to patients that are NPO and require the drug to reduce overall opiate use. The investigators reviewed data published over the past 9 years and concluded that it failed to demonstrate a decrease in opiate use or length of stay with IV acetaminophen. Regardless of restriction, the investigators discovered that drug was prescribed in virtually all post-operative patients, despite NPO or pain status. The medication was removed from formulary in 2020 in adult patients.

Pediatrics



Adults



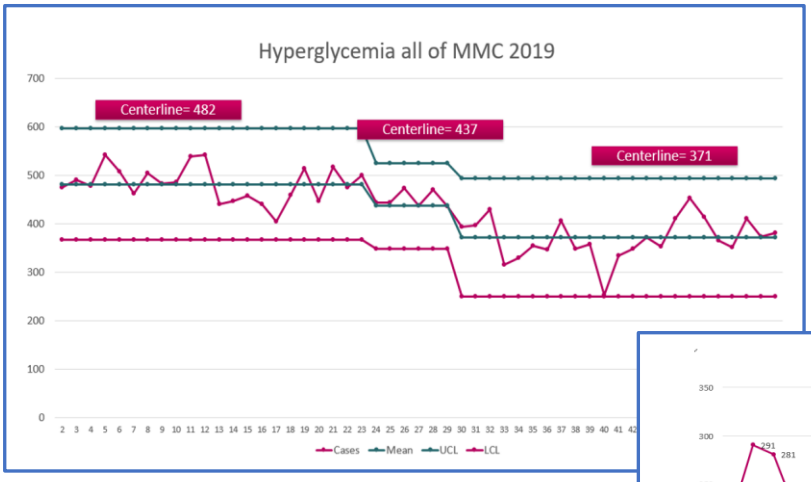
Quality Improvement Project to Improve Glycemic Control at Montefiore Medical Center

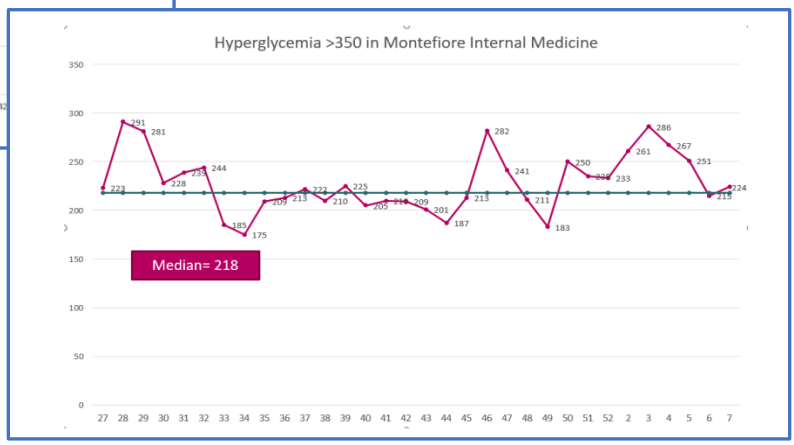
Investigators

Sarah Baron, MD
Rita Louard, MD
Ann Levine, RN, CDE
Mary McLoughlin, RN-BC, MSN, CEN, CDE
Nisha Suda, MD
Hanna Lee, MD
Shirley Candelario, NP
Mark Sinnett, PharmD
Miriam Pappo, MS, RD, CDN
Coleen Robinson-Cobblah, RN

Summary

The 2019 SMART Aims were to 1) to reduce the weekly number of patients with diabetes with severe hyperglycemic events (FSG>350) on the inpatient service by 20% (**from 482/wk. to 385/wk.**) by December of 2019 and 2) to reduce the weekly number of patients with diabetes with severe hypoglycemic events (FSG<55) while inpatient by 20%. Several tests of change were implemented including a subcutaneous insulin order set, changed the "Glucose Tab View" to include all corticosteroids, TPN, tube feeds, diet orders and oral DM medications. Providers were educated on the glucose tab view and use the hypoglycemia order set when ordering any insulin (even for hyperkalemia). The 2019 SMART Aim was successful; SMART #2 was not achieved, but glucose values were stabilized.





