

2019-2020 ANNUAL REPORT

Department of Medicine - Quality & Patient Safety Program

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Department of Medicine
SCHOOL OF MEDICINE
UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

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DOM Quality & Patient Safety Program Annual Report 2019-2020

I. Executive Summary

In this annual report, we describe the progress the DOM Quality and Patient Safety (QPS) team has made in the domains of safety, quality, value and education for academic year 2019-2020. The DOM QPS team has continued its work as a campus leader in the implementation of a systems-oriented morbidity and mortality (M&M) case review process through the monthly Department of Medicine (DOM) M&M Conferences. This forum provides a team-based review and analysis of clinical events. Quality issues and potential solutions that are identified are escalated to the M&M Steering Committee (MMSC), comprised of representatives from the clinical Divisions within DOM. The MMSC can then escalate priorities to appropriate stakeholders and, working with University of Colorado Hospital (UCH), identify resources to intervene on quality and safety issues. The DOM QPS team is also a campus leader in supporting, mentoring and promoting process and quality improvement (P/QI) efforts through a variety of events (e.g., Shark Tank Competition, Patient Safety Week) over the year. These events were held in partnership with SOM programs and Departments to promote P/QI work being done by our faculty, trainees and staff across the various clinical sites of the DOM. The DOM QPS team supported many QI efforts through increased visibility, data support, analytics development and by providing quality dashboards to track outcomes and progress on quality metrics.

Educating faculty and trainees in healthcare quality, safety and value has remained a priority for the DOM QPS team, and over AY19-20, we built upon existing programs to introduce a new Fellowship to train future leaders in clinical informatics, learning health systems and quality and patient safety. With this new Fellowship, we welcomed a new program manager, Heather Hallman, MSHS, MHA, to help support the existing and new programs built by the DOM QPS team. We collaborated with a diversity of DOM Divisions, School of Medicine Departments, UCH leaders, and invested stakeholders to provide support during the COVID-19 pandemic by building quality dashboards, clinical care pathways and meeting the quickly changing needs of our providers. Over the last academic year, the DOM QPS team has made significant strides in improving quality, patient safety, value and education and will continue to be a campus leader in these domains for the upcoming academic year.

II. Introduction

MISSION & GOALS

The mission of the DOM QPS Program is to promote a culture of patient safety, quality and systems innovation among DOM faculty, trainees and staff to deliver patient-centered and high value care. To achieve this mission, the DOM QPS Program has designated four overarching goals:



Facilitate collaboration between DOM faculty, trainees, staff along with SOM departments and training programs in conducting quality improvement activities.



Engage faculty and trainees in opportunities to learn about, participate in and lead quality improvement and safety efforts to improve clinical practice.

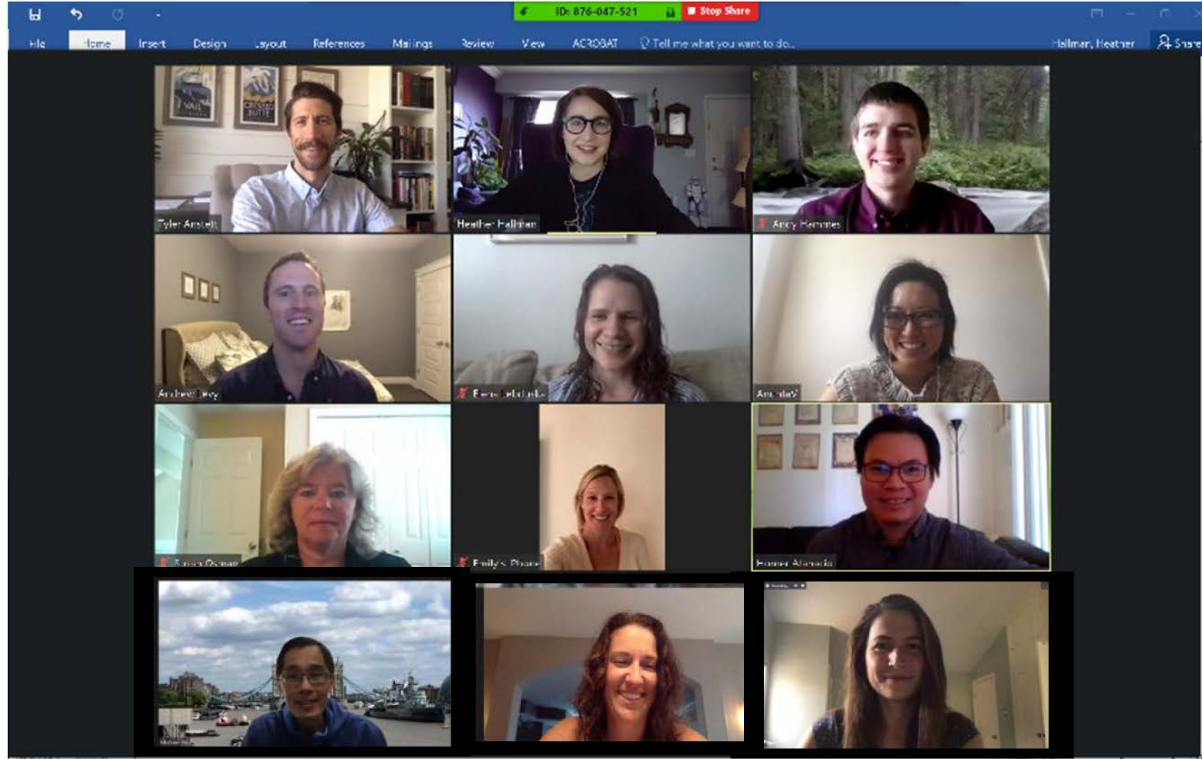


Foster a community of safety and quality among all members of the University of Colorado Anschutz Medical Campus (AMC) community.



Develop a robust data analytics program to support measurement of quality improvement performance and develop data monitoring dashboards and tools.

DOM QUALITY & PATIENT SAFETY TEAM



1st row (left to right): Tyler Anstett, Heather Hallman, Andrew Hammes; 2nd row: Andrew Levy, Elena Lebduska, Anunta Virapongse; 3rd row: Susan Osman, Emily Gottenborg, Homer Atanacio; 4th row: Michael Ho, Karen Ream, Anna Neumeier

DOM QUALITY & PATIENT SAFETY (QPS) TEAM

- **P. Michael Ho, MD, PhD**
DOM Vice Chair for Quality
- **Heather Hallman, MSHS, MHA**
Program Manager
- **Andrew Hammes, MS**
Biostatistician
- **Tyler Anstett, DO**
DOM Associate Vice Chair for Quality
- **Homer Atanacio, BS**
Project Manager
- **Anunta Virapongse, MD, MPH**
DOM Associate Vice Chair for Quality
- **Susan Osman, BS**
Analytics Developer

DOM QPS DIVISIONAL LEADERSHIP TEAM (quality leaders representing their academic affiliate clinical sites)

- **Emily Gottenborg, MD**
(UCH - Hospital Medicine)
- **Tyler Miller, MD, FACP**
(Veteran Affairs - Hospital Medicine)
- **Elena Lebduska, MD**
(Lowry - Internal Medicine)
- **Anna Neumeier, MD**
(Denver Health - Pulmonary & Critical Care)
- **Andrew Levy, MD, MS**
(Denver Health - Cardiology)
- **Karen Ream, PA-C**
(UCH - Cardiology)

DOM QPS ACTIVITIES AY19-20

In the 2019-2020 academic year, the DOM QPS Program leveraged the data infrastructure built the prior year to develop new quality and process improvement (Q/PI) activities as well as implemented and advanced novel Q/PI educational programs. These activities and programs are highlighted below:

SAFETY	QUALITY	VALUE	EDUCATION
<ul style="list-style-type: none"> DOM Morbidity & Mortality (M&M) Conferences M&M Steering Committee DOM Division Mortality Reviews 	<ul style="list-style-type: none"> Annual Quality & Safety Symposium GME Bonus Program Data support 	<ul style="list-style-type: none"> Annual Shark Tank Competition Power BI dashboards Mortality Prediction Tool 	<ul style="list-style-type: none"> Leaders in Informatics, Quality & Systems Fellowship Health Innovations Scholar Program

III. Making Patient Care Safer

DOM MORBIDITY & MORTALITY CONFERENCE

The mission of the M&M Conference is to establish a safe venue to identify areas for improvement in patient care, while promoting professionalism, integrity, and transparency. This year we saw an increase in participation from several Divisions in the DOM M&M Conference series and MMSC activities and we look forward to that same level of engagement for the upcoming academic year.

Table 1. AY19-20 DOM M&M Conferences

Date	M&M Conference Title	DOM Division	Case Presenters	Case Facilitators
July 2019	Outside Hospital Transfer to CICU	Cardiology	Christopher Barrett, MD [Cardiology Fellow]	Tyler Anstett, DO [Hospital Medicine]
August 2019	Perioperative DNAR Code [DOM Grand Rounds]	Anesthesiology	Tyson Oberndorfer, MD, MS [Geriatrics Fellow]	Tyler Anstett, DO [Hospital Medicine]
September 2019	Pain & Weakness	General Internal Medicine	Deepa Ramadurai, MD [Internal Medicine Chief Resident]	Elena Lebduska, MD [General Internal Medicine]
October 2019	Recurrent Admissions for Drug Use - High Pain Medication Requirements [DOM Grand Rounds]	Addiction Medicine	Susan Calcaterra, MD [Addiction Medicine]	Anunta Virapongse, MD, MPH [Hospital Medicine]
December 2019	A Case of Unexpected Mortality: When, How and Why Should We Review?	Cardiology	Luke Cerbin, MD [Cardiology Fellow]	Andrew Levy, MD, MS [Cardiology]
January 2020	Contraception Provision in Women with Uncontrolled Diabetes	Endocrinology, Metabolism & Diabetes	Adnin Zaman, MD & Layla Abushamat, MD [Endocrine Fellows]	Stephanie Eldred, MD [Hospital Medicine Fellow]
March 2020	A Missed Transmural MI in the Setting of Bundle Branch Block [Patient Safety Awareness Week Event]	Pulmonary Science & Critical Care	Arun Kannappan, MD & James Maloney, MD [Pulmonary & Critical Care]	Tyler Anstett, DO [Hospital Medicine]

April - June 2020	Because of the COVID pandemic, the M&M conference was cancelled for the rest of the academic year.
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Over AY19-20, the DOM QPS team worked to make the DOM M&M Conferences more diverse, the process for reviewing and presenting cases more efficient, and created a system for soliciting cases from the Divisions. We also continued the work towards helping Divisions make their own Conferences more systems-based. To ensure consistency in the M&M presentations and making conference preparation more efficient, the DOM QPS team put together a process map (see [Appendix 1](#)) that details the steps from case identification all the way through follow up of action items identified during the presentation. M&M facilitation was also opened up to faculty across the DOM, increasing the pool of M&M facilitators from 10 (AY19-20) to 18 (AY20-21). Today, AY20-21 facilitators represent seven different Divisions from seven distinct clinical sites, both inpatient and outpatient. For AY 20-21, our goal is to transition the M&M Conference series to a virtual platform and to continue to develop strategies to engage trainees in these case discussions.

AY19-20 Featured DOM M&M Conference Case: Contraception Provision in Women with Uncontrolled Type I Diabetes Mellitus (T1DM), January 2020 [Adnin Zaman, MD (left); Layla Abushamat, MD (right)]

A description of this case can be found in [Appendix 1](#). Drs. Zaman and Abushamat identified a gap in assessment and documentation of contraceptive counseling and methods that is not exclusive to Endocrinology and highlighted a wider, multi-disciplinary need. Several teams in the Rheumatology Division, including two Shark Tank Finalist projects, echoed the same need to assess and document contraceptive methods for continuity of care and patient safety. This case provided an opportunity for the DOM QPS team to bring these teams together to develop a shared solution.



DOM MORBIDITY & MORTALITY STEERING COMMITTEE

The M&M Steering Committee (MMSC) is the product of a collaborative effort between the DOM and UCH to create a shared vision for patient safety, with the goal of developing resources and initiatives to tackle issues identified through M&M Conferences to improve systems of care and patient outcomes. The MMSC member roster (see [Appendix 2](#)) includes representatives from UCH leadership, the UCH Clinical Quality team and representatives from each of the 13 DOM clinical Divisions. During the open multidisciplinary discussions, the committee helps Divisions determine the scope and breadth of actionable quality and process improvement activities and facilitates alignment with UCH's strategic initiatives.

In AY19-20, the MMSC developed and implemented a variety of action items stemming from DOM and Division M&M Conferences (see Table 2).

Table 2. DOM M&M Steering Committee Case Reviews for AY19-20

Month	M&M Conference	Outcomes
October 2019	DOM M&M Conference - <i>Pain & Weakness</i>	Collaboration with Dr. Sonia Flores, CU Vice Chair for Diversity & Justice, to include obesity sensitivity training in their upcoming curriculum for faculty and trainees.

	Hematology M&M Conference	Discussed ways to address difficult venipuncture sticks. Linked Dr. Tyler Anstett with team to explore his work on venipuncture teams in Hospital Medicine.
November 2019	DOM M&M Grand Rounds Conference - <i>Recurrent Admissions for Drug Use and High Pain Medication Requirements</i>	Multi-disciplinary discussion on Addiction Medicine services and the need to increase visibility of their new inpatient service. The MMSC worked with Dr. Susan Calcaterra to initiate a new series, <i>Did You Know?</i> , which will highlight this new service for the DOM.
January 2020	Infectious Disease M&M Conference	Highlighted the need for push notifications in Epic for post-discharge lab results. Working with Dr. Brian Montague to escalate this request in Epic.
	DOM M&M Conference - <i>A Case of Unexpected Mortality - When, How and Why Should we Review?</i>	Highlighted the importance of conducting mortality reviews, especially for unexpected deaths, to ascertain if care was delivered safely and efficiently. After analysis, death was likely attributed to an alternative diagnosis.
February 2020	DOM M&M Conference - <i>Contraception Provision in Women with Uncontrolled Diabetes</i>	Connected with Rheumatology team already working on contraception counseling/medication alerts.

DOM M&M Steering Committee Activity AY19-20

Over the last academic year, the DOM QPS team met with each of the Divisions to understand their processes for reviewing morbidity and mortality cases. The goal of these efforts was to promote standardization and provide data assistance to Divisions. To achieve standardization and support Divisions in case reviews, the MMSC collaborated with the DOM QPS team in developing the Power Business Intelligence (BI) mortality dashboard to track mortalities across all DOM Divisions (see Appendix 2). Several themes were identified after reviewing the Power BI data within each of the Divisions:

- Mortality data can be inconsistent or difficult to obtain.
- Lack of systematic, timely notification of patient deaths for inpatient (consult and primary) and ambulatory services. Real-time patient death notification can be useful for provider feedback, teaching points and peer reviews.
- Developing a mortality review process must be a collaborative effort between the DOM Divisions, UCH leadership and UCH Clinical Quality team.

To address the high-priority action items identified in the Divisional one-on-one meetings, the MMSC has chosen a two-phase approach for AY20-21:

High Priority Action Items: Phase I

- **Pilot Outpatient Mortality Notification**
 - Pilot at Lowry IP/OP first w/ Elena Lebduska (IM)
 - Feed Health Data Compass data (CDPHE state death registry) into Epic Caboodle Data Warehouse
 - Goal is fully automated integration into Epic Chronicles to send message to PCP's Epic inbasket
 - Currently assessing feasibility with HD Compass and Epic Analytics Team
- **Power BI Changes**
 - Tailoring dashboard to meet division needs

High Priority Action Items: Phase II

- **Partnering with UCH**
 - Jeff Glasheen (UCHealth CQO) and team developing Vizient dashboards for mortality data
 - Working with Jen Wiler (UCH CQO) to develop prospective mortality review process
 - Act on issues already identified by MICU, Cardiology & Hospital Medicine
- **Outpatient error reporting**
 - Increase visibility for error reporting tool (e.g., RL Solutions) for outpatient divisions

IV. Improving Quality of Care

For AY19-20, the DOM QPS team strengthened our robust data support infrastructure and helped increase visibility for quality projects throughout the UCH system. Our team collaborated with UCH leadership to host a series of events during National Patient Safety Awareness Week (PSW) in March 2020, which highlighted the quality and safety work of students, staff, trainees and faculty across all UCH sites. We also continued our collaboration with the GME Bonus Program to provide project support and data for DOM Divisions' P/QI efforts. The DOM QPS team has provided data support and built recurring reports to meet a variety of needs for DOM Divisions and UCH leadership, many used to support providers as they managed the COVID-19 pandemic. The DOM QPS team continues to support P/QI efforts through data support and by creating opportunities to showcase outcomes.

NATIONAL PATIENT SAFETY AWARENESS WEEK

A featured event of PSW was a DOM sponsored M&M Conference. Presented by Dr. Arun Kannappan (Pulm & CC) and facilitated by Drs. James Maloney (Pulm & CC) and Tyler Anstett (Hospital Medicine) with expert commentary provided by Dr. Aken Desai (Interventional Cardiology), the case, *A Missed Transmural MI in the Setting of a Bundle Branch Block* led to a productive, multi-disciplinary discussion that identified contributing system issues. Approximately 150 faculty, trainees and staff attended and participated in the discussion.



Dr. Arun Kannappan at the PSW M&M Conference, March 2020

The main event for PSW was the 2nd Annual UCH Quality & Safety Symposium, jointly sponsored by the DOM, Department of Surgery and UCH leadership, including a key note address and poster session. Unfortunately, due to the COVID-19 pandemic, the event was postponed. The conference will be rescheduled in Fall 2020 as a virtual event with a keynote address and a virtual poster session with speakers available to discuss their work via Zoom.

The poster session featured over 50 quality and safety projects across the UCH system from faculty, trainees, staff and CU students. Awards were given for the top 5 posters in addition to the *Outstanding Quality & Safety Poster Award*.

