



Atrium Health

Multiprofessional Care Behind the Tele-ICU Camera

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Atrium Health – Virtual Critical Care

Objectives

- Define tele-ICU care
- Describe multiprofessional team members and their role
- Discuss how multiprofessional tele-ICU care improves patient care



Patient Case

- 65 year old male, history of morbid obesity, COPD, CHF, OSA, tobacco use, admitted with cough and shortness of breath for 3 days.
- Presents to the ED at Stanly Regional Medical Center in Albemarle, NC.
- In the ED, the patient is noted to have increased work of breathing and altered mental status. ABG shows both hypoxia and hypercapnia. CXR shows a dense infiltrate in the bilateral lower lobes and right middle lobe.



Patient Case (continued)

- The patient is started on antibiotics, steroids, bronchodilators, and placed on BiPAP with slight improvement in respiratory status.
- He is also noted to be hypotensive and given fluid boluses with improvement in his blood pressure.
- The patient is admitted to the ICU by the hospitalist team with the diagnosis of acute respiratory failure, pneumonia, sepsis.



Patient Case (continued)



Patient Case (continued)



Patient Case (continued)

- Upon arrival to the ICU, you camera in to find the patient in respiratory distress, agitated, attempting to pull off the BiPAP mask.
- The patient's oxygen saturations are dropping.
- The RN and RT at the bedside requesting assistance.
- What info would you like to know?
- What do you do next?



Patient Case (continued)

- Resources available:
 - RT, RN at bedside
 - In house hospitalist
 - ED physician performs intubations
 - Central lines performed by ED physician or by on call surgeon



Patient Case (continued)

- You determine the patient needs to be intubated given worsening respiratory distress
- The ED physician is managing a code in the ED and not available immediately
- The hospitalist is not comfortable intubating
- RT says they can intubate, but need an order for medications to intubate



FAQ about Tele-ICU

- Procedures
- Legal implications
- Code management
- Camera etiquette
- Documentation
- Billing
- Acceptance

