Developing the Evidence for Airway Management of Critically-Ill Ventilated Patients

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- Past research funding
  - American Association of Critical-Care Nurses
  - Sigma Theta Tau, Theta Epsilon
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    - 1R21NR010262-01
  - Sage Products, Cary, IL

- Current research funding
  - National Institute for Nursing Research
    - 1R01NR014508-01A1

NO-ASPIRATE

NIH-1R01NR014508

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Objectives

1. Describe development of a program of clinical research related to airway management in in critically-ill ventilated patients.
2. Articulate the importance of inquiry, collaboration, and teambuilding in conduct of research.

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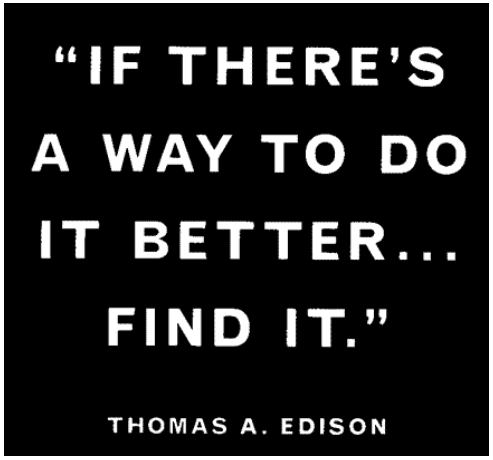
University of Central Florida

- Metropolitan research university
- Established 1963
- 64,000 students
  - 3000 nursing students
- 15,000 degrees/year
- Partnership university
- Access

Scale × Excellence = Impact

Interest in Airway Management

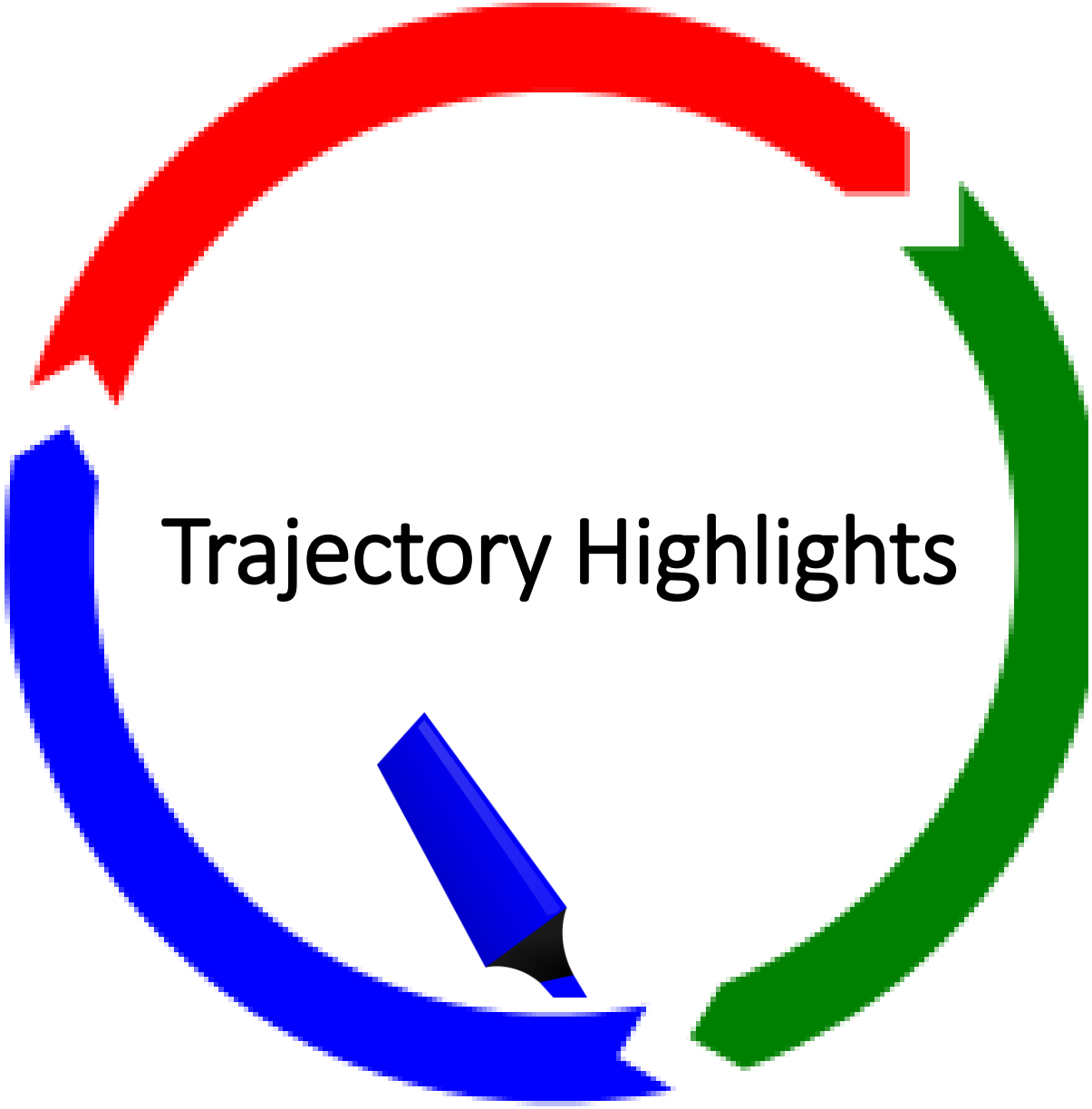
- Bedside influences as teacher and staff nurse
- Clinical Nurse Specialist position
  - Practice changes
  - Product evaluation/new technologies
- Natural instincts / characteristics
  - Skeptic; show me the evidence
  - Is there a better way?