Outstanding Quality & Safety Poster Award Winner

Lakshmi R Chauhan, MD; Misha Huang, MD; Mona Abdo, PhD, MPH; Samantha MaWhinney, SCD; Skotti Church, MD; Matt Miller, PharmD; Danielle Fixen, PharmD; Kristine Erlandson, MD
 [Department of Medicine-Infectious Disease]

Approaches to Decrease Inappropriate Antibiotic use in Acute Respiratory Conditions in a Geriatric Clinic

Top 5 Poster Award Winners

Rebecca Shay, MD (Fellow); Theresa Grover, MD; James Barry, MD [Department of Pediatrics]

Implementation of Evidence-Based Guidelines Improves Patient Safety during Non-Emergent Neonatal Intubations

Ali Zirakzadeh, MD; Santos Diaz, MBA; Teddy Montoya; Tracey Richers-Maruyama, MA; Sonia Sheck; Cyrus Gidfar [Department of Medicine-Internal Medicine]

Decreasing Tobacco Use through Clinical Systems Change at Denver Health

Sarah Billups, PharmD; Joseph Saseen, PharmD; Rachel Lowe, PharmD; Cy Fixen, PharmD; Scott Pearson, PharmD; Danielle Fixen, PharmD; Sunny Linnebur, PharmD; Emily Zadvorny, PharmD; Sara Wettergreen, PharmD; Ashley Huntsberry, PharmD; Julie Alford, PharmD; Liza Claus, PharmD; Lisa Schilling, MD [Department of Pharmacy]

Improving Blood Pressure Control in Hypertensive Patients with Clinical Pharmacist Care

Samuel Porter, MD (DOM Chief Resident for Quality & Patient Safety); Kellen Hirsch; Meha Semwal; Peter Klauck; Kasia Mastalerz, MD; Lori Sarten, MD; Chung-Wen Wang [Department of Medicine-Internal Medicine Residency Program]

Providing High Value Care by Leveraging Structured Interdisciplinary Rounding to Reduce Unnecessary VTE Prophylaxis

Anissa Jones, MSN, CNS, RN, RN-BC; Erica Pratt BSN, RN, CCRN; John Karels, BSN, RN, CCRN-K; Catherine Mickey, BSN, RN, CCRN-CSC; Sara Hanke, BSN, RN, CCRN; Georgia Handleman, BSN, RN, CCRN; Leslie Ward, BSN, RN, CMSRN, CWOCN; Alyson Dare Kelleher, BSN, RN, CCRN [UCH CTICU Nurse Team]

The 3 Hs: Preventing Head, Heinie and Heel HAPI in the CTICU

GME BONUS PROGRAM

The Graduate Medical Education (GME) Quality and Safety Bonus Program awards a financial bonus to residents and fellows for conducting a P/QI project and achieving metrics that are outlined as part of the project. The project must focus on a meaningful area within their clinical domains. Individual Residency and Fellowship programs have the ability to propose quality or safety projects that their residents/fellows will address for each academic year as well as the P/QI benchmarks. For AY19-20, the Internal Medicine Residency Training Program residents continued their work to combat the opiate crisis, this year focusing on improving access to Medication Assisted Therapy (MAT) for opiate-use disorder. The residents were able to get >75% of residents certified to be MAT providers. An amazing accomplishment considering less than 5% of physicians nationally are certified to provide this life-saving therapy. The DOM QPS team provided data (e.g., visits, medication hx, problem list, etc.) throughout the development of this project.

QPS DATA SUPPORT

The DOM QPS team has access to several data sources including Epic reports, Vizient and Health Data (HD) Compass. The team leverages these data sources to help faculty monitor performance, inform clinical decisions and implement changes in their P/QI efforts. We have provided data reports to several DOM Divisions and SOM Departments, many of which have been transitioned to system-wide UCH use. For AY19-20, the QPS team provided assistance to nine Divisions with projects addressing a wide range priorities including antibiotic stewardship, opioid abuse, length of stay, patient volumes and admissions, telehealth visits, prediction models and risk algorithms. The DOM QPS team supported projects from the GME Bonus Program, the LInQS Fellowship as well as the

Clinical Effectiveness and Patient Safety (CEPS) Small Grants Program. A list of projects completed over the last academic year are in [Appendix 3](#).

AY19-20 Featured DOM QPS Data Project: Improving Antibiotic Prescribing for Acute Respiratory Tract Infections in Seniors Clinic (Lakshmi R Chauhan, MD; Misha Huang, MD; Mona Abdo, PhD, MPH; Samantha MaWhinney, SCD; Skotti Church, MD; Matt Miller, PharmD; Danielle Fixen, PharmD; Kristine Erlandson, MD

In AY19-20, this project was piloted in the Senior’s clinic, with the goal of reducing inappropriate antibiotic use in patients presenting with respiratory symptoms. Interventions included provider and patient education, data tracking and standardized order sets to limit the number of inappropriate antibiotic prescriptions. The primary outcomes were to reduce the number of antibiotic prescriptions and the duration of medication regimens. Dr. Chauhan received funding from the CEPS Small Grants Program to support her efforts and received help from the DOM QPS team to develop a Power BI dashboard for tracking outpatient antibiotic use.

Table 3. Antibiotics Prescriptions and Durations

Indication	Number of Antibiotic Prescriptions		Duration (median, IQR) Range		P-value*
	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	
Pneumonia	47	38	5 (5,10) Range= 1,21	5 (5,7) Range= 3,10	0.15
Sinusitis	40	25	7 (7,10) Range= 5,14	7 (5,7) Range= 2,10	0.001
Pharyngitis	7	11	10 (5,10) Range=5,10	5 (5,7) Range=5,10	0.038
AE-COPD	22	23	5 (5,5) Range=5,14	5 (5,5) Range=5,10	0.40
Otitis	5	7	10 (7,10) Range= 7,10	5 (5,7) Range=5,7	0.007
Bronchitis	16	8	5 (5,5) Range=5,14	5 (5,5) Range=5,5	0.31

During the project, the DOM QPS team provided the programming logic for the UCH Clinical Quality team, who then built a Power BI dashboard (see Figure 1) to track a variety of metrics for this project. Those include antibiotic prescriptions by drug, class, indication and visit diagnosis in addition to provider and clinic

prescribing behaviors. The DOM QPS team also developed a way for Dr. Chauhan to track trends and develop targets by using these dashboards to help monitor performance over time and promote greater visibility of prescribing behaviors. After implementing the educational interventions, her team saw a marked reduction in antibiotic prescriptions for select indications (e.g., sinusitis, otitis) and downward trend for the majority of indications (see Table 3).

Figure 1. Power BI Outpatient Antibiotic Utilization and Outpatient Targets



Using the Power BI dashboards developed by the DOM QPS team, in AY20-21, Dr. Chauhan intends to expand this project to other clinics and urgent care settings. She will utilize the data to identify high utilization areas and promote targeted stewardship programs. Additionally, she plans to assess the effectiveness of other stewardship strategies such as delayed antibiotic prescription, prospective audit & feedback and peer comparisons. The DOM QPS team played an integral role in the development of this effort and have built a self-sustaining system that can be utilized in a variety of care settings.

V. Pursuing High Value Care

ANNUAL SHARK TANK COMPETITION

For the fourth consecutive year, the DOM QPS team hosted the annual Shark Tank Competition in October 2019. The purpose of the Shark Tank Competition is to identify P/QI projects, led by DOM faculty, that promote high value care (HVC). The winning project receives DOM QPS support including Six Sigma coaching, data support and analysis and increased visibility in the DOM and UCH.

The 2019 Sharks were a distinguished panel from UCH executive leadership, SOM leadership and DOM leadership. We also included the first year LInQS fellows as judges in the competition as part of their experiential leadership activities.

- P. Michael Ho, MD, PhD - DOM Vice Chair for Quality
- Richard Albert, MD - DOM Vice Chair for Clinical Affairs
- Lisa Camplese, RN - UCH Director of Quality
- CT Lin, MD - UCH Chief Medical Information Officer
- Jeffrey Glasheen, MD - UCHealth Chief Quality Officer
- Tom Mackenzie, MD - Denver Health Chief Quality Officer
- Shoshana Tell, MD - LInQS Fellow
- Aaron Emmons, MD - LInQS Fellow
- Blake Jones, MD - LInQS Fellow

2019-2020 Shark Tank Finalists

Anjeli Kalra, MD; Misha Huang, MD; Matthew Miller, PharmD; Stephen Dreskin, MD, PhD; Gerry Barber, PharmD; Levi Keller, MD; Taylor Morrisette, PharmD; Nichole Neville, PharmD [Allergy & Immunology]

Ruling Out Penicillin Allergy at the University of Colorado Hospital: Proof of Concept

Kristen Demoruelle, MD; Guiset Carvajal-Bedoya, MD; JoAnn Zell, MD [Rheumatology]

Improving Contraception Management in Rheumatology Patients on Teratogenic Medications

Elena Weinstein, MD; Katharine Moore, MD; Duane Pearson, MD; JoAnn Zell, MD; Michelle Sutter, PNP; Linda Rodamaker, NP; Tara Kennedy, NP [Rheumatology & Dept. of Pediatrics]

Easing the Transition: A Quality-based Approach to Transitioning Patients from Child and Adolescent Rheumatology Clinic to Adult Rheumatology Clinic

Karen Moulton, MD; Dan Huck, MD; Scott Freeman, MD [Cardiology]

HF-RADAR: Reduced Admissions and Decompensation and Augmented Recovery for Heart Failure Patients

The 2019-2020 Shark Tank Finalists all developed impressive HVC projects with novel interventions to improve healthcare quality and patient safety. The sharks were impressed with each team's project aims and methodologies, to the extent that all four were chosen to receive DOM QPS support. Dr.

Moulton’s winning project is described below. Since October 2019, the DOM QPS team has assisted Dr. Demoruelle in submitting an Epic request to create a best practice alert (BPA) for teratogenic medication risks for women of child-bearing potential (WOCBP), confirmation of contraception use before proceeding with teratogenic medication orders and a developed data collection plan to monitor the use of these two interventions. The DOM QPS team worked with Dr. Weinstein and Dr. Moore to collect baseline data on Rheumatology patients coming to UCH from CHCO. In addition, we connected Dr. Weinstein with Dr. Tina Finlayson (Associate Medical Director, CU Medicine), who is working on an UCH collaborative to improve transitions of care from CHCO to UCH.

These Shark Tank projects are making significant impacts in changing care and driving value at UCH. They address utilization, cost and help improve the effectiveness and efficiency of care. Looking forward, the Shark Tank Competition will be moved out to May 2021 to align with the academic year. For next year, the finalist presentations will be conducted during the DOM Grand Rounds and will incorporate audience voting to support the judges’ decisions.

2019-2020 Shark Tank Winner: HF-RADAR: Reduced Admissions, Decompensation and Augmented Recovery for Heart Failure Patients (Karen Moulton, MD; Dan Huck, MD; Scott Freeman, MD)



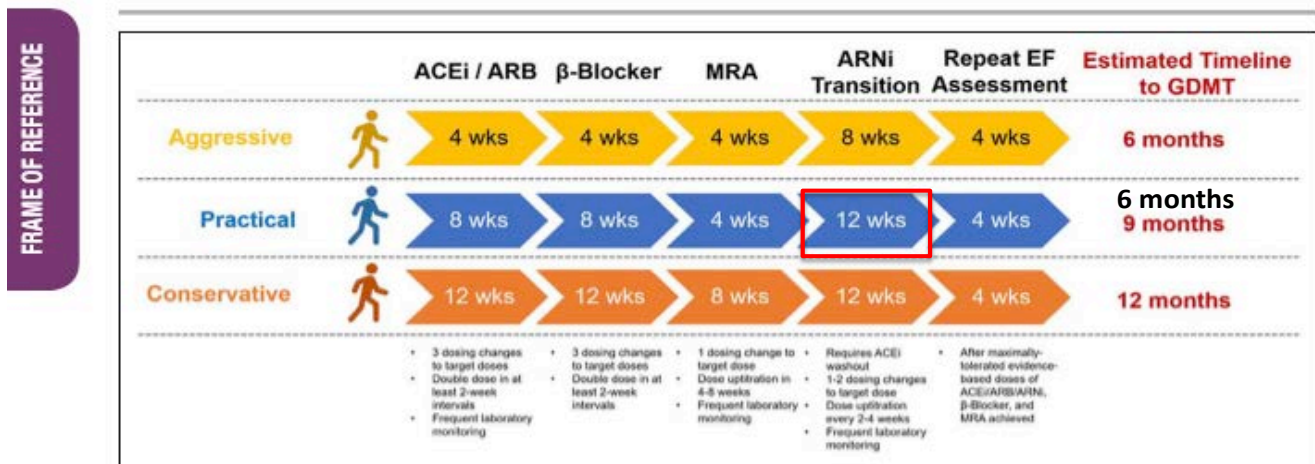
The goal of this project is to achieve timely optimal medical therapy (OMT) titration to prevent costly hospital re-admissions (e.g., 15% reduction) and improve clinical outcomes. The project team developed an Epic smart list to track and coordinate care for HF patients enrolled in the protocol. After patients’ initial post-acute care visits, the clinic team schedules patients for 6 months of follow-up care visits with Cardiology fellows or NPs to initiate and uptitrate drug to guideline recommended goals. The after-visit summary (AVS) includes patient education materials and the goals for each visit. A key element of this project is communication with the patients’ primary care provider (PCP) for continuity of care.

Dr. Karen Moulton & Dr. Dan Huck Shark Tank Competition Presentations, October 2019

Figure 2. Optimal Medical Therapy Timeline

Gracia, et al. Circulation 2019; 140: 621-623

Timely Management of New-Onset Heart Failure

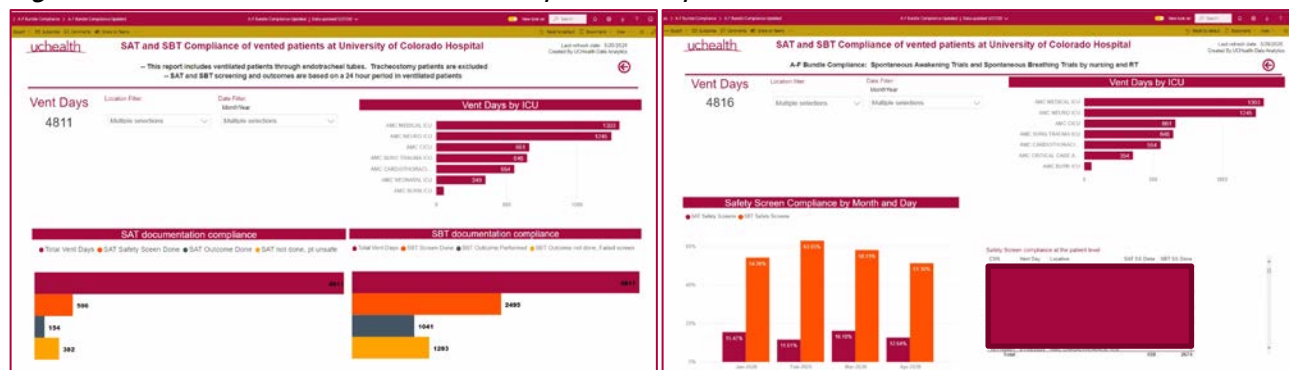


Dr. Moulton's team will measure the percentage of patients on OMT at six months and one year. Outcome measures include changes in NYHA functional classification, change in LVEF and hospital readmission rates. Additionally, the project team will administer pre- and post-provider/staff satisfaction surveys. The DOM QPS team has worked with Dr. Moulton to develop a baseline data collection plan and created process maps for the fellows, NPs and medical assistants to schedule and manage patients enrolled on the study protocol. To date, the project team continues to collect baseline data and track patients enrolled in the protocol.

2018-2019 Shark Tank Winner - Update: ICU Liberation with Epic Partnership (Arun Kannappan, MD; Ellen Burnham, MD; Jeff Sippel, MD; Mark Yoder, RN; Olivia Thornton, RN; Jana Butler, RN; Grace Howard, RRT; David Norton, RRT; Andrea Foreman, RRT; Rebecca Medina, PT; Kyle Ridgeway, PT)

The goal of this project was to create standardized protocols (i.e., ABCDEF Bundle) to improve care for ICU patients. The outcomes of interest for the intervention included: reduction of ICU days, reduction of ventilator-associated complications and reduction in neurocognitive and psychiatric morbidity. The project team created a novel Epic order set and collaborated with the DOM QPS team to develop a Power BI dashboard (see Figure 3). The new order set and Power BI reporting tool went live in July 2019. This allowed unit/manager level documentation of metrics including delirium days, spontaneous breathing trials (SBT), spontaneous awakening trials (SAT), central line days, ventilator days, time to extubation and ICU length of stay. The project team continues to work on developing weekly and monthly reports and are continuing education efforts in the MICU. Roll-out to other ICUs will occur in 2020.

Figure 3. Power BI ABCDEF Bundle Compliance Report



MICROSOFT POWER BI DASHBOARDS

Power BI Dashboard Reports:

- Inpatient & Outpatient Mortalities w/in 48hrs of Admission
- Patient Consult Volumes
- Outpatient Clinic Volumes & Charges
- A-F Bundle Compliance
- Inpatient Admissions & Transfers

Over AY19-20, the DOM QPS team has leveraged the Power BI dashboards for a variety of clinical data needs in the DOM. These data dashboards can provide a wide range of data from Epic and can be customized to meet the needs of each Division and project

teams. The utility of the Power BI program helped the DOM QPS team transition existing manual

reports into this platform to track UCH patient volumes, telehealth visits and corresponding financial data and tracking compliance with clinical best practices and many more. The Power BI reports continue to grow in necessity and the DOM QPS team continues to utilize the Power BI platform to its fullest extent. More information on the Power BI dashboards is in [Appendix 4](#).

