



Atrium Health

Multiprofessional Care Behind the Tele-ICU Camera

Nehal Thakkar, MD, FCCP and Sonia Everhart, PharmD, BCPS, BCCCP
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)

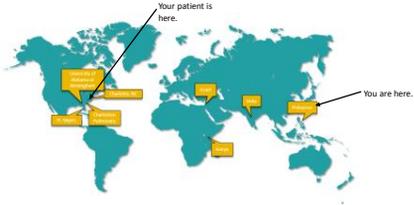
- The patient is started on antibiotics, steroids, bronchodilators, and placed on BiPAP with slight improvement in respiratory status.
- He is also noted to be hypotensive and given fluid boluses with improvement in his blood pressure.
- The patient is admitted to the ICU by the hospitalist team with 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
 Drive critical care staff resources for high-profile patients with knowledgeable and quality resources to reduce length of stay and mortality.

Greater Cost Effectiveness
 Drive greater financial performance by streamlining care pathways, using value-changing value models for financial performance & cost.

Improved Outcomes
 The goal for demonstrated quality outcomes is essential for today's ICU, supported by analytics and compliance data.

Increasing ICU Populations
 Aging populations and acute mortality of 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

Atrium Health CCN

- System Standards
- Care Coordination
- Workforce Development
- Virtual Critical Care
- Differentiable Quality

Virtual Critical Care Program Goals

Improve patient outcomes while improving efficiency and financial outcomes related to critical care

Effective Care (Quality Outcomes)

- Enhanced Safety with 24/7 and clinical teams
- VCC New Patient Evaluations for ICU admits
- Standard best practices support by the VCC
- QSOC participation, monthly datapolicy reviews, advanced analytics
- Reduced ICU Mortality, O/E -5.2%

Efficient Care (Financial Outcomes)

- Ability to care for higher acuity patients, patient acuity +1.3%
- Higher DRG mix for regional facilities, increased ANR
- Decrease ICU and hospital length of stay, LOS - 5.9% (+7.8% risk-adjusted)
- Increase bed utilization, cases +1.7%
- Care closer to home

Virtual Critical Care (Tele-ICU)

Use of a 'command center' comprised of critical care staff who provide care to critically ill patients in distant ICUs using real-time audio/video, telemetry and health information systems.

Virtual Critical Care

Use of a 'command center' comprised of critical care staff who provide care to critically ill patients in distant ICUs using real-time audio/video, telemetry and health information systems.

Is...

- An integrated member of the facility ICU team
- Additional Critical Care MD and RN support for the facility ICU team
- A resource to assist in the management of acute needs in the ICU
- Early Intensivist assessment of new ICU patients
- A tool to assist in the proactive management of ICU patients and adherence to established best practice
- A risk-adjusted data base to drive QA and PI

Is Not...

- A replacement of the facility ICU team
- A consult or admitting service
- To be utilized as an 'as needed' service

Virtual Critical Care Journey

Growth of Virtual Critical Care has been rapid and a catalyst for additional virtual services

Year	Development	102 beds	Growth	269 beds	Exceeding Goals	350+ beds
2012	0 beds	Launch	102 beds	269 beds	350+ beds	Looking Ahead
2013	0 beds	Launch	102 beds	269 beds	350+ beds	Looking Ahead
2014	0 beds	Launch	102 beds	269 beds	350+ beds	Looking Ahead
2015	0 beds	Launch	102 beds	269 beds	350+ beds	Looking Ahead
2016	0 beds	Launch	102 beds	269 beds	350+ beds	Looking Ahead
2017	0 beds	Launch	102 beds	269 beds	350+ beds	Looking Ahead
2018	0 beds	Launch	102 beds	269 beds	350+ beds	Looking Ahead

24/7 Virtual Critical Care Staffing

Virtual Critical Care has grown rapidly to become one of the nation's largest tele-ICU programs. Also included are:

- Three Virtual Respiratory Therapists (VRT)
- Three board certified ePharmacists

42

36 Critical Care RNs
2 APACHE RNs
4 Clinical Supervisors
+10 years of clinical leader
+40 RNs w/ CCW credential
+14 years average experience

86

46 Atrium Physicians
7 CPA Physicians
10 UAB Physicians
20 Remote ICU
3 Flex Pool

16

16 Unit Coordinators

10

1 Nurse Manager
1 Program Coordinator
2 Staff Assistants
5 IS Support
1 Administration

Virtual Critical Care Across the Carolinas

- More than 330 critical care beds
- One of the largest tele-ICU programs in the nation

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.

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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)

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Virtual Services

- ePharmacy
- Virtual Respiratory Therapy
- eRN

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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

BEACON AWARD FOR EXCELLENCE

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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

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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

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American College of Clinical Pharmacy. Pharmacotherapy. 2014; 34(8):794-797.

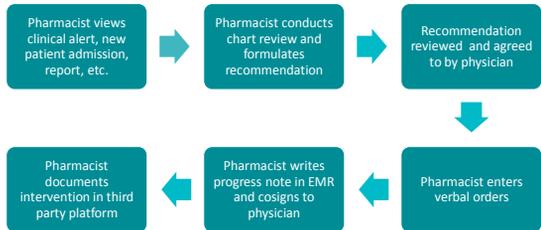
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Tele-ICU Pharmacy Services

- 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

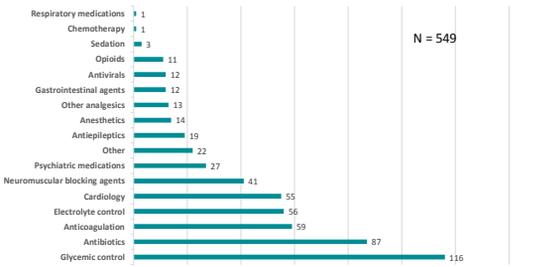
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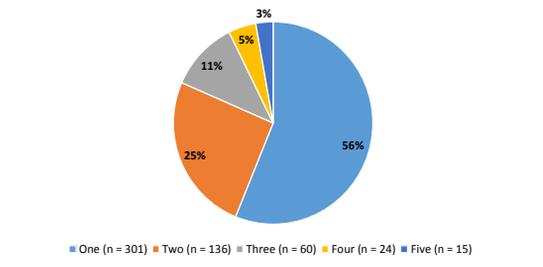
ADE Intervention Activities

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

Intervention Type	Percentage
Code Sepsis	10.2%
Electrolyte Management	12.7%
Glucose Management	11.4%
Medication Management	44.3%
Stress Ulcer Prophylaxis	19.4%
VTE Prophylaxis	1.7%

VTE: venous thromboembolism

Dayshift Pharmacist Interventions by Facility

Facility	Percentage
Facility A - 18 beds	44%
Facility B - 10 beds	22%
Facility C - 16 beds	15%
Facility D - 14 beds	11%
Facility E - 8 beds	6%
Facility F - 10 beds	2%

Dayshift Intervention Acceptance Rates

Acceptance Status	Percentage
Accepted	84%
Accepted Modified	5%
Rejected	7%
Canceled/Undetermined	4%

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?

- Nehal Thakkar, MD
 - Nehal.Thakkar@atriumhealth.org
- Sonia Everhart, PharmD, BCPS, BCCCP
 - Sonia.Everhart@atriumhealth.org