Utilization of Aprepitant For Use in Post-Operative Nausea and Vomiting (PONV) for High Risk Patients at the Ambulatory Surgery Center

Investigators
Harshal Shukla PharmD, BCPS
Vicken Yaghdjian PharmD
Pavel Goriacko PharmD MPH, BCPS
Frank Aroh PharmD,
Sara Zouine PharmD
Issam Koleilat MD
Curtis Choice MD

Summary
The primary objective of this study was to evaluate the hypothesis that in patients with high risk for PONV, the use of aprepitant in addition to the standard antiemetic medication will decrease the total PACU length of stay as well as the number of administered anti-emetics postoperatively. The use of aprepitant did not decrease the median PACU time, however, it decreased the number of antiemetics administered post-operatively compared to the patients who received a scopolamine patch

❖❖❖

Reducing Patient Exposure to Acid Suppressive Medications at Montefiore Medical Center

Investigators
Jessica Cacace, PharmD, MBA
Pavel Goriacko, PharmD, MPH, BCPS

Summary
The goal of this PI initiative was to determine the prescribing patterns of acid suppressive therapy (AST) across Montefiore Medical Center and evaluate the effectiveness of systemic interventions aimed at reducing exposure to AST. Interventions included educational presentations provided to ICU residents about appropriate use of AST, removal of IV pantoprazole from order sets, removal of "BID" dosing buttons, switch from famotidine/pantoprazole bags to IV push and require IV pantoprazole is "pharmacy entry only" in EPIC. Interventions were most successful in decreasing non-UGIB IV pantoprazole use to goal of 50%. Unfortunately, overall IV pantoprazole use rebounded over the initial intervention. Continued overutilization of AST is driven by lack of mandatory indications, lack of reassessment of therapy, and lack of medication reconciliation review.

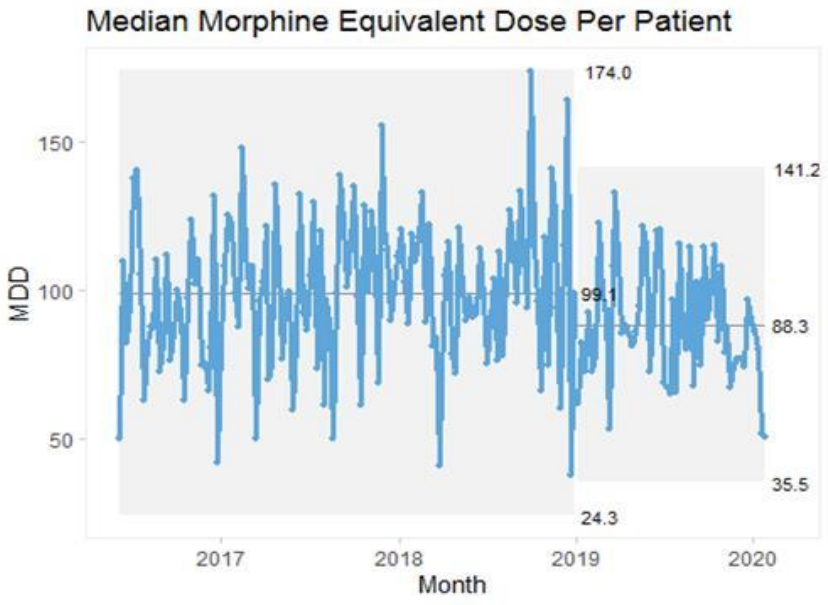
Reducing Perioperative Exposure to Opioids – From Orthopedics to Bariatric Surgery

Investigators

Pavel Goriacko, PharmD, MPH, BCPS
Vicken Yaghdjian, PharmD
Harshal Shukla, PharmD, BCPS
Sandeep Ponnappan, PA-C
Michael P. Choi, MD
Singh Nair, PhD

Summary

In this series of performance improvement initiatives, the CPRQ worked on implementing multimodal analgesia protocols with various surgical disciplines in an effort to reduce postoperative patient exposure to opioids. CPRQ members worked to develop clinical protocols, implemented changes to the computerized order entry screens, and analyzed utilization data before and after protocol implementation. The initial results from orthopedic surgery demonstrated a median reduction of 10 milligram morphine equivalents after protocol implementation. Further investigation is exploring ways to reduce opioid prescriptions upon discharge.