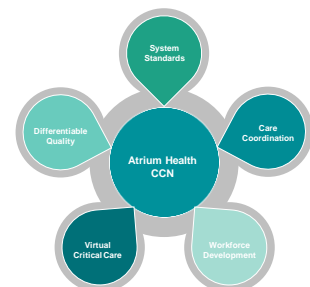


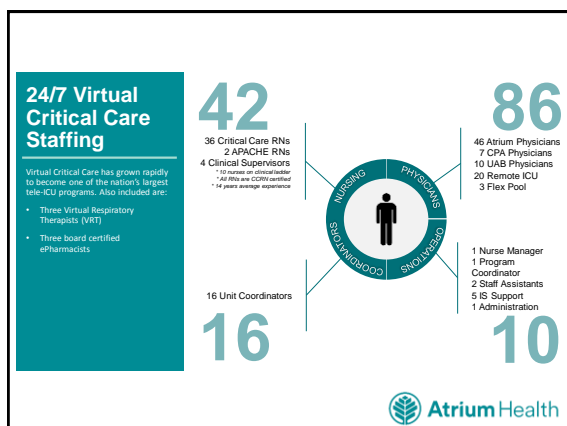
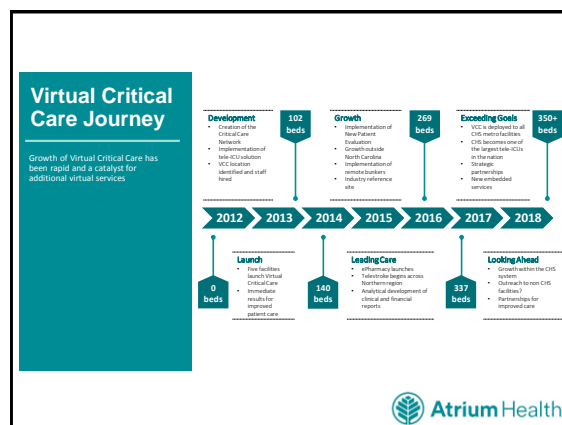
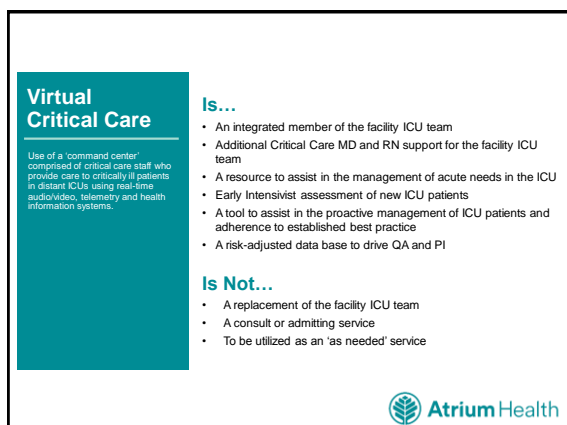
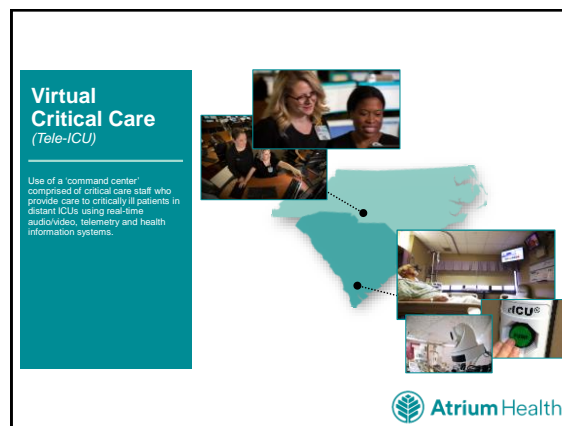
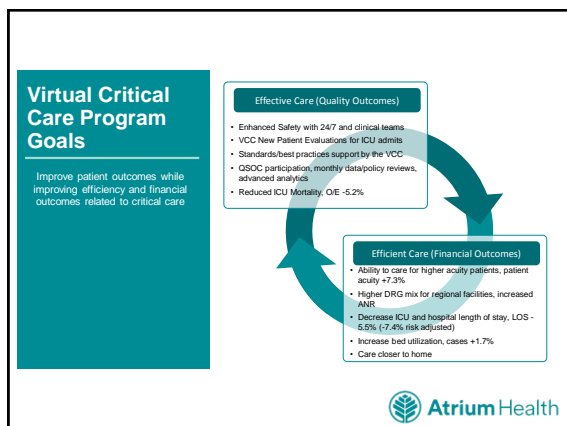
- Clinical Staff Shortages**
Reduce critical care staff resources to care for patients with knowledge and quality resources to reduce length of stay and mortality
- Greater Cost Effectiveness**
Improve care and reduce costs to improve patient outcomes, along with changing value models the financial performance is vital
- Improved Outcomes**
The need for demonstrated quality outcomes is essential for today's ICUs supported by evidence and comparative data
- Increasing ICU Populations**
Aging population and more acute care patients demand more of today's resources and healthcare costs

Atrium Health's Critical Care Network

- Guiding Principles**
- Evidence-based Practice
 - Intensivist-managed Care
 - Multidisciplinary Teamwork
 - Care As Close to Home as Possible

Deliver consistently reliable, effective and efficient Critical Care Services across all Atrium Health facilities





National & International Partnerships

Partnerships with national and international intensivists creates one of the nation's broadest pool of virtual, board certified intensivists

- Remote ICU
- University of Alabama at Birmingham
- Charleston Pulmonary Associates
- Individual partnerships throughout the U.S.



Virtual Critical Care Impact

Virtual Critical Care has grown rapidly and realized the initial goals and outcomes of the program

- Cases +1.7%
- Patient Acuity +7.3%
- Adjusted Net Revenue
- Patient Days -2.3%
- Mortality O/E -5.2% (199 Lives)
- LOS -5.8% (-7.4% risk adjusted)

Virtual Services



Virtual Critical Care Nursing

Critical Care Certified nurses provide consistent assistance and support to all Atrium Health facilities

- Our nursing staff includes...
- 36 Virtual Critical Care RNs
 - 2 APACHE RNs
 - 4 Clinical Supervisors
 - Daisy Team Award Participant
 - Beacon Award for Excellence

Initiatives...