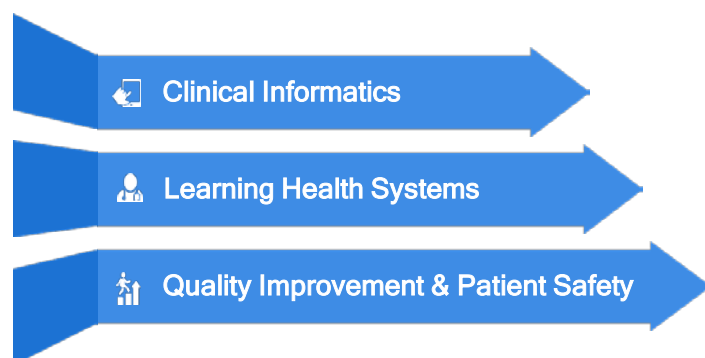
MORTALITY PREDICTION TOOL

The DOM QPS team developed a machine learning tool to quantify a patient's mortality risk during the hospitalization based on admission risk factors. Applications for this tool can help to assess whether a fatal event in the hospital was expected or unexpected based on admission characteristics. Potential applications of this model are still being explored. One potential application would be to identify mortality cases for clinical review in scenarios where a patient was not predicted to die based on admission characteristics and then subsequently had a fatal event during the hospitalization (i.e., unexpected death). This approach could potentially decrease the number of mortality cases to review. More information can be found in [Appendix 5](#).

VI. Educating Future Leaders

LEADERS IN INFORMATICS, QUALITY & SYSTEMS FELLOWSHIP

In 2019, the DOM QPS team introduced the Leaders in Informatics, Quality & Systems (LInQS) Fellowship Program. The objective of the LInQS Fellowship Program is to develop fellows and junior faculty into future leaders with successful academic careers in the areas of quality improvement, clinical system design, clinical informatics, and/or patient safety. This is a two-year program that combines didactics, longitudinal mentorship and hands-on training from faculty mentors with diverse expertise to support trainees and junior faculty. The LInQS fellows focus on one of three tracks.



The LInQS fellows attend a didactic lecture series over the two-year program including track-specific lectures, the Quality Safety Academy (QSA) workshops and participate in the IHQSE Certificate Training Program (CTP). We leverage these didactic programs to support the LInQS fellows as they develop a P/QI project that has significant clinical impact for their Divisions. The LInQS fellows also participate in bi-monthly work-in-

progress meetings where they provide project milestone presentations, discuss challenges and barriers in their P/QI projects and complete post-lecture assessments. LInQS fellows must complete multiple deliverables including dissemination of work in peer-reviewed journals, presentations at local or national conferences, become a resource and mentor for Division P/QI projects, submit their projects for intramural or extramural funding and participate in track-specific activities. The LInQS Fellowship Program didactics listing can be found in [Appendix 6](#).

Table 4. LInQS Fellowship Program Faculty Members

Clinical Informatics	Learning Health System	Quality Improvement & Patient Safety
CT Lin, MD Professor, Internal Medicine	P. Michael Ho, MD, PhD Professor, Cardiology	Tyler Anstett, DO Assistant Professor, Hospital Medicine
Lisa Schilling, MD, MSPH Professor, Internal Medicine	Andrew Levy, MD, MS Assistant Professor, Cardiology	Karen Ream, PA-C Assistant Professor, Cardiology
Amber Sieja, MD Associate Professor, Internal Medicine	Sridharan Raghavan, MD Assistant Professor, Hospital Medicine	Tyler Miller, MD, FACP Assistant Professor, Hospital Medicine
Jonathan Pell, MD Associate Professor, Hospital Medicine	Cory Hussain, MD Assistant Professor, Infectious Disease	
Brian Montague, DO, MS, MPH Associate Professor, Infectious Disease		

Cohort 1 (AY2019-2021) LInQS Fellows

The first cohort of the LInQS Fellowship Program began in September 2019.

Cohort 1 is comprised of a diverse group of accomplished fellow physicians from DOM Divisions as well as one from the Department of Pediatrics. These fellows have already exceeded expectations and have made significant strides in their P/QI

projects. Dr. Blake Jones and Dr. Shoshana Tell had posters accepted for the 2nd Annual UCH Quality & Safety Symposium in March 2020 and were awarded intramural funding by the CEPS Small Grants Program. Dr. Tell also presented her work at the CHCO 2020 Annual Spring Research Poster Session in May 2020. Dr. Aaron Emmons played an integral role in the response to COVID-19 within the Division of Cardiology. Dr. Jennifer Taylor's LInQS project will focus on improving COPD care in ambulatory clinics and this project was accepted by the GME Bonus Program for the Pulmonary Division fellows. A description of each fellows' P/QI project can be found in [Appendix 6](#).

LInQS Fellows (Cohort 1):

- Blake Jones, MD, Gastroenterology fellow
- Shoshana Tell, MD, Pediatric Endocrinology fellow
- Jennifer Taylor, MD, Pulmonary Science & Critical Care fellow
- Aaron Emmons, MD, Cardiology fellow

Cohort 2 (AY2020-2022) LInQS Fellows

For the second cohort, the LInQS Fellowship Program expanded eligibility to junior faculty members within the DOM including physicians and advanced practice providers (e.g., NP, PA). In January 2020, a call for applications for Cohort 2 received a sizeable response from within and outside the DOM. Eight fellows were selected to join Cohort 2. This Cohort 2 has a wide range of exceptional skills and diverse

LInQS Fellows (Cohort 2):

- Laura Peters, DNP, Cardiology
- Timothy Yen, MD, Gastroenterology fellow
- Tara Ward, AGACNP-BC, Hospital Medicine
- Henry Kramer, MD, Hospital Medicine
- Lorna Allen, NP, Infectious Disease
- Ryan Flood, DO, Renal Medicine Disease & Hypertension
- Sarah Mann, MD, Infectious Disease
- Laura Macke, MD, Internal Medicine

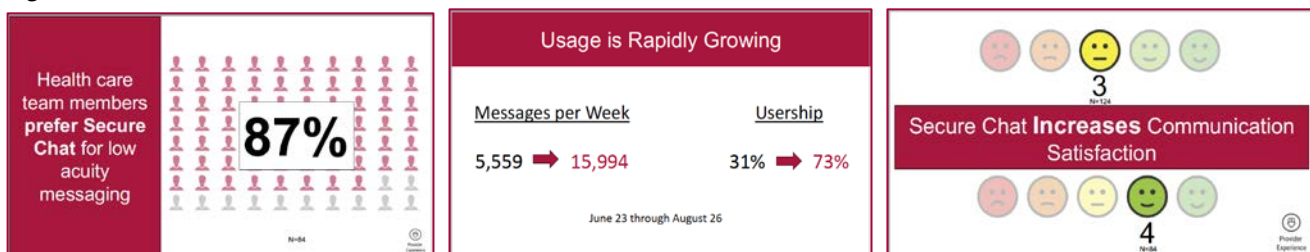
backgrounds. Cohort 2 will begin in July 2020. For this second cohort, the LInQS Fellowship Program has introduced a structured block schedule of didactics, new track-specific activities and a timeline of project milestones and deliverables. A description of the program schedule can be found in [Appendix 6](#).

HEALTH INNOVATIONS SCHOLAR PROGRAM

The Health Innovations Scholar Program (HISP) is an intensive training program for medical students who seek to lead innovative transformation of US healthcare. Medical schools typically do not provide the knowledge or skills necessary to drive reinvention of healthcare systems. The HISP is a mechanism to engage medical students early in their careers towards P/QI and innovation. The students who have participated in HISP from 2013–2019 have engaged in experiential work across multiple clinical settings.

For AY19-20, the cohort of students represented seven medical schools from across the US. This group worked on categorizing and developing best practices for the new Epic Secure Chat feature implemented at UCH. For the AY20-21, the HISP program is being modified to include only students from the University of Colorado School of Medicine, due to the COVID-19 pandemic.

Figure 4. HISP Data from AY19-20



VII. COVID-19 Response

While COVID-19 had a significant impact on DOM QPS activities in AY19-20, we were able to leverage the resources and skills of the team to help support UCH during this challenging time. Members of the DOM faculty played a key role in the development of three COVID-19 Agile MD pathways, which are now being used by providers throughout the UCH system. These pathways, which are contained within Epic electronic health record, have helped hundreds of providers throughout the UCH system deliver care that is efficient and evidence-based. Developing these pathways required collaboration among DOM Divisions along with several other SOM Departments. The following DOM Divisions and partners helped build the *COVID Testing and Management Pathway*, the *COVID Discharge Pathway* and the *Ambulatory Care COVID Pathway*.

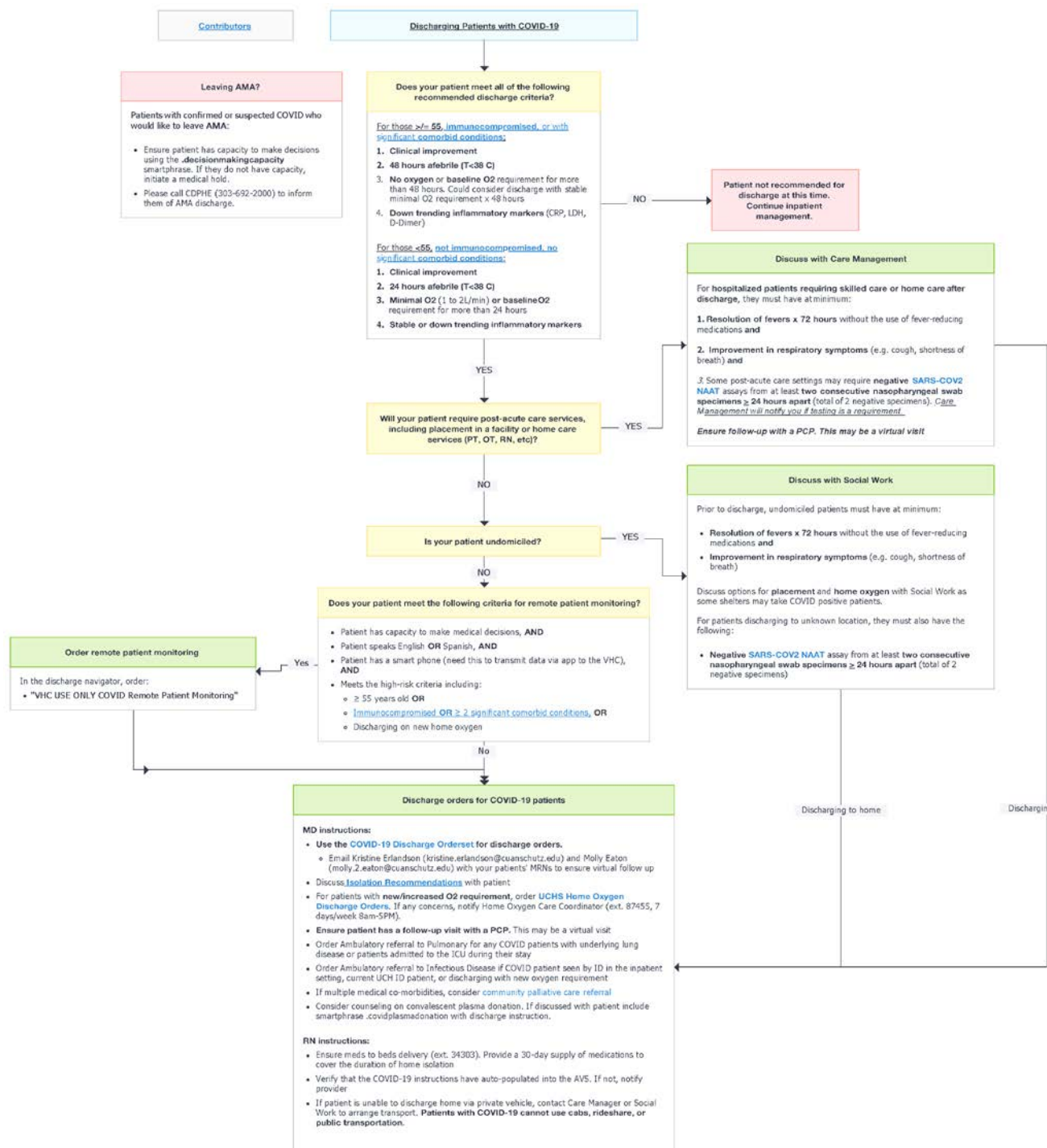
Department of Medicine Divisions:

- Pulmonary & Critical Care
- Internal Medicine
- Hospital Medicine
- Infectious Disease

SOM Department Partners:

- Family Medicine
- Emergency Medicine
- Neurology
- Pharmacy
- Radiology

Figure 5. COVID-19 Inpatient Discharge Pathway



In response to the need for accurate, real-time patient volumes data, the DOM QPS team created a new Power BI dashboard to show Infectious Diseases (ID) inpatient consult volumes (as described in Appendix 4). This dashboard was vital to ID as they cared for patients during the peak of COVID-19 admissions and provided UCH with valuable data to strategize staffing, resource allocation and develop future plans. Work is underway to create the same tool for other consult Divisions. The DOM QPS team has also developed a Power BI dashboard to track telehealth visits in the ambulatory

setting, which has been highly valuable during this pandemic to track the frequency of virtual visits and associated revenue. Additionally, LInQS fellow Dr. Aaron Emmons, was recognized by the Department of Cardiology at Denver Health for volunteering to serve as a COVID-19 critical care physician during the crisis. Dr. Emmons worked day and night shifts helping to care for critically ill patients. He, along with five other fellows, were nominated for this recognition by Dr. Peter Buttrick, Division Head of Cardiology for the DOM.

VIII. Return on Investment

Over the last academic year, the DOM QPS team has significantly contributed to increasing the safety, quality and value of care for the DOM and UCH. We collaborated with the majority of DOM Divisions, several SOM Departments and UCH leadership to create opportunities for faculty to move the dial on quality metrics and increase visibility of their work to invested stakeholders. Our M&M Conferences highlighted several system issues and the MMSC worked with a variety of clinical units to prioritize small and large changes to improve the efficiency and effectiveness of care. The DOM QPS team also provided mentorship, data support and analytic developments for over 50 projects, including those from the GME Bonus Program, the CEPS Small Grants Program, the Shark Tank Finalists and LInQS fellows. The Power BI dashboards developed over the last academic year played a significant role in addressing resource utilization, transitions of care, and patient outcomes during the COVID-19 pandemic. We will continue to build on these platforms to increase the productivity of the DOM and support the scholarly contributions our faculty have made in their fields. The DOM QPS team has also made significant investments in training junior faculty to become future leaders in healthcare quality and safety and we will continue to grow our educational programs.

IX. Scholarship

Over the AY19-20, the DOM QPS team has supported several DOM activities resulting in scholarly output in peer-reviewed journals and national and local conferences.

MANUSCRIPTS

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Levy A, Ream K, Hammes A, Anoff D, Raines J, Beck N, Rudofker E, Marshall K, Nensel J, Messenger J, Masoudi F, Allen L, Ho M, "ICD-10, DRG, and ACTION: Poor Agreement Between Diagnoses of Acute Myocardial Infarction Results in Significant Differences in Process and Outcome Measures"; published in *Circulation: Cardiovascular Quality and Outcomes*; April 2019.

Levy A, Ream K, Hammes A, Rudofkier E, Beck N, Raines J, Marshall K, Nensel J, Anoff D, Messenger J, Masoudi F, Allen L, Ho M; "Are We Ready for High(er) Sensitivity Troponin Assays? The Positive Predictive Value of a Contemporary Troponin Assay for Acute Myocardial Infarction"; published in *Circulation: Cardiovascular Quality and Outcomes*; April 2019.

CONFERENCES

Jones, B, Patel SG et al. Leveraging Electronic Medical Record Functionality to Capture Adenoma Detection Rate: Proof of Concept. ACG, Oct. 2020: Nashville, TN.

Hammes, A. Length of stay prediction model. CU/CSU ML/AI Summit, Aug. 2019: Denver, CO.

X. Future Plans

Looking ahead to the next academic year, we are enthusiastic to continue to expand and innovate through our current programs, diversify faculty and trainee participation in DOM QPS efforts and to increase the visibility of our programs to the DOM Divisions. We will continue to collaborate with the DOM Divisions and UCH leadership to provide data support, education and collaborate to address the quality and safety needs of our faculty. For AY20-21, we will focus on transitioning existing programs to an online format (e.g., Quality & Safety Symposium, Shark Tank Competition, LInQS Fellowship and M&M Conferences) to continue our same level of engagement with trainees and faculty. We will also continue to develop Power BI dashboards to meet the needs of the DOM and its Divisions leading projects that drive quality and safety changes at UCH. The Power BI dashboards will also be utilized to continue tracking metrics related to the COVID-19 pandemic and we will leverage this data to address new quality issues arising in the following year.