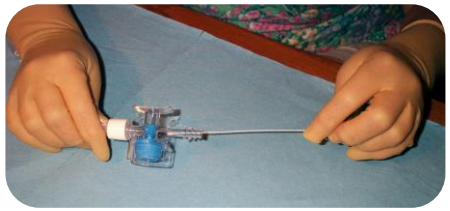
Limited Evidence Guided Practice

- High-pressure, low volume ETT
  - Deflated ETT cuff every 2 hrs—aspiration?
- Oral care
  - No standards
  - Comfort/hygiene
- Some care still lacks evidence
  - Oral and ETT suctioning
  - Cuff pressure management
  - Repositioning ETT
  - Securement devices
  - Tracheostomy care

Trajectory Highlights



Colonization

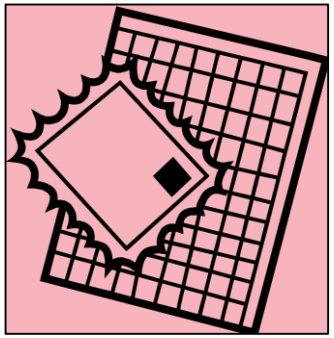


- 20 subjects
- Cultures mouth, tracheal aspirate, devices
  - All had VAP pathogens in the mouth
  - 67% positive tracheal cultures
  - Tonsil suction contaminated; 39% MRSA

- Serendipitous findings set the stage …
  - Cuff pressure lower than morning measure; 20% were 10-12 cm H_2O lower
  - Copious amount of oral secretions in subset

Sole, M.L., Poalillo, F.E., Byers, J.F., & Ludy, J.E. (2002). Bacterial growth in secretions and on suctioning equipment of orally-intubated patients: A pilot study. *American Journal of Critical Care*, 11, 141-149.

National Study of Airway Practices: STAMP



- Site and individual practices
- 27 sites; 1667 respondents
- ETT cuff pressure
  - Frequency and method of measurement varied
  - Nurses not aware of value nor importance
- Oral care
  - Lack of oral care, tooth brushing, oropharyngeal suctioning
- **Differences in practices between nurses and RTs**

Sole, M.L., Byers, J.F., & Ludy, J.E., & Ostrow, C.L. (2002). Suctioning techniques and airway management practices (STAMP): Pilot study and instrument evaluation. American Journal of Critical Care, 11, 363-368.