- SAT/SBT
- A-F Bundle compliance
- Fluid Volume studies
- Sedation and Pain management
- Emergency Department Carts for boarders
- Proning
- Code Cool, Code Sepsis, Code PE oversight
- Wound Care assistance

Collaboration...

- eMentor Program
- Transition to Practice students
- Local nursing and respiratory therapy clinical rotations



Virtual Respiratory Therapy (VRT)

- Initiated 2017
- 3 respiratory therapists (RT)
- Spontaneous Awakening Trial (SAT)/Spontaneous Breathing Trial (SBT)
 - Assist with time to initiation/completion
 - Assess for re-trials for failures
- RT Clinical Support
 - Assist bedside RTs with challenging ventilator situations
 - Airway Clearance Suggestions



Critical Care Pharmacy Services

- American College of Critical Care Medicine guidelines for critical care services and personnel
 - Pharmacy services provided by qualified and competent pharmacist are essential to ICU
- American College of Clinical Pharmacy
 - Standards of Clinical Practice
 - Require residency training or equivalent post-licensure experience and board certification
- ICU pharmacists
 - Reduce costs, morbidity and mortality

Haupt MT, et al. Crit Care Med. 2003; 31(11):2677-2683.
American College of Clinical Pharmacy. Pharmacotherapy. 2014; 34(8):794-797.

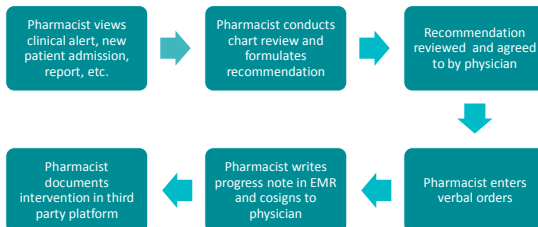


Tele-ICU Pharmacy Services

- Critical Care Pharmacy services for Atrium Health
 - Three facilities with dedicated daytime critical care trained pharmacists
 - Critical care pharmacist availability
 - Limited on 2nd shift and none on 3rd shift
- 2015 – 2nd shift, M-F, 3pm – 11pm
 - 2 pharmacists; alternate weeks
- 2017 – 1st shift, M/W/F, 8am – 12pm
 - 1 pharmacist
- Clinical surveillance alert and profile review to generate interventions
- Standard workflow developed



Second Shift Workflow

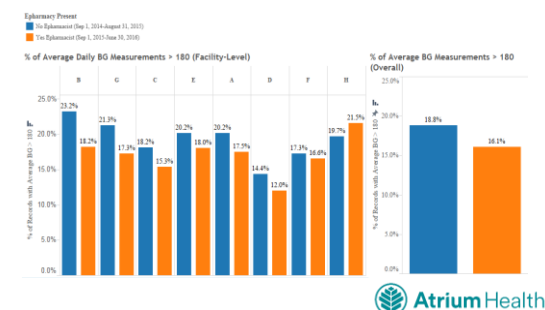


Tele-ICU Pharmacist Interventions

- Intervention categories
 - Hyper- and hypoglycemia
 - Abnormal electrolytes
 - Sodium, potassium, magnesium, phosphorus
 - Code Sepsis
 - Adverse drug events avoided
 - Medication management
- Intervention data
 - 13,638 interventions performed between 9/2015 and 7/2018
 - 991 on 1st shift (7.3%)
 - 12,647 on 2nd shift (92.7%)



Impact on Glycemic Control



Hyponatremia Interventions

- Risk of osmotic demyelination syndrome with overcorrection of serum sodium
- 60 interventions in 49 patients across 9 ICUs
- Interventions included:
 - Notification of actual or potential overcorrection
 - Increased frequency of laboratory monitoring
 - Fluid management alterations
 - DDAVP administration
 - Discontinuation of potentially exacerbating home medications
- System-level changes to order sets completed