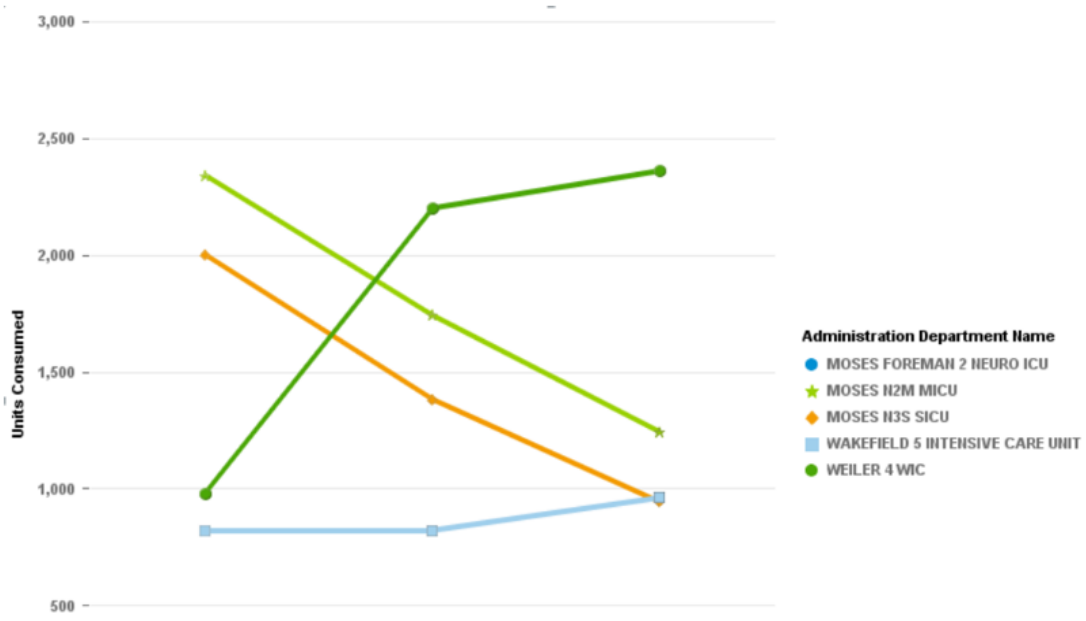
Utilization of Vasopressin in Critically Ill Patients

Investigators

Nicholas Quinn, PharmD, BCCCP
Nadia Ferguson, PharmD, BCPS, BCCCP
Saira Khalique, PharmD
Pavel Goriacko, PharmD
Michelle Gong, MD
Lewis Eisen, MD
Melba Garcia, RN

Summary

The SMART Aim for this PI initiative is to decrease the unnecessary use of vasopressin by 20% in 2020. The first test of change was to Initiate a protocolized approach to the discontinuation of vasopressin. This appeared successful in most ICUs. The second test of change will be to change the order name of vasopressin the CSICU as the majority of vasopressin use occurs in this unit.



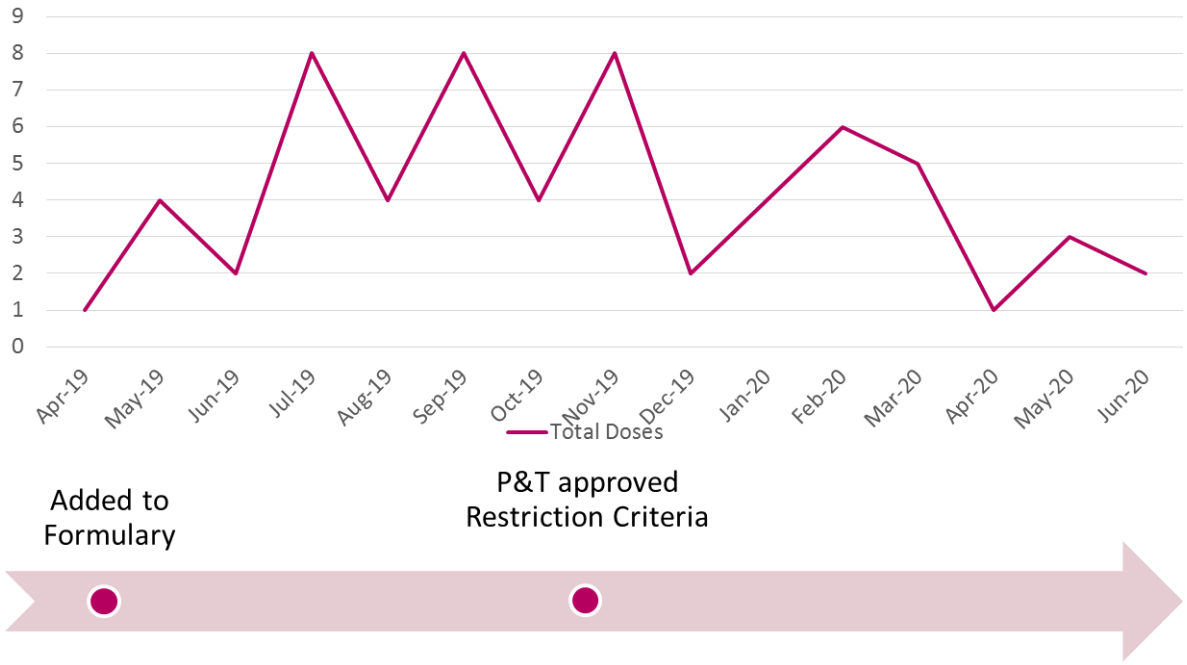
Andexanet Alfa for the Management of Life-Threatening or Uncontrolled Bleeding