Legend

AVS - After Visit Summary

BI - Business Intelligence

CDPHE - Colorado Department of Public Health and Environment

CEPS - Clinical Effectiveness and Patient Safety

CHCO - Children's Hospital Colorado

CI - Clinical Informatics

CTP - Certificate Training Program

DOM - Department of Medicine

GME - Graduate Medical Education

HDC - Health Data Compass

HISP - Health Innovation Scholars Program

HVC - High Value Care

IHQSE - Institute for Healthcare Quality, Safety & Efficiency

LHS - Learning Health Systems

LINQS - Leaders in Informatics, Quality & Systems

M&M - Morbidity & Mortality

MMSC - Morbidity & Mortality Steering Committee

QPS - Quality & Patient Safety

PCP - Primary Care Provider

PSW - Patient Safety Week

Q/PI - Quality and Process Improvement

QSA - Quality Safety Academy

SOM - School of Medicine

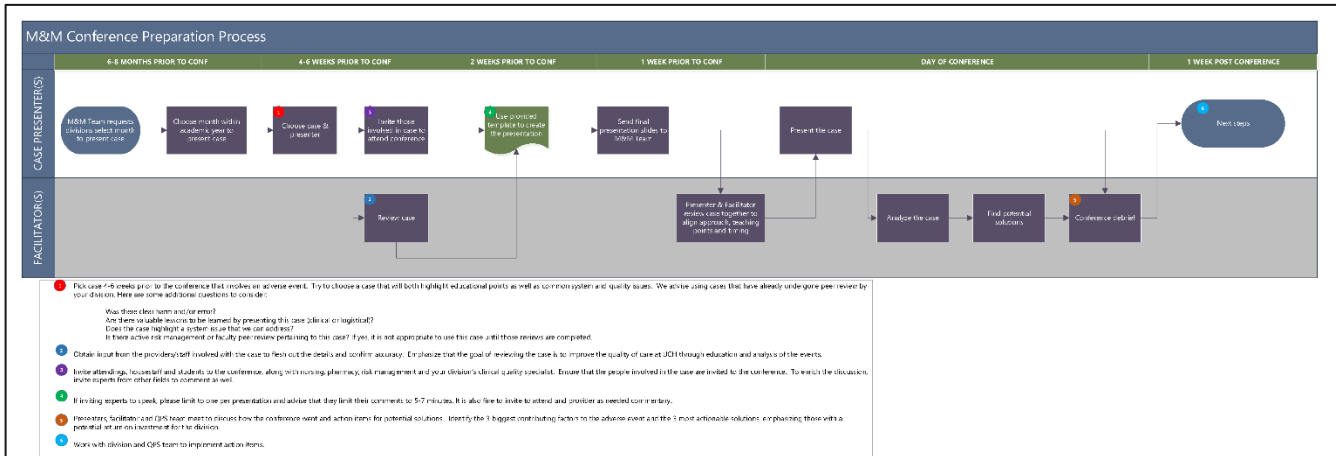
UCH - University of Colorado Hospital

WOCBP - Women of child-bearing potential

XI. Appendix

APPENDIX 1. MORBIDITY & MORTALITY CONFERENCES

Figure 6. DOM M&M Conference Preparation Process



AY19-20 Featured DOM M&M Conference Case

In January 2020, Endocrine fellows Adnin Zaman, MD and Layla Abushamat, MD presented the case *Contraception Provision in Women with Uncontrolled Type I Diabetes Mellitus (T1DM)* at the DOM M&M Conference. This case highlighted a significant gap for addressing contraception in WOCBP, especially for women with comorbidities. The gap in assessment and documentation of contraceptive counseling and methods is not exclusive to Endocrinology and highlighted a wider, multi-disciplinary need. Several teams in the Rheumatology Division, including two Shark Tank finalist projects, echoed the same need to assess and document contraceptive methods for continuity of care and patient safety. This case provided an opportunity for the DOM QPS team to bring these teams together to develop a shared solution.

WHAT ADVERSE EVENT(S) OR NEAR MISSES OCCURRED? PREVENTABLE?

1. Pregnancy was initially undesirable
2. Did not know to report pregnancy (caught during organogenesis)
3. Multiple ED visits for BG control
4. Labile BG throughout pregnancy
5. Scheduled delivery for poorly controlled DM done earlier due to pre-eclampsia without severe features
6. Post-partum pre-eclampsia w/severe features + IV Mg
7. Baby was large for gestational age (LGA)
8. Baby had a NICU stay x1 week for postnatal hypoglycemia with respiratory distress syndrome (RDS)
9. Baby with hyperbilirubinemia
10. Prolonged postpartum hospitalization (8d)



The patient in this case presented with several comorbidities (e.g., poorly controlled T1DM, retinopathy, neuropathy, toxic adenoma) and presumed gestation of 5 weeks. The patient developed pre-eclampsia and was scheduled for caesarian section at 37 weeks. The patient had a prolonged hospitalization with post-partum pre-eclampsia and the infant had several complications (e.g., large gestational weight, post-partum hypoglycemia,

respiratory distress syndrome, hyperbilirubinemia) requiring one week in the neo-natal intensive care unit (NICU).

This case highlighted a need to educate providers on best practice guidelines and standardize communication with WOCBP with DM. Drs. Zaman and Abushamat cited several national recommendations and risks for the DM population.

- The American Diabetes Association recommends pre-conception counseling be incorporated into routine diabetes care¹.
- The American College of Obstetricians and Gynecologists recommends optimization of HbA_{1c} (e.g., less than 6.0%) and increasing folic acid intake when attempting to conceive².
- Failing to appropriately plan for pregnancy for women with T1DM can lead to severe maternal and fetal complications³.
- Data show two out of three pregnancies in diabetic women are unplanned⁴ and less than one out of three women with pre-gestational DM seek pre-pregnancy counseling⁵.

In their case analysis, Drs. Zaman and Abushamat described barriers to following these guidelines embedded in the culture of the practice. Endocrine providers mainly depend on primary care providers to conduct contraceptive counseling, focusing on their patients' DM diagnoses. Additionally, there is a knowledge gap for providers regarding the appropriate contraceptive methods to prescribe for WOCBP with DM. This case conference highlighted a gap in practice and documentation for contraception counseling and this gap is not isolated to the Endocrine practice. There is a clear need to have contraception counseling and contraceptive methods routinely documented in Epic for WOCBP across all primary and specialty care services.

Several action items were developed in response to this case analysis, many of which have already been implemented.

- The Endocrine team added educational materials to the AVS in Epic including pregnancy risks, contraindicated medications and ideal contraceptive methods for WOCBP with DM.
- The Endocrine team will initiate an educational campaign to increase provider awareness surrounding best practice guidelines and tools to discuss and prescribe contraceptives for WOCBP with DM.
- The Endocrine team will update the note template to include LMP date, documentation of contraception counseling and contraception methods.
- The DOM QPS team connected the Endocrine fellows with the Rheumatology clinic to collaborate on similar goals (e.g., Shark Tank Finalist Project). The DOM QPS team submitted an Epic change request for a BPA to emphasize the risks in teratogenic medication orders in WOCBP and confirmation of contraceptive method before proceeding with that order.

This DOM M&M Conference shone a light on a larger need to improve Epic identification of and alerts for WOCBP at UCH. The MMSC has escalated the action items identified in this conference, and similar projects, to the Epic team and UCH leadership to improve documentation of contraceptive counseling and contraceptive methods within Epic. Additionally, there is a need to promote education among providers regarding contraceptive counseling within all primary and specialty care clinics. As shown in this case, the DOM M&M Conference is as a platform for DOM Divisions to escalate issues to the MMSC, appropriate stakeholders and UCH leadership. Within this a forum, we were able to identify system issues impacting multiple Divisions and develop interventions to prevent avoidable adverse outcomes.

References

1. ACOG Practice Bulletin No. 201: Presentational Diabetes Mellitus. *Obstet. Gynecol.* 2018;132(6):e228-e248.

2. Alexopoulos, A., Blair, R., Peters, A. Management of Preexisting Diabetes in Pregnancy: A Review. *JAMA*, 2019;321(18):1811-1819.
3. Browne, K., Park, B., Goetzinger, K., Caughey, A., Yoo, R. The joint effects of obesity and presentational diabetes on the risk of stillbirth. *J Maternal Fetal Neonatal Medicine*. 2019: 1-7.
4. Mackin, S., Nelson, S., Wild, S., et al. Factors associated with stillbirth in women with diabetes. *Diabetologia*. 2019;62(10):1938-1947.
5. Schwarz, E., MAselli, J., Gonzales, R. Contraceptive counseling of diabetic women or reproductive age. *Obstet. Gynecol*. 2006; 107(5):1070-1074.

APPENDIX 2. MORBIDITY & MORTALITY STEERING COMMITTEE

Table 5. DOM M&M Steering Committee Member Roster

Role	Members	Division/Unit
MMSC Chair	Anunta Virapongse, MD, MPH	Hospital Medicine
DOM Division Representatives	Jenny Stitt, MD	Allergy & Immunology
	James Carter, MD; Andy Levy, MD, MS; Karen Ream, PA-C	Cardiology
	Helen Lawler, MD; David Saxon, MD; Beth Tupta, NP	Endocrinology, Metabolism & Diabetes
	Jennifer Czwornog, MD; Steve Edmundowicz, MD; Christie Heller, MD	Gastroenterology & Hepatology
	Elena Lebduska, MD	General Internal Medicine
	Bennet Parnes, MD	Geriatric Medicine
	Emily Gottenborg, MD; Tyler Anstett, DO; Li Ngov, MD; Amy Yu, MD	Hospital Medicine
	Brian Montague, DO, MPH, MS	Infectious Disease
	Daniel Bowles, MD; Leigh Gates	Medical Oncology
	Arun Kannappan, MD; Anna Neumeier, MD	Pulmonary Science & Critical Care
	Annie Chen, MD	Renal Diseases & Hypertension
	Elena Weinstein, MD	Rheumatology
UCH Partners	Jen Wiler, MD	UCH Chief Quality Officer
	Alyson Kelleher, RN; Kimberly Marshall, RN; Lisa Casanova-Sidoti, RN; Aimee, Zak, RN; Molly Holmes, RN; Anne-Marie Murray, RN	UCH Clinical Quality Specialists
	Jamie Nordhagen, RN	UCH Patient Services
	Kaycee Shiskowsky	UCH Clinical Planning
	Katharine Perica, PharmD	UCH Pharmacy

DOM M&M Steering Committee - Power BI Mortality Dashboard

The Power BI mortality dashboard was created by the DOM QPS team in 2019. Unlike the Vizient dashboard, which categorizes mortalities only by primary team, the Power BI dashboard is able to capture the full spectrum of involvement by primary and consulting teams by subcategorizing the data using note authorship by service line. Using this dashboard, we reviewed the Power BI data with each Division to assess the frequency of inpatient mortalities per division by month (see figure 7) and assessed the feasibility of reviewing 100% of these cases. Divisions that had primary services, such as Cardiology, Pulmonary & Critical Care and the Hospital Medicine service, had the majority of

mortalities, while consult driven services had lower monthly averages and less utility for improving their practice, but focused more on analyzing morbidities. For AY20-21, we plan to continue to refine this dashboard to meet the needs of the Divisions by including trigger tools and improving the analytics for ease of analysis by Divisions.

Figure 7. Power BI Mortality Data Summary Run Chart

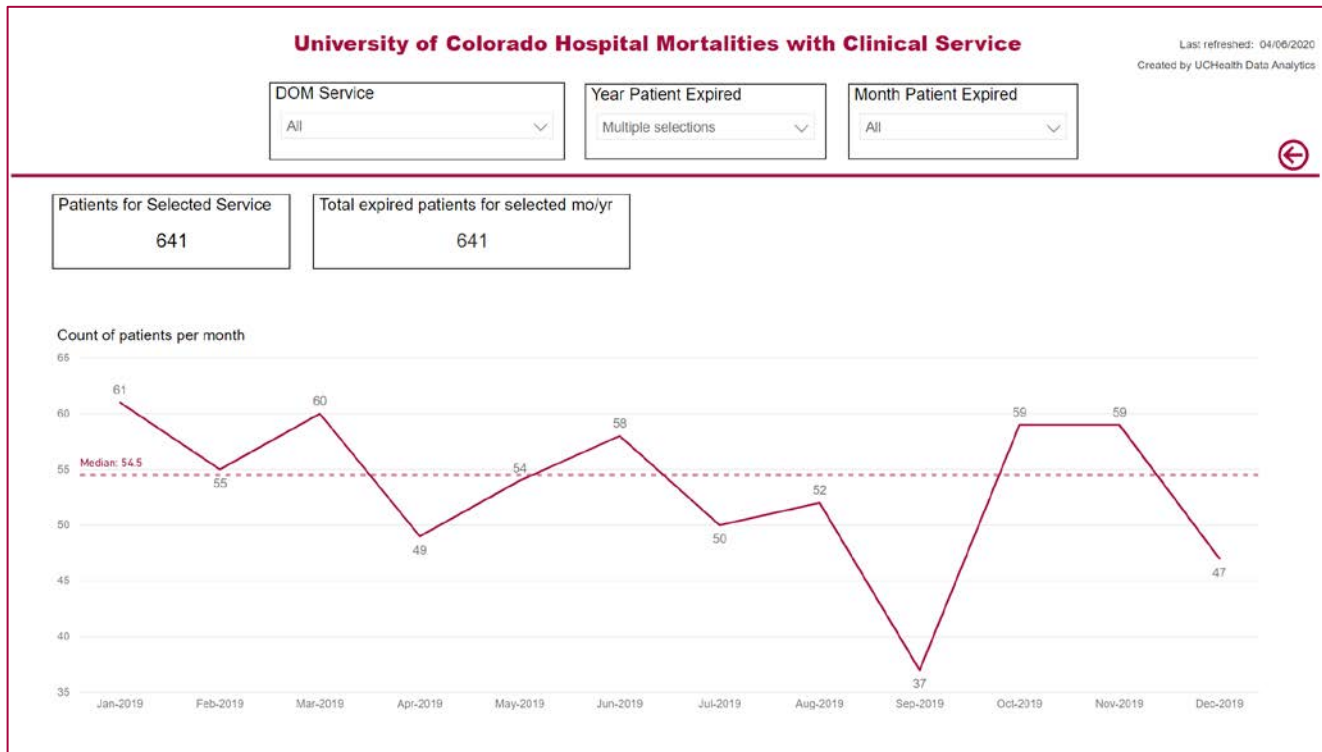


Table 6. Mortality Frequency (Average per Month) by DOM Division AY19-20

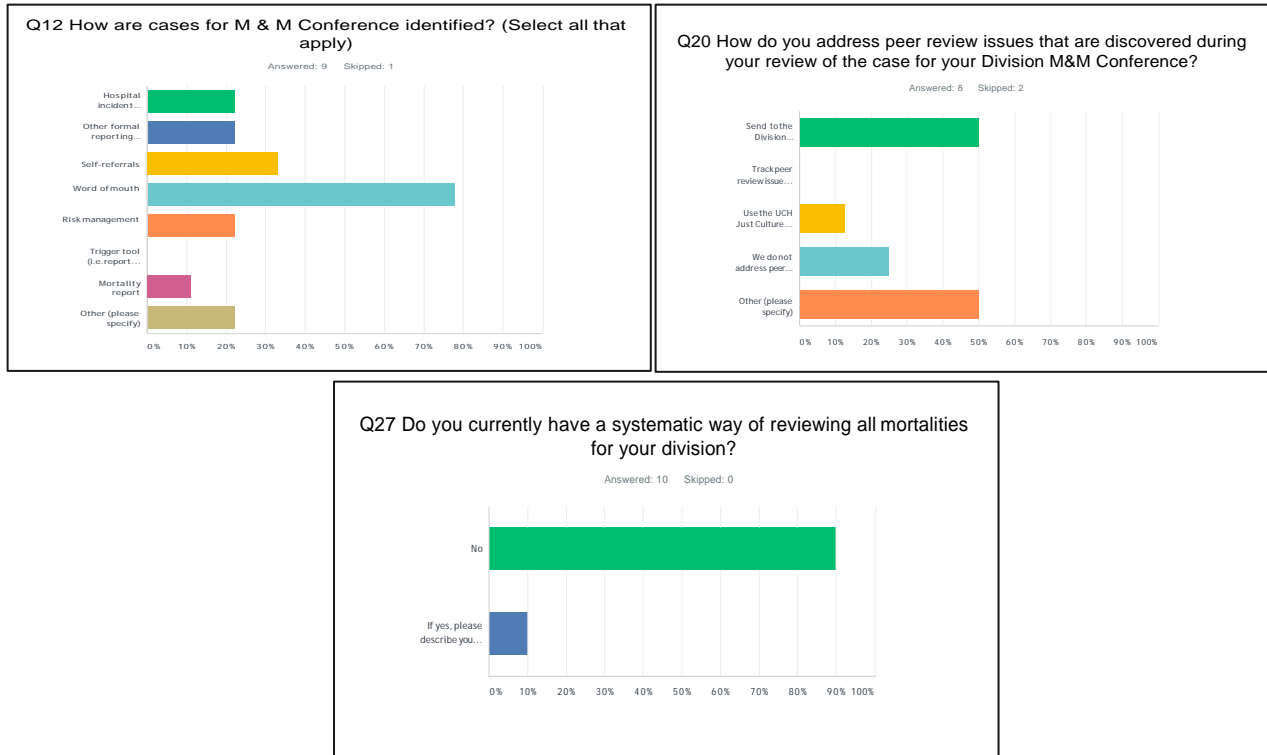
DOM Division	Avg. Mortalities (per month)
Allergy & Immunology	1
Cardiology	14
Endocrinology, Metabolism & Diabetes	1 (Endo) & 4 (GMT)
Gastroenterology & Hepatology	6
General Internal Medicine	2
Geriatric Medicine	3 (ACE)
Hospital Medicine	20
Hematology/BMT	2 (Heme) & 3 (BMT)
Infectious Disease	13
Medical Oncology	2 (Onc) & 4 (Med Onc)
Pulmonary Science & Critical Care	33
Renal Diseases & Hypertension	23 (Renal) & 4 (Hepatology)
Rheumatology	2

DOM M&M Steering Committee - Division Inventory

In 2019, the MMSC conducted a survey to understand how each DOM Division manages their M&M Conferences. The *DOM Division M&M Conference Inventory* was sent to all 13 clinical Divisions with responses from 10 representatives. The survey assessed the frequency of M&M Conferences,

identification of cases, case review processes and the process for addressing issues identified during these Conferences. The survey also captured data on peer review processes and the Divisions' processes to review all documented mortalities. Below are the survey results of selected questions.