Physician Workload Optimization

- 4,786 interventions triaged to physician in 505 tele-pharmacist work days in 2017 and 2018
- 9.48 interventions per 8 hour shift
 - Estimated 10 minutes per intervention (5 to 15 minutes)
 - Tele-pharmacists identified clinical concerns beyond bedside requests and Best Practice Alerts
- Represents 95 minutes of physician time reallocated during peak admission hours
 - Contributed to efficiency of physician workflow
 - Minimized or eliminated need for physician EMR review
 - Physician satisfaction has not been formally evaluated



Adverse Drug Events (ADEs)

- Drug-related injuries
 - Significant morbidity, mortality, and cost
 - Fourth to sixth leading cause of death in the US
 - More common in the ICU
 - Reduction demonstrated by critical care pharmacists

| Study | Cost Estimate (at time of study) | Cost Estimate (April 2018) |
|--------------|---|----------------------------------|
| Bates 1997 | \$3,244 (1993)/\$5,857 per preventable ADE | \$5,630/\$10,160/preventable ADE |
| Cullen 1997 | \$5691 additional ICU cost (1993), p = 0.16 | \$9,870 |
| Classen 1997 | \$2,262 (1993) | \$3,890 |
| Lee 2002 | \$1,098 (1998 to 1999) | \$1,660 |
| Hug 2012 | \$3,420 (2005/2006) | \$4,200 |

Kohn LT, et al. *To err is human: building a safer health system*. 2000.
 Kane GL, et al. *Crit Care Med*. 2013;41(5):e183-89.
 Lippincott, et al. *JAMA*. 1995;273(12):1505-10.
 Bates DW, et al. *JAMA*. 1997;277(16):307-11.
 Cullen LS, et al. *Crit Care Med*. 1997;25(10):189-97.
 Classen DC, et al. *JAMA*. 1997;277(16):303-305.

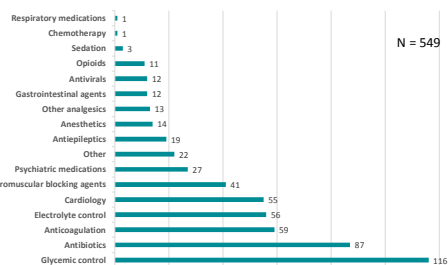
Lee AL, et al. *Am J Health Syst Pharm*. 2002;59(20):2077.
 Hug B, et al. *J Crit Care J Qual Patient Saf*. 2012 May;38(5):120-6.
 U.S. Bureau of Labor Statistics. *CPDR-Adverse Drug Events*.
 Available from: <https://www.bls.gov/news.release/archives/cpdradrug020202.pdf>
 Lippincott, et al. *JAMA*. 1995;273(12):1505-10.
 Hug B, et al. *Am J Health Syst Pharm*. 2007;64(24):2487-2497.
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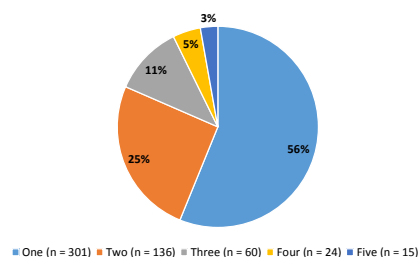
ADE Intervention Activities

