Visualizing Success in the Cardiac ICU
Texas Children’s Hospital

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Agenda

- Introduction to the Cardiac ICU
  - Texas Children’s Hospital Houston TX
- Our Data Journey
- Tableau in Action
- Making a Difference for Children
- Q&A
Texas Children’s Hospital

Largest and most comprehensive specialty pediatric hospital

>4.3 million patient encounters

- Downtown Houston in the Texas Medical Center, ~ 592 inpatient beds
- Ranked in all 10 pediatric subspecialties in *U.S. News & World Report*
- >11,000 employees
- More than 40 sub-specialties, programs and services
- 2,000 board-certified physicians and pediatric sub-specialists
Texas Children’s Heart Center is one of the nation’s leading providers of pediatric cardiac care

#1 in the nation for pediatric cardiology and heart surgery
23,000 patients, 962 heart surgeries annually

Total of 48 beds the Cardiac ICU (3 floors!)
- Heart surgery for heart defects
- End-stage heart failure & heart transplant

Ranked #1 in the country by U.S. News & World Report.
Heart Defects are the leading cause of birth defect-associated infant death

1 in 120 children are born with a heart defect...40,000 babies born in the U.S.
¼ of them need heart surgery within the first year of life

Our CICU includes dedicated doctors, advanced providers, nurses, and support staff providing intensive care to newborns, infants, children and young adults with birth defects and acquired heart disease.
ICU Complexity

Many, many (many) medications

- Life sustaining
- Nutrition
- Sedation (comfort)
- Safety of Devices
- Pain Control
Charlie:
Diagnosed by prenatal ultrasound with a heart defect that would need open heart surgery after he was born (no mother wants to hear that)
At 2 weeks old, he was flown to Texas Children’s Hospital and following a ~13-hour operation,
Charlie experienced his first day with a healthy heart on Valentine’s Day.

Today:
Charlie is an active 20-month-old little boy with big personality. He is a little heart warrior with a second chance at life.

Dad says, “When it comes to your child, you’re going to do anything and everything you can
to give your son or daughter the best possible chance to live and have a full life…
to me, Texas Children’s is not just a game changer, it’s a life changer.”
“Intensive Care Toxicity vs. Healing”

December 2016

“The U.S. Food and Drug Administration (FDA) is warning that repeated or lengthy use of general anesthetic and sedation drugs during surgeries or procedures in children younger than 3 years or in pregnant women during their third trimester may affect the development of children’s brains.”

Neuropsychological and Behavioral Outcomes after Exposure of Young Children to Procedures Requiring General Anesthesia: The Mayo Anesthesia Safety in Kids (MASK) Study

David O. Warner, M.D.; Michael J. Zaccariello, Ph.D., L.P.; Slavica K. Katusic, M.D.; Darrell R. Schroeder, M.S.; Andrew C. Hanson, B.S.; et al
**Delirium:** A sudden state of severe *confusion* and rapid changes in brain function, sometimes associated with *hallucinations and hyperactivity*, during which the patient is *inaccessible to normal contact*

Prevalence of delirium in PICU to be notably high at 25%
With an ICU stay of $\geq 6$ days and use of mechanical ventilation
prevalence increased to 38% and 53%, respectively

Patients in **CICU** exhibit an even higher prevalence;
near 100% in cardiac ECMO patients and 49% in children after cardiac bypass

Optimal Sedation Evaluation Challenge

- Assess ICU sedation practice
- Make practice changes
- Measure improvement

“Knowledge is applied information”
Visual Analytics in the CICU

“Could we have the ability to look at every Medication Exposure, Dose and Duration?”

- Yearly
- Monthly
- Daily
- Hourly
- By provider, nurse, or practitioner?

AND make it easy to use for excellent decision making?

Drive Better Insight to the Point of Care
Counting every dose of popular sedation meds (>100,000 doses)

Pattern reveals increased frequency of use in dosing per patient over years

“Knowledge is applied information”
Variation by the hour of the day

- Spikes 2-3 standard deviations greater at 4AM, 7AM and 7PM
- Significant difference in day and night dosing totals
  \( (p=0.002 \text{ and } p=0.009) \)
Historical reports

• Led to implementation of massive education strategies
  • Mandatory Learning modules
  • Review Lectures to all providers from Faculty, Trainees, Nurses
• Adoption of objective validated scoring
• Development of Sedation Protocols
• Documentation
Have we made a difference since implementation?

YES!
Year 2017: daily rescue use *per hour* has decreased from Q1(left) to Q4 (right)
Year 2018: Average daily rescue has decreased from Q1(left) to Q4 (right)

Making a DIFFERENCE for our patients!
Year 2019: Average dose per patient rescue significantly decreased.
HISTORICAL DATA

- Number of bolus dosing
- Total dose exposure
- ICU Length of Stay
Nursing Dashboard

Allows direct visualization of weekly dosing as compared to annual dosing for that bedside nurse

- Choose week
- Choose Nurse
- Compare to annual

Allows directed feedback and targeted education

Wollam, A. Dashboarding Sedation Medications Allows for Targeted Improvement Strategies
• **Old way**: Extracted data from SQL queries of clarity Table EPIC performed by pharmacy
  • Large chunks of data into existing reports joined/blended

• Critical Care Department: 4 core server

• **New way**: Medication data daily update from EPIC clarity tables
  • Currently receiving flat files, calculations/processing
  • Publish/Share
  • Medication Dashboards
What to Expect from Dashboarding

- Improved **consistency** in **assessment** and **identification** of sedated, delirious, and withdrawal patient states
- Improved **communication** around the dashboards
- Sedation “rounds”
- Improved **approaches** and **interventions** for prevention
Sedation Stewardship Committee

- Quality measures
  - audits on use of standardized practices matched with quality metrics
  - Sustainable protocols/pathways
  - Ongoing education
- Research projects
- Complex Sedation Team
  - for chronic patients
  - automated alerts for patients reaching thresholds for high risk
Benefits of Visualization

So far, we have been able to describe and provide insight to previously unavailable data. With our visuals we have effect and can show...

- *reduced* total dose exposure ~ less patients experiencing addiction and delirium
- *reduced* ICU length of stay ~ enhanced bed management
- *reduced* frequency of unplanned events ~ improved safety margins

“Metrics will Drive Change”
Today’s analytics and insights will make the difference in tomorrow’s clinical outcomes.
Please complete the session survey in the mobile app

View ‘My Evaluations’ in the menu or find your session under ‘Schedule’
Today’s analytics and insights will make the difference in tomorrow’s clinical outcomes.
Interactive Dashboards
Interactive Dashboards
Thank You