Figure 8. DOM Division M&M Conference Inventory (2019)



Survey findings showed a variety of trends that informed future directions for the MMSC in the upcoming academic year:

- Majority of Divisions hold regular M&M Conferences, subscribing to the DOM M&M model for case reviews implemented in 2018.
- Conferences are typically held on a quarterly basis with fellows leading the case presentations and analyses. This is a great learning opportunity for the fellows and encourages peer engagement from trainees during case discussions.
- Cases presented are typically identified through colleagues, self-referrals or hospital incident reports (e.g., RL Solutions) and center on a system-based error leading to an adverse event.
- Many cases examined morbidities and/or adverse events that did not result in death.
- The majority of Divisions do not have a formal tracking system of cases and no clear pathway for reporting results of case analyses.
- If a peer review issue was identified during the M&M Conference, the majority of Divisions (e.g., 7/10) do not have a formal peer review pathway and typically refer reviews to their Division leadership.
- Most Divisions (e.g., 9/10) do not have a systematic way of reviewing all mortalities.

These findings were helpful in understanding how each DOM Division manages their M&M Conferences and case reviews, and highlighted the need to gather more information from each Division.

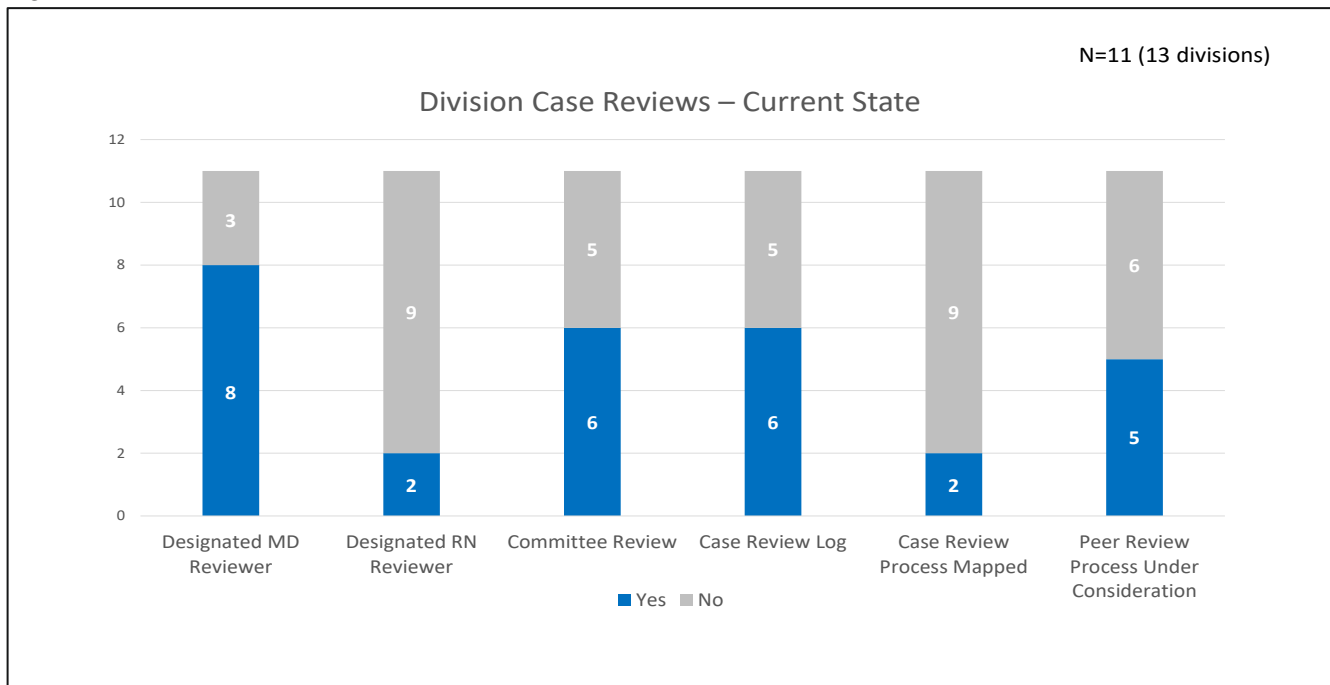
DOM M&M Steering Committee Division One-on-One Meetings

Next, we sought to explore findings of the 2019 survey in more detail by meeting with each Division individually. In 2020, from January to May, the DOM QPS team conducted one-on-one meetings with 11 of the 13 DOM clinical Divisions to discuss standardization of reviews, ideal processes, barriers to reviews and meeting data needs. Assessments of each Divisions' M&M Conference processes revealed several trends.

DOM Division One-on-One Meetings: Current State

- Most Divisions have a designated MD reviewer (primarily the Division representative for the MMSC) or committee review of cases prior to M&M Conferences.
- The majority of Divisions do not have a routine RN reviewer of cases, though most expressed they would like to identify a nurse within their Division to fulfill this role.
- Most Divisions do not have a formal case review process and case logs are done manually and intermittently.
- When system-issues are identified, there is no clear pathway for escalating these to leadership and for ambulatory services, no reporting mechanism for errors or safety events (e.g., RL Solutions).
- Many of the Divisions (e.g., 5/11) now have a peer review process under review, which was an improvement compared to the 2019 survey data showing most Divisions referred cases for peer review to their Division leadership (e.g., 7/10) or had no pathway.

Figure 9. Division Case Reviews - Current State



DOM Division One-on-One Meetings: Future State

The MMSC has chosen a two-phase approach to address the high-priority action items identified in the Division one-on-one meetings. In phase I, the MMSC has initiated a pilot to improve outpatient death notifications in Epic. This pilot will be tested at UCH Internal Medicine at Lowry clinic, led by Dr.

Elena Lebduška. The DOM QPS team is working to incorporate HD Compass data (e.g., CDPHE state death registry data from outside institutions) into Epic Caboodle Data Warehouse. The goal is to have a fully automated integration into Epic Chronicles to send a message to providers' Epic in-baskets when a patient has died. The DOM QPS team is currently assessing feasibility of this pilot with HD Compass and the Epic Analytics Team.

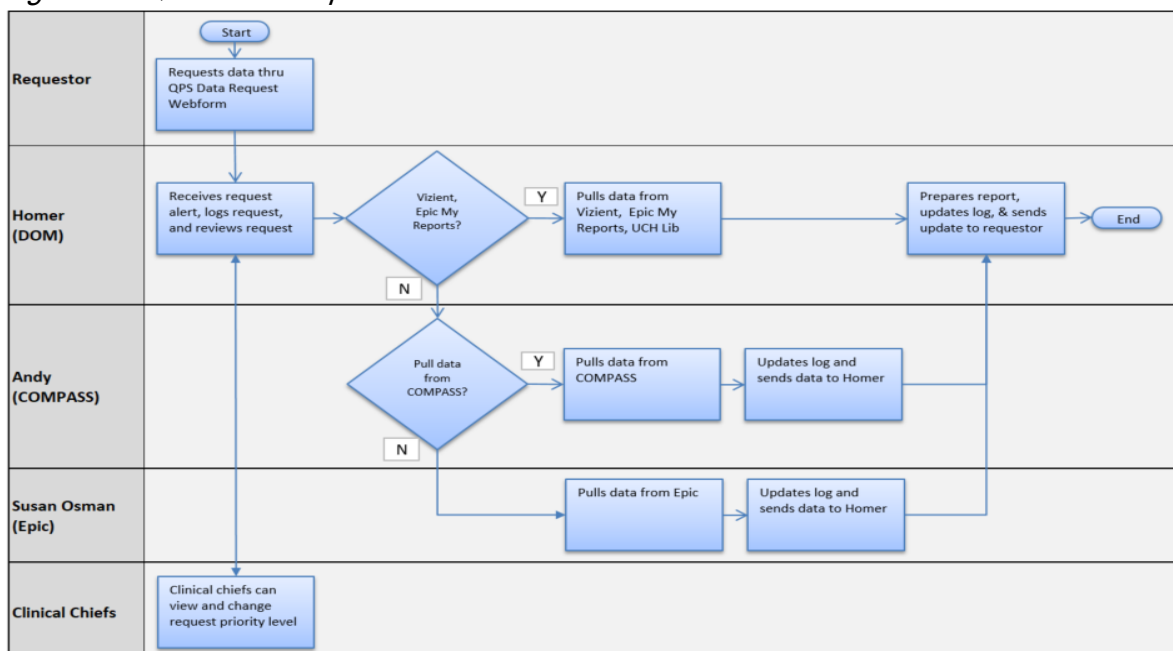
Additionally, in phase I, the MMSC will make several changes to the Power BI dashboard incorporating new data filters to assist Divisions in identifying and reviewing mortality cases. Phase I will also include efforts to address the need for error reporting in the ambulatory setting. RL Solutions, currently used for error reporting in the inpatient setting, is available for ambulatory, but is challenging to access. The MMSC will improve visibility of the ambulatory function in RL Solutions. This will require plans to operationalize use of the system, create a review process and a pathway for concerns requiring escalation to leadership.

The phase II high-priority action items will be a focus for the next academic year and will be implemented in partnership with the UCH leadership and UCH Clinical Quality team. We are happy to include the UCH Chief Quality Officer, Dr. Jen Wiler, as a new partner of the MMSC and look forward to collaborating on these priorities. We will partner with UCH to address the action items already identified by the DOM Divisions. Secondly, we will partner with the UCH leadership and UCH Clinical Quality team to align data sources for the mortality dashboards. Lastly, we will work with the UCH leadership and UCH Clinic Quality team to develop a prospective mortality review process for use across the DOM Divisions and other clinical Departments.

APPENDIX 3. QPS DATA PROJECTS

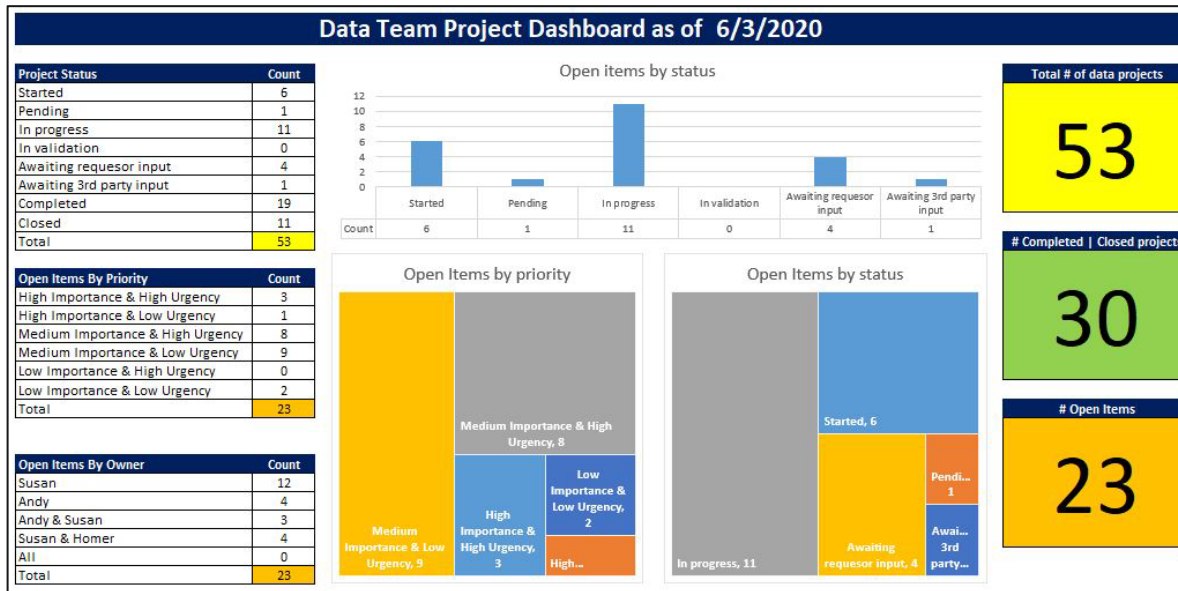
The DOM QPS team has developed a user-friendly, online portal by which data requests are submitted. Once received, the team triages requests and determines the best source for data.

Figure 10. QPS Data Request Workflow



The DOM QPS Team Project Dashboard was developed in 2020 to track the status and priority of project requests. This provides a snapshot of the team's workload, priorities and timelines for all projects. Each data request is given a priority score and assigned to a member of the team based on project needs. All projects are closely monitored and priorities and status are updated as needed on a weekly basis. The dashboard is a valuable project management tool and helps the DOM QPS team communicate more effectively on goals and priorities.

Figure 11. QPS Data Monitoring Dashboard



For AY19-20, the DOM QPS team worked on a variety of data projects for the DOM Divisions and UCH leadership. Many of these projects have utilized the Power BI platform to create data dashboards for tracking quality outcomes, financial data and patient volumes. In addition, the DOM QPS team contributed reports to the UCH Health Analytics Report Library, which is a collection of data reports used throughout the system to track quality metrics. The DOM QPS team provided data to project teams funded by the CEPS Small Grant Program and the GME Bonus Program and also provided support for Shark Tank finalists and the LInQS Fellowship projects. The DOM QPS team continues to develop our data support capabilities and expand our contributions to those teams addressing the quality metrics.

Table 7. QPS Data Projects (AY2019-2020)

Outpatient Antimicrobial Stewardship in Seniors Clinic	
DOM Division:	Infectious Disease (CEPS Small Grant Award)
Faculty Lead/Team:	Dr. Lakshmi Chauhan; Dr. Misha Huang
Purpose:	To assess inappropriate antibiotic use in the outpatient setting and monitoring antimicrobial use after launching stewardship initiatives. The pilot project will be performed at the Seniors clinic at UCH with plans to expand system wide to other clinics.
Outcomes:	Report promoted to production environment of the UCH Health Analytics Report Library. Developed SSRS report tool for monitoring outpatient antibiotic use. Team can track trends in patient and provider metrics.
Resident Admission Numbers in 24 Hours	
DOM Division:	Internal Medicine
Faculty Lead/Team:	Dr. Geoffrey Connors

Purpose:	To determine how many patients each resident is admitting in a 24-hour period on each service that is covered by our IM residents.
Outcomes:	The residency program was able to establish a manual data tracking system to monitor daily admissions. This report is used to allocate resources and staffing for peak admission times.
Epic Billing Reports in Infectious Disease	
DOM Division:	Infectious Disease
Faculty Lead/Team:	Dr. Steven Johnson
Purpose:	This report will be used to prospectively track billing, visit volume, and productivity by ID service and by the individual provider. This will allow us to provide individual feedback on performance and enhance billing and revenue.
Outcomes:	Using ID billing provider notes, a Power BI dashboard was created to track data and is refreshed daily. It provides monthly, weekly, and daily trending of inpatient consults and progress notes to track and plan for resource allocation.
AHA Cholesterol Management Pilot	
DOM Division:	Internal Medicine
Faculty Lead/Team:	Dr. Carmen Lewis
Purpose:	The purpose of this project is twofold, 1) to improve the approach to cardiovascular health in IM practices using resources from AHA, and 2) to serve as a pilot site for AHA cholesterol resource implementation and evaluation. UCH will build on the target BP success in the two IM practices where hypertension control in both practices achieved over the 70% target, improving control by 15% points in both practices.
Outcomes:	Provided the data files necessary for further statistical analysis of provider use of the ASCVD Risk Calculator in primary care clinic notes at Anschutz and Lowry Internal Medicine clinics.
Troponin Analysis	
DOM Division:	Cardiology
Faculty Lead/Team:	Dr. Andrew Levy
Purpose:	To assess the predictive value of using troponin for different cardiology outcomes. This is a continuation of the original troponin analysis, which resulted in a publication.
Outcomes:	Original analysis was published, and has another one submitted and under review. Additional analysis is being done in preparation for submission to conferences with Residents.
Inpatient Mortality Data	
DOM Division:	Hospital Medicine
Faculty Lead/Team:	Dr. Anunta Virapongse
Purpose:	Mortality data has been requested to track patients who expired within 48 hours of Inpatient admission to UCH. Patient ADT movement will be tracked for expired patients, to include changes in level of care and to include the clinical services involved in patient care. Data will be shared with appropriate Divisions as well as MMSC for reviewing mortalities.
Outcomes:	Report is now in Power BI. This report will be used to assess and review mortalities per Division.
Outpatient Mortality Data	
DOM Division:	Internal Medicine
Faculty Lead/Team:	Dr. Elena Lebduska; Dr. Carmen Lewis
Purpose:	To study primary care patients from Lowry and Anschutz practice that get admitted to the ICU or die shortly after being seen in one of their continuity clinics. The report will be used to generate cases for review in an outpatient M&M fashion for P/QI efforts.