| Intervention Activity | n | % |
|-------------------------------------|------------|---------------|
| Discontinue medication | 119 | 22.2% |
| Glucose: hypoglycemia | 102 | 19.0% |
| Add medication | 62 | 11.6% |
| Dose adjustment: renal | 61 | 11.4% |
| Alternate medication | 33 | 6.2% |
| Duplicate therapy | 24 | 4.5% |
| Contraindication | 22 | 4.1% |
| Electrolyte abnormality: sodium | 21 | 3.9% |
| Change route/formulation | 18 | 3.4% |
| Non-renal/hepatic dose adjustment | 14 | 2.6% |
| Administration issue | 14 | 2.6% |
| Drug interaction | 13 | 2.4% |
| Order clarification | 9 | 1.7% |
| Electrolyte abnormality: potassium | 9 | 1.7% |
| Medication omission | 8 | 1.5% |
| Allergy avoidance/clarification | 4 | 0.7% |
| Electrolyte abnormality: magnesium | 2 | 0.4% |
| Electrolyte abnormality: phosphorus | 1 | 0.2% |
| Total | 536 | 100.0% |

ADEs by Drug Class



ADE Interventions per Patient



ADE Interventions per Facility

| Facility | Total ICU Beds | Interventions n (%) |
|--------------|----------------|---------------------|
| Facility A | 18 | 142 (26.5) |
| Facility B | 14 | 106 (19.8) |
| Facility C | 16 | 68 (12.7) |
| Facility D | 10 | 55 (10.3) |
| Facility E | 30 | 48 (9) |
| Facility F | 30 | 45 (8.4) |
| Facility G | 8 | 25 (4.7) |
| Facility H | 49 | 21 (3.9) |
| Facility I | 10 | 21 (3.9) |
| Facility J | 131 | 5 (0.9) |
| Total | 316 | 536 (100) |



Drug-Drug Interactions and Cost Savings

- Drug-Drug Interactions
 - Most common with antibiotics (34.5%) and psychiatric medications (23.1%)
 - Other agents included oral electrolytes, direct oral anticoagulants, antiepileptics, highly active antiretroviral therapy, kayexalate, neuromuscular blocking agents and midazolam
- Cost Savings
 - \$889,760 to \$3,017,680 (April 2018 USD)



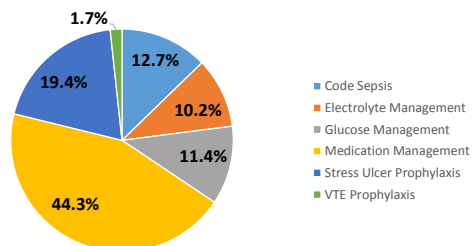
Dayshift

- 74 ICU beds at 6 facilities monitored
- Average of 41 charts reviewed per shift
- Majority of interventions made are through
- 1024 interventions made for 634 patient

| Interventions Per Patient Chart Review | | |
|--|-----|-------|
| Number | n | % |
| 1 | 396 | 62.5% |
| 2 | 154 | 24.3% |
| 3 | 52 | 8.2% |
| 4 | 15 | 2.4% |
| 5 | 7 | 1.1% |
| 6 | 7 | 1.1% |
| 7 | 2 | 0.3% |
| 8 | 1 | 0.1% |
| Total | 634 | 100% |



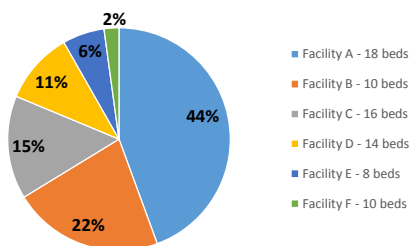
Dayshift Intervention Types



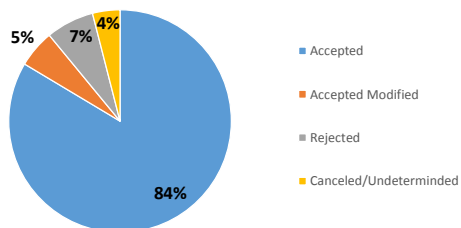
VTE: venous thromboembolism



Dayshift Pharmacist Interventions by Facility



Dayshift Intervention Acceptance Rates



Dayshift Challenges and Innovations

- Challenges
 - Determining optimal intervention delivery route
 - Integration with bedside and multidisciplinary teams
- Innovations
 - Virtual rounds
 - 1 day per week at one facility
 - MWF with second facility
 - Providing drug information to bedside teams and tele-ICU nurses



Questions?

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