Investigators

Saira Khalique, PharmD
Nadia Khalique, PharmD
Nick Quinn, PharmD, BCCCP
Henny Billet, MD
Ava Lieberman, MD
Carla Touzin, PharmD

Summary

The SMART Aim of this initiative was to decrease the unnecessary use and associated costs of andexanet alfa by 35% by December 2020. The first test of change was to revise the restriction criteria and include them on the Epic order. Orders of andexanet did not appreciably change. Next intervention to further restrict andexanet use.



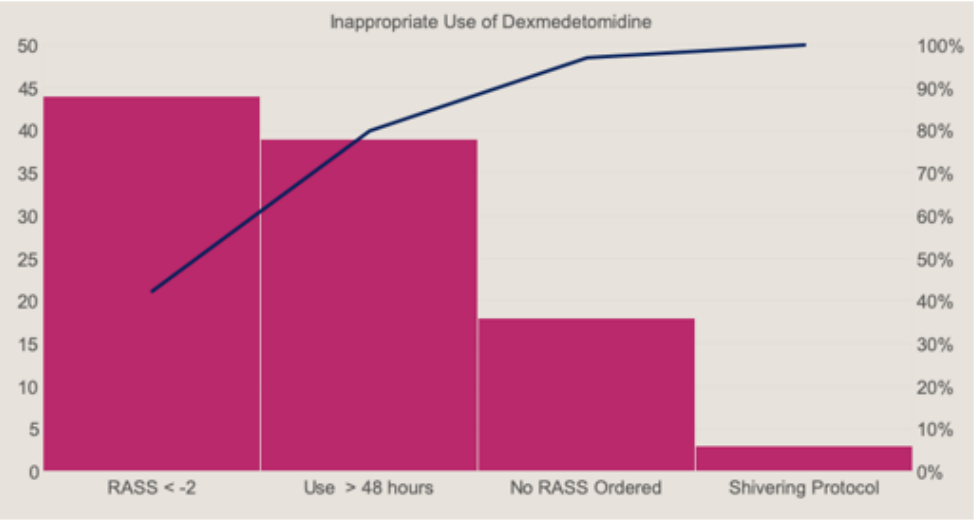
Dexmedetomidine: Improving Availability without Increasing Costs

Investigators

Nadia Ferguson, PharmD
Saira Khalique, PharmD
Pavel Goriacko, PharmD
Will Smith, PharmD
Nicholas Quinn, PharmD, BCCCP
Michelle Gong, MD
Sumit Kapoor, MD

Summary

The primary aim is to decrease prolonged use of dexmedetomidine, defined as >48 hours, by 25% by July 2020. The secondary aims are to decrease associated Richmond Agitation-Sedation Scale (RASS) orders of <-2 and to increase appropriate use of dexmedetomidine by 25%. 126 dexmedetomidine orders were reviewed pre-implementation of order set change and 134 orders reviewed thereafter.



Prior to implementation, 60% of the dexmedetomidine orders were considered inappropriate with the leading cause of inappropriate use being RASS Goal < -2. Post-implementation, 50% of the dexmedetomidine orders were considered inappropriate with the leading cause of inappropriate use being duration of therapy > 48 hours. The addition of dexmedetomidine to the sedation order set has initially assisted in decreasing inappropriate utilization by 10% and increased overall use by 6.3%. PI ongoing

Appendix C: CPRQ Consulted Projects and Research

Opioid Prescribing Project

Project Led By:

Joanna Starrels, MD
Associate Professor in the Department of Medicine

CPRQ Responsibilities

Data consulting, universe training

Summary

This NIH-funded project at Montefiore seeks to quantify and reduce opioid use upon discharge from the hospital. CPRQ members were instrumental in training project staff on the use of medication data mining tools (Business Universe) and provided consultations on interpreting prescription generation data in the context of NYS controlled substance law.