Outcomes:	Power BI dashboard will be used to track mortalities from UCH and CDPHE data. These data support the pilot effort at Lowry IP/OP to notify providers in Epic when their patients have died.
Opioid Use Disorder and Prescription of Medically-Assisted Treatment	
DOM Division:	Internal Medicine Residency Program (GME Bonus Project)
Faculty Lead/Team:	Dr. Tyler Anstett; Dr. Sam Porter
Purpose:	Aim to increase the percentage of IM residents in all IM residency tracks trained and certified in medically assisted treatment (MAT) for opioid use disorder from 15% to 60% by the end of AY19-20. Aim to increase the percentage of patients at UCH and Denver Health who carry a diagnosis of opioid use disorder (OUD) by the end of the year, pending baseline data, with an aim for each resident to diagnose roughly one new patient with opioid use disorder over the course of the year.
Outcomes:	The residents were able to get >75% of their residents certified to be MAT providers. An amazing accomplishment considering less than 5% of physicians nationally are certified to provide this life-saving therapy.
Maximum Allowable Contrast	
DOM Division:	Cardiology
Faculty Lead/Team:	Dr. Andrew Levy; Dr. Charley Tharp; Dr. Justin Morrison; Dr. Larry Allen
Purpose:	To regularly quantify the percentage of patients undergoing coronary angiography who have maximum allowable contrast volume documented in their pre-procedure note and correlate this to rates of contrast induced nephropathy.
Outcomes:	Report has been successfully created and now available in UCHealth Analytics Report Library.
DOM Inpatient Admissions & Transfers	
DOM Division:	All DOM Divisions
Faculty Lead/Team:	Dr. Richard Albert
Purpose:	Dr. Albert has requested a report showing the volumes of patients admitted to the DOM Inpatient Services. He would like columns for admissions, transfers in/patient updates displayed daily. He would also like to look at trending over time.
Outcomes:	Power BI presented to Clinical Directors.
DOM Outpatient Consult Volumes Report	
DOM Division:	All DOM Divisions
Faculty Lead/Team:	Dr. Richard Albert
Purpose:	Provide power pivot report for each selected service line to include Epic notes used for billing. Report to show summary volume by date/month/note type. Additional tabs for breakdowns by provider, details, and descriptive tab explaining the report components.
Outcomes:	Working to create Power BI solutions for each of the consult Divisions. ID is complete and updating daily. Rheumatology is nearly complete, under final validation.
Length of Stay Analysis	
DOM Division:	All DOM Divisions
Faculty Lead/Team:	Amanda Anthony, DNP; Isobel Handler
Purpose:	Developing collaboration with UCH to predict length of stay (LOS) based on data from HD Compass. The ultimate goal of the project is to develop a prediction model which will predict LOS based on preliminary factors and interventions to minimize LOS.
Outcomes:	Model was implemented in Epic Reporting Workbench environment. Testing is in progress to deliver model results using real-time Epic data.
5-Year Mortality Prediction Model	
DOM Division:	Internal Medicine

Faculty Lead/Team:	Dr. Carmen Lewis
Purpose:	Improve HVC for patients in IM practices and potentially across UCH. Implement a 5-year predictive mortality model to identify patients unlikely to benefit from medical interventions with lag time to benefit that are greater than 5 years. Determine potential overuse or low value care for cancer screening services (e.g., colon cancer, PSA testing, mammography) for patients with life expectancies of less than 5 years identified with the predictive model.
Outcomes:	Existing model has been built using UCH data and results delivered to Dr. Lewis. Data are also being used to develop a more advanced and accurate machine-learning model.
NavLab Electrocardiogram Interface	
DOM Division:	Allied Health Technicians (AHT)
Faculty Lead/Team:	Sharon Pincus c/o NavLab
Purpose:	An interface of UCH to examine EKG and venipunctures.
Outcomes:	Updated data incorporated into AHT interface. All required formatting and aesthetic modifications have been completed. Awaiting meeting with stakeholders.
Prevention of Pneumocystis Jirovecii Pneumonia in Patients On Steroids at University of Colorado Hospital (PREPOSTERUS)	
DOM Division:	Pulmonary & Critical Care
Faculty Lead/Team:	Dr. James Maloney
Purpose:	Develop risk algorithm. Identify all non-HIV/non-BMT cases at UCH since 2009 and detect those non-HIV/non-BMT patients at PJP risk in real-time over 2019, using process interventions (team contact of steroid-prescribing providers, follow-up) and educational interventions to foster prevention while target the clinical areas generating these PJP cases.
Outcomes:	Data analysis in progress.
PICC Line Data Analysis	
DOM Division:	Hospital Medicine (CEPS-RF Small Grant Award)
Faculty Lead/Team:	Dr. Tyler Anstett
Purpose:	An analysis of the PICC line data from admitted patients used for the resident project for the CEPS-RF Small Grant Award.
Outcomes:	Data analysis in progress.
ICU Liberation with Epic Partnership (A-F Bundle)	
DOM Division:	Pulmonary & Critical Care
Faculty Lead/Team:	Dr. Arun Kannappan (Shark Tank Winner 2018)
Purpose:	By incorporating a multi-disciplinary team and instituting standardized protocols with the use of Epic's robust data collection and processing capabilities, we can improve the care for ICU patients through reduction of ICU days, reduction of ventilator-associated complications and reduction in neurocognitive and psychiatric morbidity.
Outcomes:	Power BI has been created and reviewed with the project leadership. Several additions requested and in-progress. Dr. Kannappan will present it to nursing leadership and promote regular monitoring of these metrics.
Telehealth Visits	
DOM Division:	All DOM Divisions
Faculty Lead/Team:	Dr. David Schwartz; Dr. Duane Pearson; Dr. Richard Albert
Purpose:	The intent of this report is to track telehealth visits as denoted through UCH & via Epic data pull. There are 3 levels of data including telehealth visits, charged/billed telehealth visits, and bills collected. In the dashboard, we will have the capability to look at individual patients rolled up to each provider, rolled up to the clinic and then the Division.

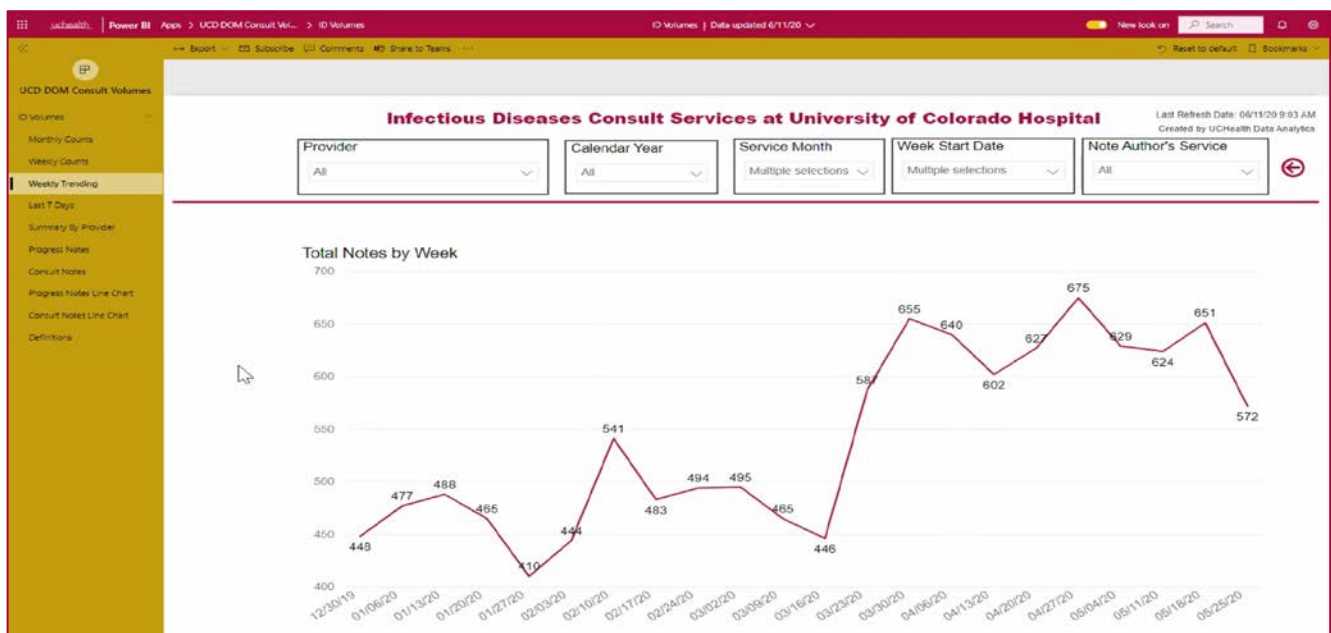
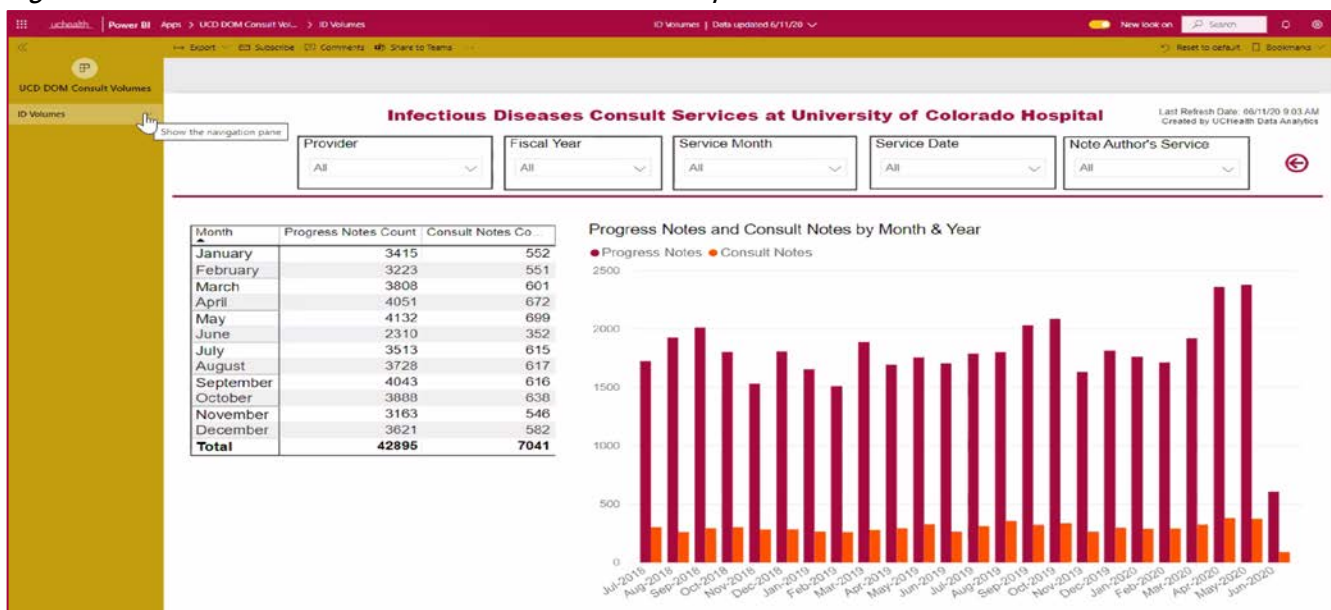
Outcomes:	Power BI created using combination of CU Medicine charges data and Epic visits.
Predictive Model for Opiate Abuse	
DOM Division:	Cardiology
Faculty Lead/Team:	Dr. Michael Ho
Purpose:	A model to predict patients who will abuse opioids based on existing opioid data.
Outcomes:	CDPHE data in HD Compass has been updated with needed connective fields. SQL code and cohort coding is in progress, along with building of model.
72-Hour Fasts	
DOM Division:	Endocrine, Metabolism & Diabetes
Faculty Lead/Team:	Dr. Abtin Farahmand
Purpose:	Improve the number of 72 hour fasts that happen, collecting cost data, patient level info,
Outcomes:	Data have been provided to Dr. Farahmand for analysis.
Automated Adenoma Detection Rate Tracking	
DOM Division:	Gastroenterology (LInQS Fellowship Project)
Faculty Lead/Team:	Dr. Lisa Schilling; Dr. Blake Jones
Purpose:	Create Power BI dashboard for the GI Division to track % screening colonoscopies where an adenoma is detected. It is used as a measure of screening colonoscopy quality. Need a way to extract information from colonoscopy and pathology notes and quantify for report.
Outcomes:	Will allow providers to track and compare adenoma detection rates. This will provide individual faculty with a quality report card including their own ADR. The goal is to have a fully automated system in the future.

APPENDIX 4. MICROSOFT POWER BI REPORTS

Power BI DOM Patient Consult Volumes Report

The Power BI Patient Consult Volumes Report was created in response to a growing need for accurate and timely patient volumes data at UCH. The dashboard was initially created for the ID Division so they may track inpatient consult volumes. This dashboard became an integral tool during the peak of the COVID-19 pandemic and has been expanded to include several other consult Divisions. The report is refreshed daily to look at data through the previous two days and displays weekly, monthly and yearly trends. In addition to showing patient volumes, this report also indicates billing providers by Division. Work is underway to expand use of this tool for all consult Divisions.

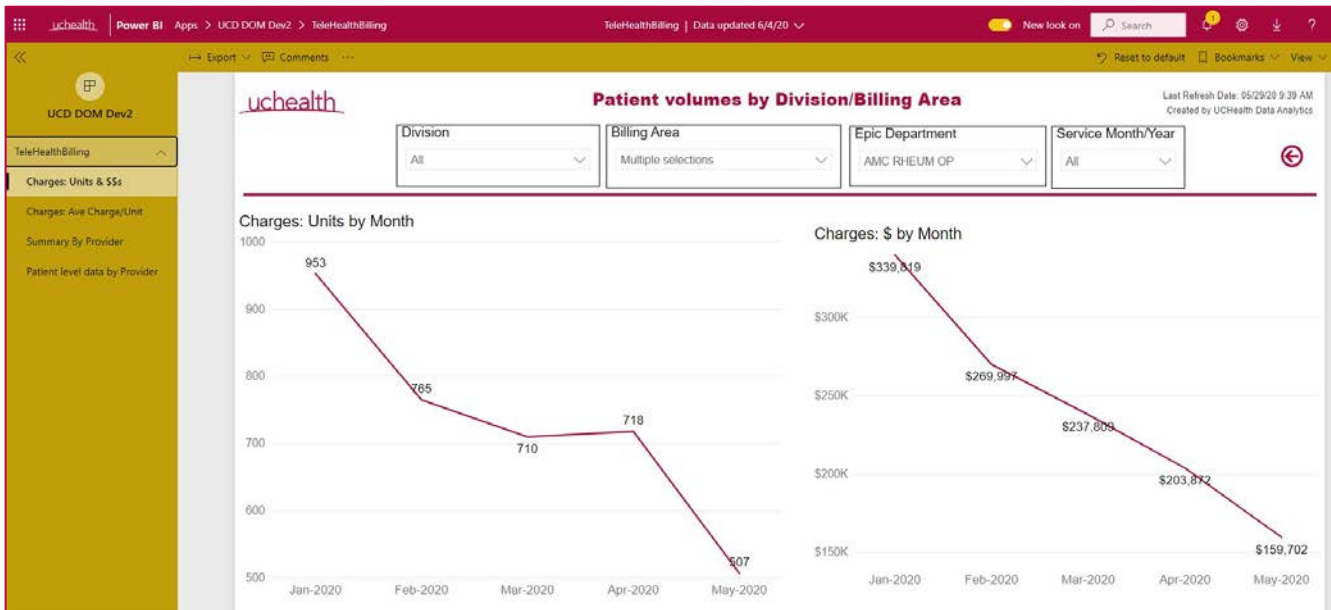
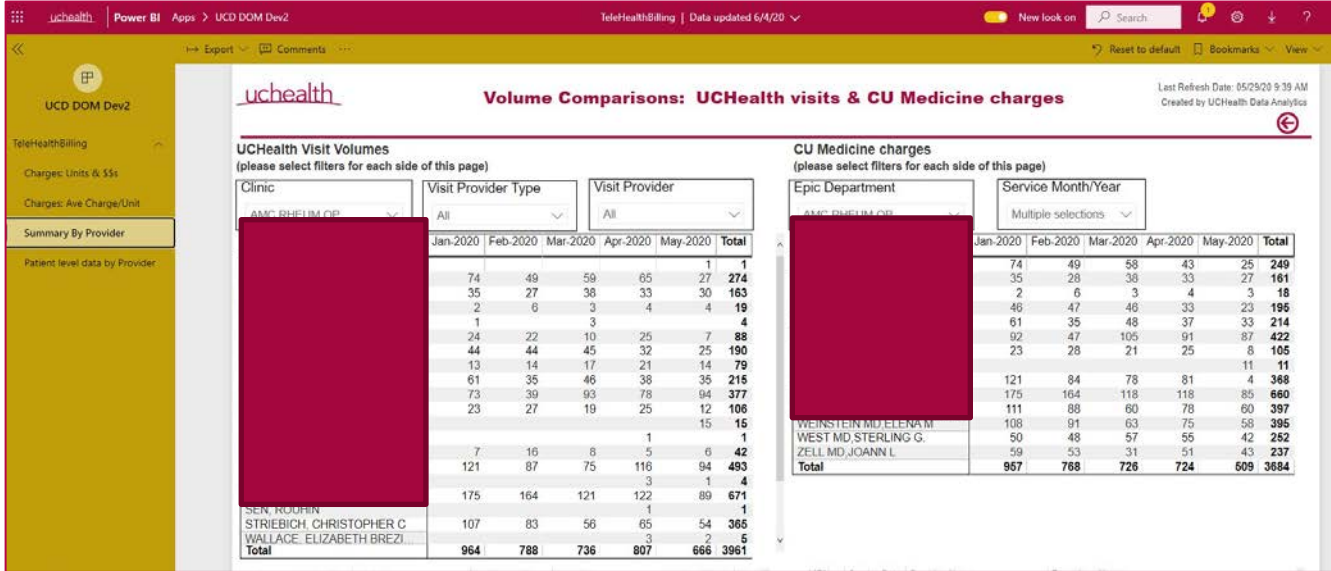
Figure 12. Power BI DOM Patient Consult Volumes Report



Power BI DOM Outpatient Clinic Volumes & Charges Report

The DOM Outpatient Clinic Volumes & Charges Report was designed to track visit activity and billing of outpatient services. The intent is to provide Divisions with the ability to monitor trending to assess the impact of COVID-19. Baseline data collection began in January 2020 and is updated weekly. The tool has various slicers, which allow users to examine data by Division, billing area, Department, service month, and visit type. Charge units and dollars, charges by payor, and provider level data are trended. Patient level detail is available in the tool for closer examination if desired.

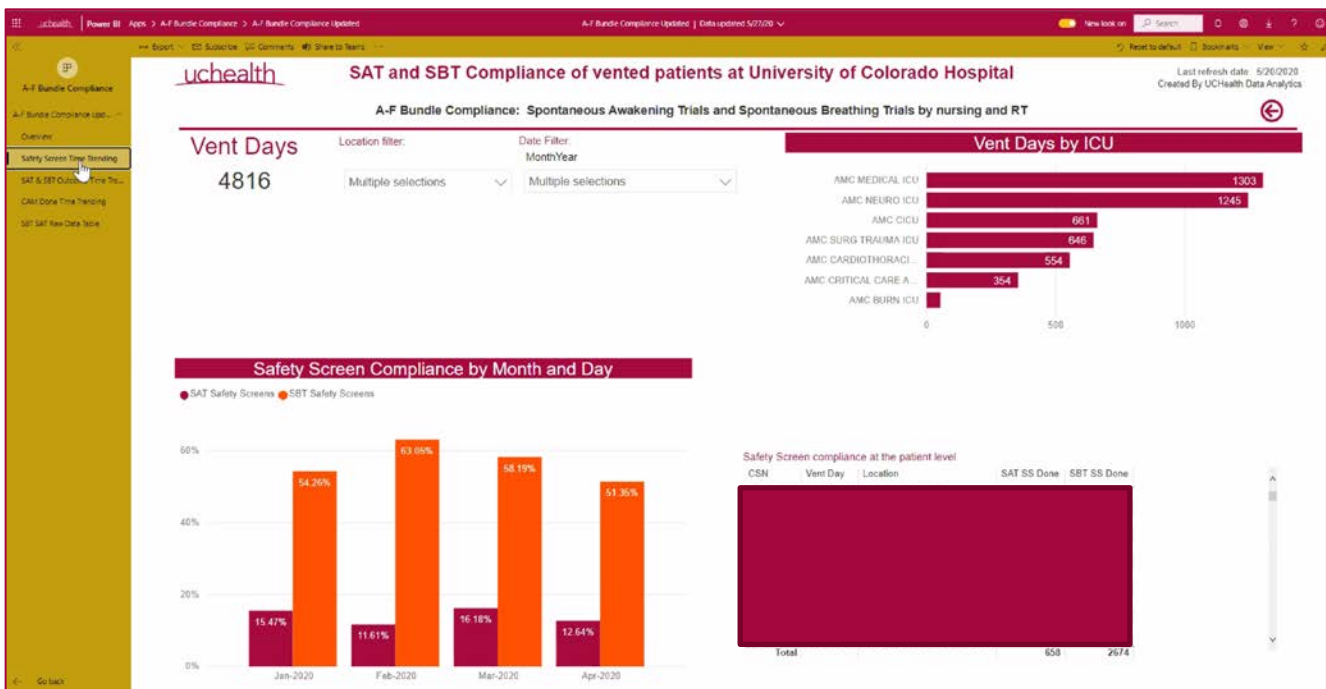
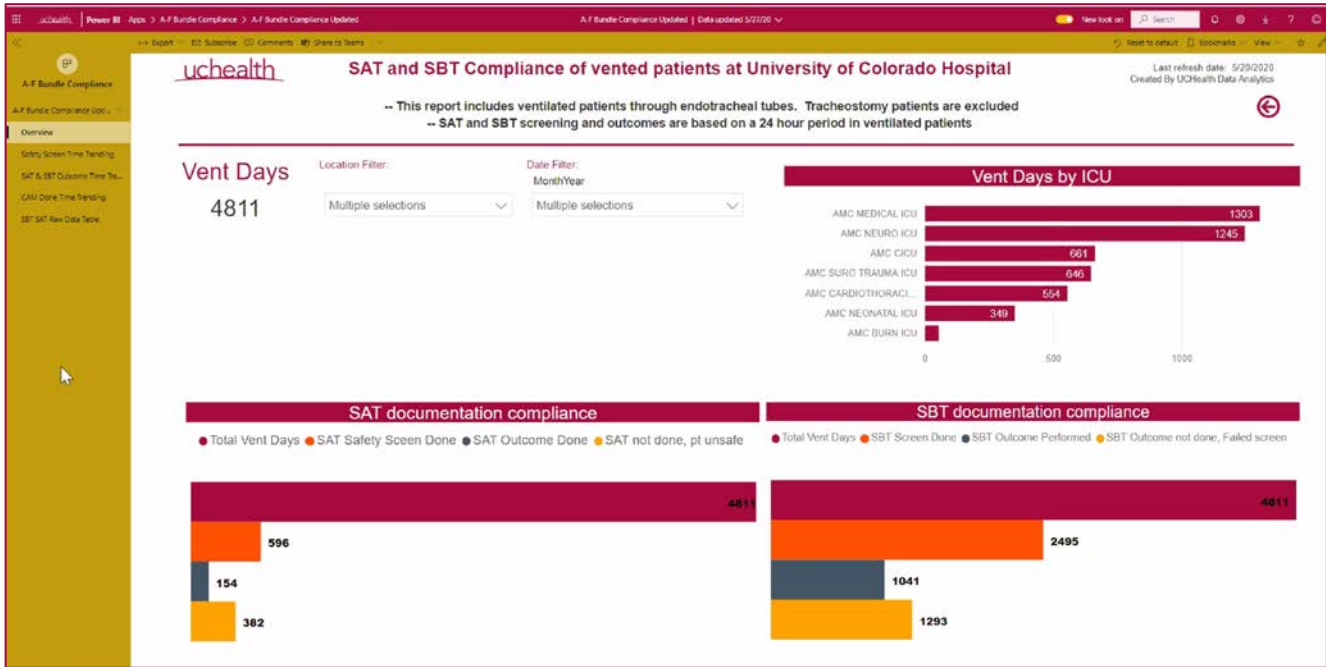
Figure 13. Power BI Outpatient Clinic Volume & Charges Report



Power BI ABCDEF Bundle Compliance Report

The A-F Bundle Compliance Power BI was developed to create a solution that would allow trending of timeliness of spontaneous awakening trials (SAT) and spontaneous breathing trials (SBT) by nursing and respiratory therapy staff. Compliance with safety screens and outcomes of the trials are shown as well as CAM compliance on patients designated at the ICU level of care.

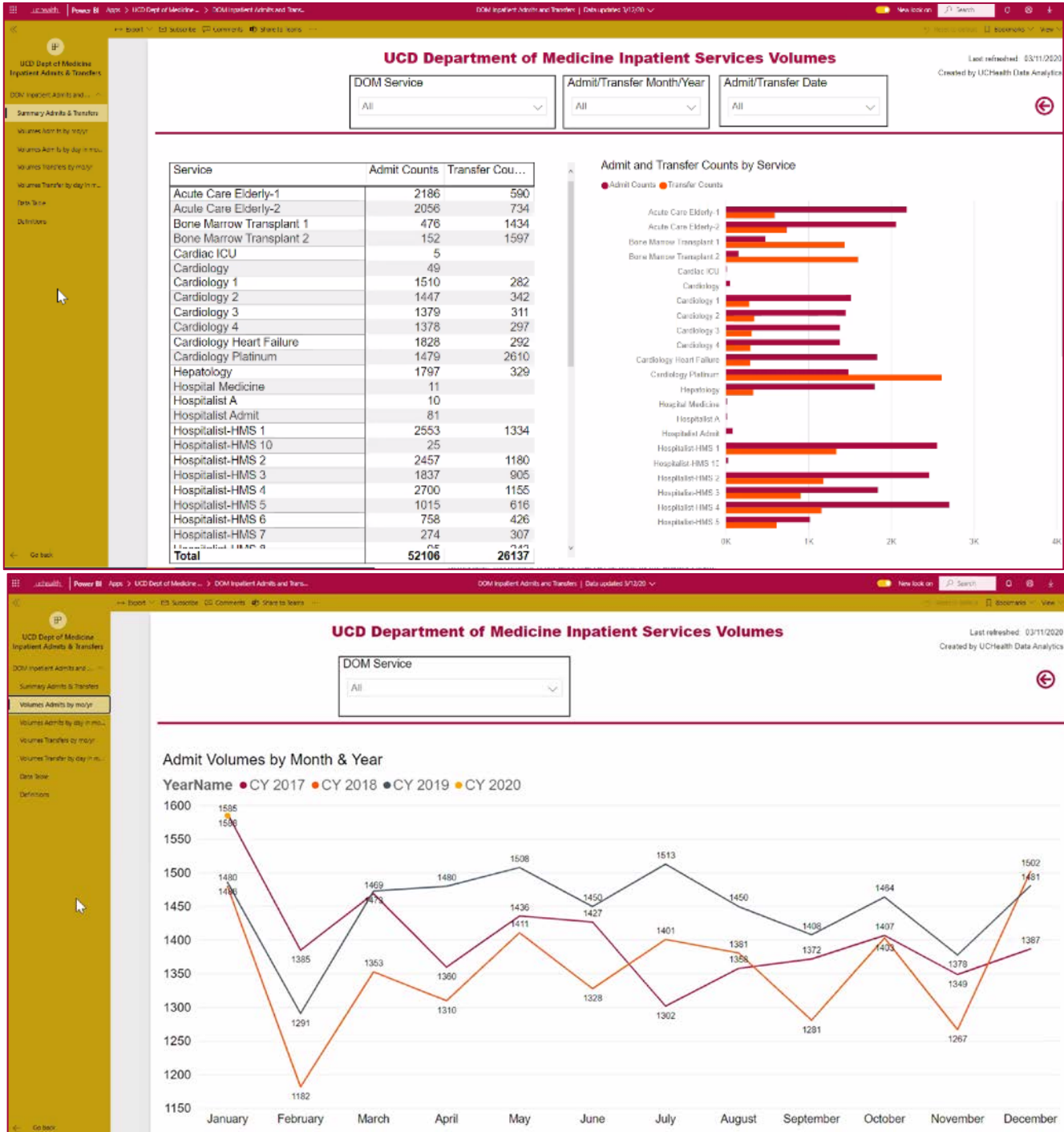
Figure 14. Power BI ABCDEF Bundle Compliance Report



Power BI DOM Inpatient Admissions and Transfers Report

The Inpatient Admissions and Transfers Power BI was built to track volumes of admissions and transfers to and from DOM service lines. Service-line data are not readily available in other existing data solutions. This tool provides important volume data for resource planning. Customized logic was created to properly classify admissions and transfers using provider notes and Epic ADT data. Users can filter by service and month & date.

Figure 15. Power BI DOM Inpatient Admissions & Transfers Report



APPENDIX 5. MORTALITY PREDICTION TOOL

The mortality prediction tool is a machine-learning model that predicts inpatient mortality based on clinical and administrative data from the first 24 hours of admission. This method is fully patient data-driven and impartial. The model was tested using 125,000 inpatient encounters from 2018 and 2019, with 920 deaths (i.e., expirations). Patients who met the inclusion criteria were pulled from the Caboodle Data Warehouse (CDW) within HD Compass. The variables used in this model include general patient demographic information, admission vitals, previous encounters, flowsheet selections (e.g., homeless), recent procedures and rating scores (e.g., BMI, LACE+, Braden). Additionally, patients' diagnosis related groups (DRGs) were captured and filtered into ~200 categories including information on severity of illness and risk of mortality.

To validate the risk model, we randomly chose 15,000 patients who did not die and all patients who died to include in the analysis. Of these cases, 1,000 patients were removed for a validation-testing cohort. We then developed the prediction model on the rest of the patients. The data showed 898 patients did not expire as predicted and 69 patients did expire as predicted (see Figure 16). However, 33 patients were incorrectly predicted (i.e. 18 patients predicted to expire who did not, and 15 patients predicted to not expire and did) (see Figure 16). Next, we conducted chart review of the patients who were incorrectly predicted to determine if data from the chart were missing in the analysis or if there were subsequent clinical events occurring after the initial 24 hours that contributed to the patient's death (e.g., complications). For those patients who were not predicted to expire but did, there were additional clinical factors such as septic shock, transplant denial, post-surgical complications and post-procedure complications occurring during the hospitalization that contributed to their death.

Figure 16. Mortality Prediction Tool Test

Cutoff	actual	prediction		Sensitivity	Specificity
		Not expired	Expired		
0.5	Not expired	898	15	98.0%	82.1%
	Expired	18	69		

Sensitivity - This is the percent of people who were predicted to *not* expire who did *not* expire

Specificity – This is the percent of people who were predicted to expire who did expire

After this initial mortality prediction tool test, we piloted this tool with specific Divisions to assess model performance. The pilot was conducted with Cardiology patient data (see Figure 17). There were approximately 1,800 Cardiology patients tested including those from several units (e.g., cath lab, med unit, post-procedure unit, ICU). Of these patients, five were not expected to expire and did. The cases where the model did not accurately predict mortality will be chart reviewed to determine if data from the chart were missing in the analysis and/or if there were subsequent in-hospital events that contributed to the patient's death. The goals of these chart review were to determine if there were quality issues that need to be addressed. We do not expect that the risk model will be 100% accurate

as it is only using the first 24 hours of clinical and administrative data to predict in-hospital mortality.

Figure 17. Mortality Prediction Tool Test - Cardiology

Cutoff	actual	prediction		Sensitivity	Specificity
		Not expired	Expired		
0.25	Not expired	1791	5	99%	66.6%
	Expired	5	10		

APPENDIX 6. LINQS FELLOWSHIP PROGRAM

LInQS Fellowship Program Core Didactics Series

The LInQS Core Didactics Series is a core didactic component for the clinical informatics and learning health systems tracks given over 20 sessions in Year 1 of the program. The LInQS Core Didactics Series is led by the LInQS faculty team and invited speakers from across the Anschutz Medical Campus and UCH system. In these lectures, fellows gain critical knowledge and skills in a wide variety of topics meant to prepare them for leadership roles in their future positions. Principles and practice of leadership are woven throughout the didactics.

Table 8. LInQS Core Didactics Lecture Series (1-year curriculum)

Track	Lecture Title	Lecturer
Clinical Informatics	CI-1: Overview of Clinical Informatics	Lisa Schilling, MD
Clinical Informatics	CI-2: What is Yottabyte: Technology Acceleration	CT Lin, MD
Clinical Informatics	CI-3: Introduction in EHR Design	Jon Pell, MD & Katy Trinkley, PharmD, PhD, BCACP
Clinical Informatics	CI-4: Clinical Decision Support: Design, Support, Use and Evaluation	Jon Pell, MD
Clinical Informatics	CI-5: Strategies to Support HIT Adoption and Avoid Burnout	Amber Sieja, MD
Clinical Informatics	CI-6: End of Secrecy in Healthcare	CT Lin, MD & Jon Pell, MD
Clinical Informatics	CI-7: Databases and Data Modeling	Lisa Schilling, MD
Clinical Informatics	CI-8: Business of Health IT (Role playing activity)	CT Lin, MD
Clinical Informatics	CI-9: Virtual Health	Ben Scott, MD & Amy Hassel, RN
Clinical Informatics	CI-10: Artificial Intelligence, Data Science & Machine Learning	David Kao, MD
Learning Health Systems	LHS-1: Identifying the Gap: Finding and Evaluating the Evidence	Andy Levy, MD
Learning Health Systems	LHS-2: Case Studies in LHS: Outcomes and Operations	Mike Ho, MD, PhD
Learning Health Systems	LHS-3: QI vs. Research: When Do I Need an IRB?	Cat Sutherland, PhD

Learning Health Systems	LHS-4: Big Data: Current Challenges in using Electronic Health Record (EHR) and Data Registries	Sridharan Raghavan, MD
Learning Health Systems	LHS-5: Thick Data: Basics of Qualitative Research and Why Mixed Methods are Important	Juliana Barnard, MA
Learning Health Systems	LHS-6: Value in Healthcare: Cost Effectiveness vs. Cost-benefit vs. Return on Investment	Brad McQueen, PharmD
Learning Health Systems	LHS-7: Pragmatic Clinical Trials	Mike Ho, MD, PhD
Learning Health Systems	LHS-8: Systems Theory and Research Design in Complex Systems	Heather Gilmartin, PhD
Learning Health Systems	LHS-9: Implementation and Improvement Science 1: Dissemination & Implementation	Amy Tyler, MD, MSCS
Learning Health Systems	LHS-10: Implementation and Improvement Science 2: Workflow & Process Redesign)	Mustafa Ozkaynak, PhD, MS

IHQSE Certificate Training Program

The Certificate Training Program (CTP) is a core didactic for the quality and safety track of the LInQS Fellowship Program given over 22 sessions in Year 2 of the program. CTP is IHQSE's most rigorous professional development program for clinical unit and program leaders. CTP focuses intensively on the development and enhancement of highly functioning Clinical Leadership Teams capable of transforming the quality, safety, operational efficiency, and experience of care for patients. The program places special emphasis:

- Developing and supporting inter-disciplinary teams skilled at leading change
- Enabling those teams to integrate analysis of quality, safety, operational efficiency, patient experience, staff/provider engagement, and cost data into strategic decision-making
- Establishing the necessary culture and infrastructure to facilitate continuous performance improvement

The longitudinal curriculum builds on itself and requires thoughtful development of a leadership structure, performance improvement strategy, and data-driven improvement work. IHQSE faculty include Jeffrey Glasheen, MD (IHQSE Director), Read Pierce, MD (CTP Director), Patrick Kneeland, MD, Sarah Caffrey, MBA, Daniel Hyman, MD, MMM, Jennifer Wiler, MD, Ethan Cumbler, MD, Jenny Reese, MD and several other Q/PI and patient safety experts throughout the University and UCH system. Below is a listing of CTP lecture topics over the course of the 1-year curriculum.