❖❖❖

Specialty Pharmacy Program Accreditation

Project Led By:

Steven Tuckman, BS Pharm, MBA
Director of Outpatient Pharmacy

CPRQ Responsibilities

Universe training, dashboard creation, QI methodology consulting

Summary

The accreditation of the specialty pharmacy service requires a continuous quality improvement process to be implemented and followed. CPRQ were consulted in helping implement this process and develop data elements in the Business Universe to track patient experience and outcomes. Additionally, CPRQ worked to implement continuous quality indicator reviews for specialty pharmacy program, with the findings presented quarterly to the CPRQ steering committee.

❖❖❖

Einstein Pharmacy Staffing Model Optimization

Project Led By:

Michael Thomas, PharmD
Director of Pharmacy Operations at Einstein Campus

CPRQ Responsibilities

Universe training, dashboard creation, data analysis consulting

Summary

This project sought to analyze Montefiore Einstein pharmacy order verification trends by hour, day, and season, and use the data to rearrange shift assignments in more equitable and predictable ways. CPRQ was consulted in using the data from Business Objects to understand verification data, interpret the findings, and help put data into action by rearranging shift assignments.

❖❖❖

Patient Safety Committee Naloxone Use Data

Project Led By:

David Adams, MD
Joanna Starrels, MD
Naum Shaparin, MD

CPRQ Responsibilities

Data analysis consulting

Summary

This project aims to quantify opioid-related adverse events by tracking naloxone administration data with opioids administered in the two hours preceding the event. CPRQ was consulted to train project members in the use of R to merge data from different sources in order to create quality indicators.

Appendix D: Business Universe Project

In 2019, CPRQ worked with the Business Intelligence team to develop two pharmacy data universes in Business Objects. This was an extensive project which required thorough review of available data elements, mapping of data elements in the tool, creation of data descriptors, and establishment of hierarchies and nomenclatures of pharmacy data. In addition, CPRQ was tasked to be the stewards of the two data universes, which involves user provisioning, training, and ensuring HIPAA compliance.

The two data universes now contain information of over 30 million medication administrations and are widely utilized throughout the health system for quality, research, and performance improvement initiatives. As of July 2020, members of the following departments have been trained in the use of this data mining tool:

- Pharmacy
- Infectious Diseases
- Inpatient Quality
- Pediatrics
- Antibiotic Stewardship
- Critical Care
- Hospital Medicine
- Geriatrics
- Neonatology
- Anesthesiology
- Montefiore IT / Epic Willow

CPRQ continues to maintain and improve the tools. The next important steps include the addition of insurance data elements, development of better merging techniques between different data universes, clarifying data object nomenclature, and linking medication use data with patients in our newly available cohort building tools including OHDSI's OMOP and Atlas.

Appendix E: COVID-19 Drug Shortage Prevention

During the COVID-19 pandemic of 2020, increasing hospital admissions led to a surging demand for staffing, PPE, supplies, and medications. At its peak, Montefiore saw 1162 admissions in one day, with 273 of its 369 ventilators in use. Medication shortages impacted sedatives and analgesics, as the demands greatly outweighed the supplies, complicating the healthcare team's ability to manage patients as they normally would.

The current drug inventory model that Montefiore operates by is a "just in time" system - a model that decreases waste and inventory costs by ensuring minimum and maximum quantities for major medication stock. This tight supply chain is adequate for normal daily functioning but not for extraordinary circumstances like that of the COVID-19 pandemic. At the peak of the first surge, propofol use at Wakefield went from 100 administrations per day at baseline to 550 administrations per day, which was an absolute increase of 550%.

To manage this increased medication demand, CPRQ was consulted to build dashboards that track the highest increases in medication use demand due to COVID-19 that were reviewed daily. These dashboards allowed administrators and buyers to take proactive steps in reaching out to manufacturers and distributors to adequately procure inventory needed to manage critically ill patients. As a result of this data-driven approach, patients at Montefiore did not experience any interruptions in therapy due to medication shortages, in contrast to other health systems in the region.

To prepare for any future shortages, CPRQ is working to correlate new hospital admissions with the use of critical medications. Using this information, we will be able to approximate the use of propofol for the next few weeks, allowing the hospital to anticipate dramatic increases in propofol use. In addition, this data will help the composition of our critical medication stockpile to adequately prepare for potential resurgence of COVID-19 while minimizing stockpiling-associated waste.

This data-driven process of shortage mitigation at Montefiore has been summarized in *Critical Care Explorations*, the official journal of the Society of Critical Care Medicine:

> Ferguson N, Quinn N, Khalique S, Sinnett M, Eisen L, Goriacko P. Clinical Pharmacists: An Invaluable part of the COVID-19 Frontline Response. *Critical Care Explorations*. 2020 (Accepted for publication).