Table 9. IHQSE Certificate Training Program Didactics (1-year curriculum)

Track	Lecture Topics	Lecturer
Quality Improvement & Patient Safety	CTP-1: Creating our learning environment; Beginning with the end in mind; Intro to CTP & Transformation; Enhancing the learning community; Setting the stage for leadership practice & development	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-2: Transformation: Leading change at the project level	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-3: Strengthening your team's foundation; Leading change at the organizational level	IHQSE Faculty

Quality Improvement & Patient Safety	CTP-4: Defining "team"; Personal transformation: Leadership, teamwork & awareness of differences	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-5: QI & project management: Initiate --> Plan phase	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-6: QI or research?; Effective meeting management	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-7: Business case for quality; Enhancing culture through team behaviors	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-8: Complex adaptive systems & systems thinking; Communication as catalyst	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-9: Clinical revenue; Data storytelling and positive deviance	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-10: Leadership journey; Presenting to influence; Mid-year presentation preparation/coaching	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-11: Progress Report Out	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-12: Revisiting the change roadmap for projects; Using influence to navigate conflict and skepticism	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-13: QI methods integration	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-14: Intro to patient safety; Learning from human and system failures	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-15: Leadership and high reliability; Keeping humans at the center of resilience and wellbeing	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-16: Human experience of complex delivery systems and harm; Keeping humans at the center of user-centered design	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-17: Leading across generations; Project consultation workshop	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-18: Sustaining and embedding change; Advanced QI data analysis; Measure and reporting safety and effectiveness	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-19: Spreading good ideas in complex systems; Disseminating improvement work	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-20: Progress reports part 1	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-21: Progress reports part 2	IHQSE Faculty
Quality Improvement & Patient Safety	CTP-22: Closing time; Leadership Journey; Building momentum: Strategy action session	IHQSE Faculty

Quality Safety Academy Series

The Quality Safety Academy (QSA) is a core didactic for the LInQS Fellowship Program given over three sessions. The QSA program content is designed to support progressive acquisition of competency. The LInQS fellows will attend the QSA series in the first year of the program to build a foundation of quality and safety knowledge. This foundation will help fellows as they develop and embark on their individual P/QI projects. The three-session series is described below.

Session 1: Foundations of Patient Safety

In the first 4-hour workshop, participants learn to conduct an adverse event analysis and to facilitate a systems-based M&M Conference.

Session 2: Turning Adverse Events into Quality Improvement

In the second seminar, trainees learn and apply tools of P/QI methodology, including approaches to data collection, to guide P/QI practice.

Session 3: Quality in Academics

During the third and final session, trainees learn and apply principles of change management to promote sustainability of their P/QI projects. They also learn the role of the Institutional Review Board (IRB) in P/QI work and how to approach manuscript publication.

Table 10. Cohort 1 LInQS Fellows QI Projects

Blake Jones, MD [Gastroenterology]	
LInQS Program Track:	Clinical Informatics
Project Title:	Assuring Colonoscopy Quality: Automated Adenoma Detection Rate Tracking
Problem Statement & Aims:	<p>The process of tracking adenoma detection rate (ADR) is difficult, as it requires coupling of data separated in time and place within the EHR. The data needed to track ADR exists within the EHR but is not easily extractable with current capabilities (non-discreet format).</p> <ul style="list-style-type: none"> • Aim #1: To develop a tool that accurately facilitates data extraction from endoscopic and pathology text within the EHR to automate ADR tracking. • Aim #2: To provide individual faculty with a quality report card including their own ADR.
Progress To Date:	Currently validating the natural language processing tool for extracting data from compiled colonoscopy and pathology text. This involves finding individual examples of various findings, checking the tools ability to extract the data points of interest and then comparing the tools ability to spit out data tables across a range of colonoscopies comparing this to a database of manually extracted data in Redcap.
Future Plans:	Shifting to prospective data mining and building the infrastructure necessary to make this a sustainable tool for the GI Division.
Shoshana Tell, MD [Pediatric Endocrinology]	
LInQS Program Track:	Clinical Informatics
Project Title:	Improving Dyslipidemia Management in Type 1 Diabetes
Problem Statement & Aims:	<p>Cardiovascular Disease (CVD) is major cause of morbidity and mortality in T1D, and the BDC clinic has inconsistent approach to lipid monitoring and management. In the adult clinic, 34% of patients with LDL>130 are not on a statin and 11% of patients with diagnosis of ASCVD or dyslipidemia are not on a statin. 36% of patients 40 years or older are not on statin therapy.</p> <ul style="list-style-type: none"> • Aim #1: Improve percentage of patients on or offered statin for patients age 10-19 with LDL >130x2, age 20+ LDL>130. • Aim #2: Improve percentages above to 50% within 12 months of implementation.
Progress To Date:	Developed BDC lipid algorithm, performed workflow analysis, collected baseline data, and have built several Epic clinical-decision support tools.
Future Plans:	Working on BPA and plan for Epic go-live July 2020. Will continue to collect additional data and perform statistical analyses.

Jennifer Taylor, MD [Pulmonary Science & Critical Care]	
LInQS Program Track:	Leading Health Systems
Project Title:	Improving Comprehensive COPD Care in Ambulatory Clinics
Problem Statement & Aims:	<p>One of the most common diagnoses seen in any Pulmonary clinic is chronic obstructive pulmonary disease (COPD), accounting for nearly 5.7m outpatient visits per year, according to the CDC. COPD is one of the most common diagnoses managed by the CU Center for Lungs and Breathing and the Denver Health Pulmonary clinic. Despite how common this diagnosis occurs the documentation of COPD severity, key for prescribing appropriate, guideline-based therapy, is highly variable.</p> <ul style="list-style-type: none"> • Aim #1: Have >80% of patients who are referred to Pulmonary clinic for COPD undergo spirometry testing within a year of their clinic visit. • Aim #2: Have at least 65% of patients who meet diagnostic criteria for COPD based on spirometry have their symptoms categorized by either mMRC or CAT. • Aim #3: Have >50% of patients who have a diagnosis of COPD and an FEV1<60% predicted be prescribed long acting bronchodilator therapy.
Progress To Date:	We have currently made data pulls from both the CU Center for Lungs and Breathing and the DH Pulmonary clinic regarding our current rates of spirometry and prescribing of long acting bronchodilators. We will use this as our baseline to compare our iterative progress.
Future Plans:	We will collect data on rates of spirometry for patients referred to Pulmonary clinic for COPD, symptom categorization and rates of prescription of long acting bronchodilators for patients with FEV1 <60% predicted.
Aaron Emmons, MD [Cardiology]	
LInQS Program Track:	Quality Improvement & Patient Safety
Project Title:	Increasing SGLT2i Prescriptions Among Patients Discharging with Diagnosis of HFrEF and DM2
Problem Statement & Aims:	<p>SGLT2i are a novel class of medications developed to treat diabetes, but have benefit in multiple cardiovascular conditions, including Heart Failure. Despite multiple large randomized trials showing benefit in HFrEF, uptake has been low.</p> <ul style="list-style-type: none"> • Aim #1: Identify patients with diagnosis of HFrEF and DM2 at hospital discharge. Encourage providers to add or change therapy to include SGLTi by making change to heart failure discharge order set.
Progress To Date:	Worked to integrate SGLT-2 as an indicated medication for patients with heart failure in the cardiology discharge order set, roll out in July.
Future Plans:	Next steps will be education for the hospitalists and housestaff prior to the new order set roll out in July. Education will continue into the fall.

Figure 18. Blake Jones, MD (LInQS fellow - Cohort 1) Poster for the 2nd Annual UCH Quality & Safety Symposium, March 2020

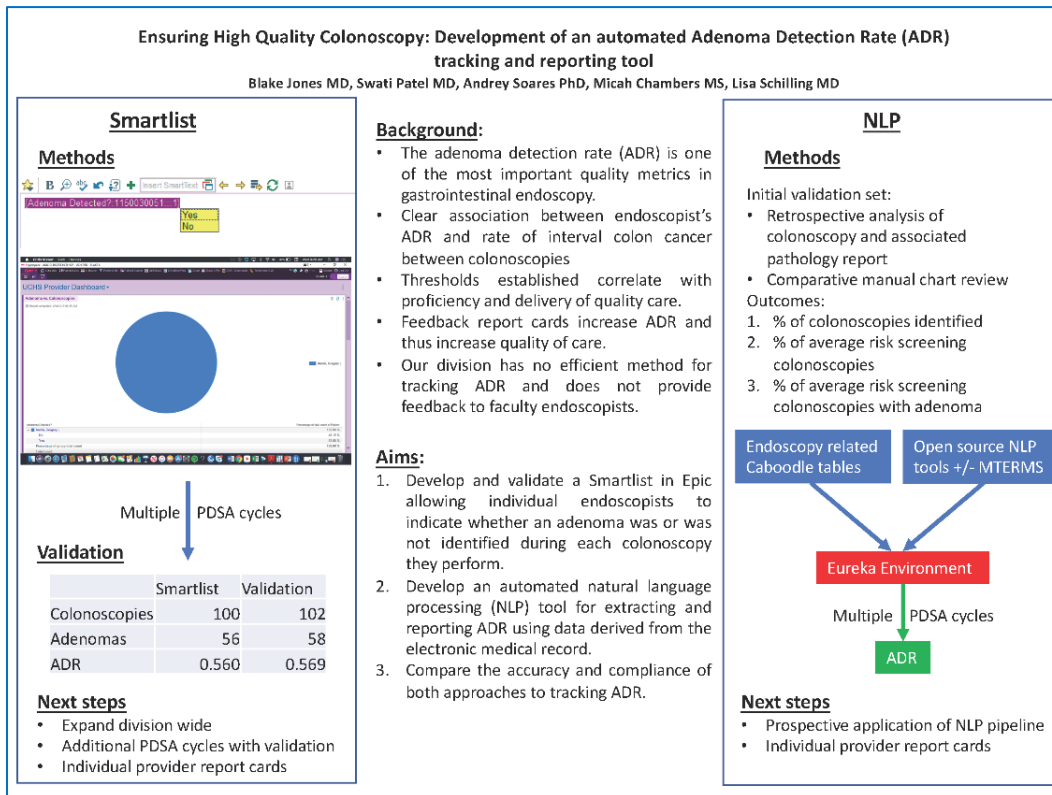
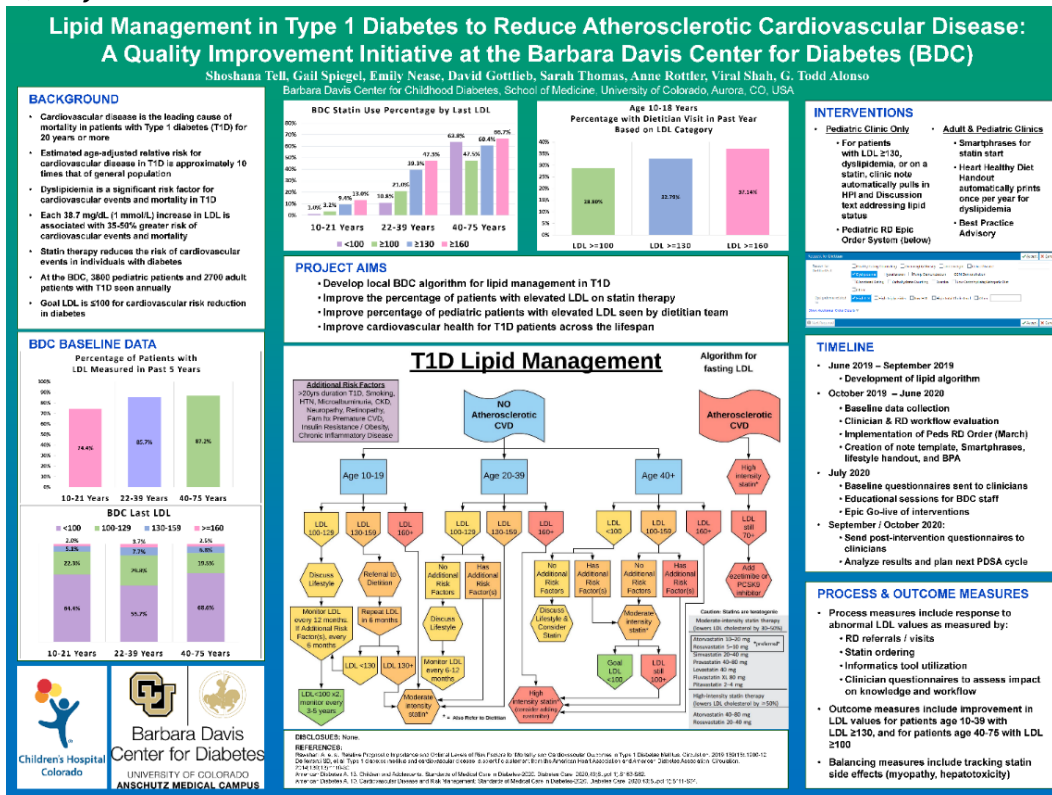


Figure 19. Shoshana Tell, MD (LInQS fellow - Cohort 1) Poster for the CHCO 2020 Spring Research Conference, May 2020



Cohort 1 (AY2019-2021) Lecture Feedback Data

After each didactic session, LInQS fellows complete the *Lecture Feedback Assessment Form*. The data show most fellows strongly agreed (i.e., blue) the learning objectives were clear, the content was relevant to their projects, they understood the concepts well enough to apply them to their projects and they would apply the concepts in their projects. Additionally, the data show fellows strongly agreed the lecture instructors effectively presented the concepts. We did find fellows were seeking more resources for learning outside of the lectures as well as more concrete examples of concepts. In the upcoming academic year, we will focus on preparing lecture instructors to meet these needs.

Figure 20. LInQS Didactic Content & Instructor Feedback

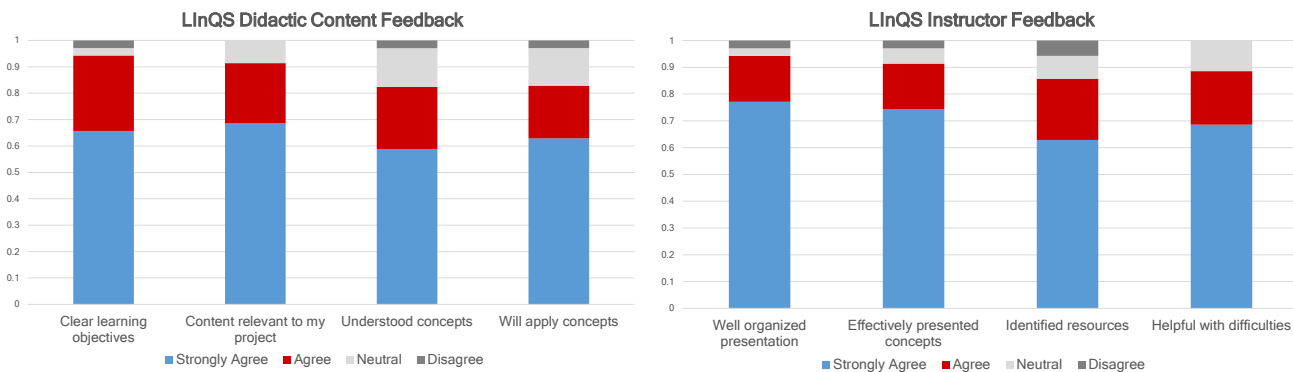


Figure 21. LInQS Block Schedule (AY21-22)

	LInQS Fellowship Year 1																								
	BLOCK 1						BLOCK 2																		
	Jul-2020	Aug-2020	Sep-2020	Oct-2020	Nov-2020	Dec-2020	Jan-2021	Feb-2021	Mar-2021	Apr-2021	May-2021	Jun-2021	No meetings												
LInQS Fellowship Core Meetings 1st & 3rd Wednesdays @ 3-5p	WIP-1	WIP-2	WIP-3	WIP-4	WIP-1	WIP-2	WIP-3	WIP-4	WIP-1	WIP-2	WIP-3	WIP-4	WIP-1	WIP-2	WIP-3	WIP-4	No meetings								
Work-In-Progress (WIP) Updates - 1st hour																									
Didactic Lectures (LHS & CI) - 2nd hour	LHS-1	CI-1	LHS-2	CI-2	LHS-3	CI-3	LHS-4	CI-4	LHS-5	CI-5			LHS-6	CI-6	LHS-7	CI-7	LHS-8	CI-8	LHS-9	CI-9	LHS-10	CI-10			
Quality Safety Academy (QSA) Three sessions @ 1-5p (Fall) or 8-12p (Spring)				QSA-1	QSA-2	QSA-3																			
IHQSE Certificate Training Program (CTP) 2nd & 4th Tuesdays @ 1-5p																									
Track-specific Experiences																									
Total Hours	2	2	2	2	2	2	6	2	6	2	4	0	2	2	2	2	2	2	2	2	2	2	2	0	0

	LInQS Fellowship Year 2																									
	BLOCK 3						BLOCK 4																			
	Jul-2021	Aug-2021	Sep-2021	Oct-2021	Nov-2021	Dec-2021	Jan-2022	Feb-2022	Mar-2022	Apr-2022	May-2022	Jun-2022	No meetings													
LInQS Fellowship Core Meetings 1st & 3rd Wednesdays @ 3-5p	WIP-1	WIP-2	WIP-3	WIP-4	WIP-1	WIP-2	WIP-3	WIP-4	WIP-1	WIP-2	WIP-3	WIP-4	WIP-1	WIP-2	WIP-3	WIP-4	WIP-1	WIP-2	WIP-3	WIP-4	WIP-1	WIP-2	WIP-3	WIP-4	No meetings	
Work-In-Progress (WIP) Updates - 1st hour																										
Didactic Lectures (LHS & CI) - 2nd hour	LHS-1	CI-1	LHS-2	CI-2	LHS-3	CI-3	LHS-4	CI-4	LHS-5	CI-5			LHS-6	CI-6	LHS-7	CI-7	LHS-8	CI-8	LHS-9	CI-9	LHS-10	CI-10				
Quality Safety Academy (QSA) Three sessions @ 1-5p (Fall) or 8-12p (Spring)																										
IHQSE Certificate Training Program (CTP) 2nd & 4th Tuesdays @ 1-5p																										
Track-specific Experiences																										
Total Hours	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	0

References

Tad-Y, D. B., Pierce, R. G., Pell, J. M., Stephan, L., Kneeland, P. P., & Wald, H. L. (2016). Leveraging a Redesigned Morbidity and Mortality Conference That Incorporates the Clinical and Educational Missions of Improving Quality and Patient Safety. *Academic Medicine*, 91(9), 1239-1243.