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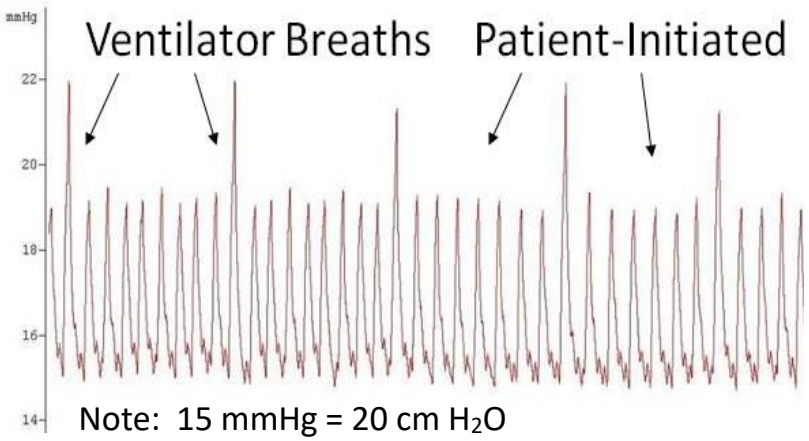
Cuff Pressure

- Does ETT cuff pressure decrease over time?
  - Cuff pressure decreased 4 cm H_2O over a 12h period
- Could continuous ETT cuff pressure monitoring provide a better picture of changes?
  - Challenges of implementing the technology

Sole, M.L., Combs, S.M., & Willis, J. (2003). Changes in endotracheal cuff pressures over time. *Critical Care Medicine 31*(2), Supplement, A144.
Sole, M.L., Aragon, D., Bennett, M., & Johnson, R.L. (2008). Continuous measurement of endotracheal cuff pressures: How difficult can it be? AACN Advanced Critical Care, 19, 235-243
Sole, M.L., Penoyer, D., Su, X., et al. (2009). Endotracheal tube cuff pressure: Changes associated with activity and over time. *American Journal of Critical Care*, 18:e8.

Cuff Pressure Discoveries

- 10 subjects
- Pressure 20-30 cm H_2O only 54% of time
- Out of range
  - 16% High (transient)
  - 30% Low
- Trend to decrease over time
- Duration of intubation a possible factor



Sole, M.L., Aragon, D., Su, X., et al. (2009). Assessment of endotracheal cuff pressure with continuous monitoring: A pilot study. *Am J Crit Care*, 18, 133-43.

Cuff Pressure Intervention

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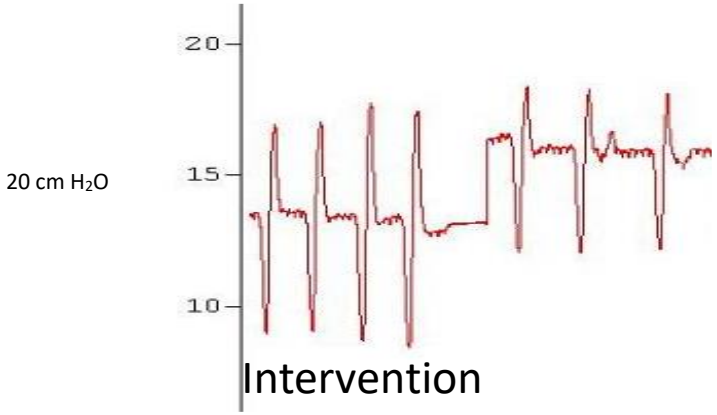
- Randomized, repeated measures, crossover design; 32 subjects
- Data collected for 12 hours for 2 days
  - Control Condition—usual care
  - Intervention; adjust cuff pressure using alarm triggers

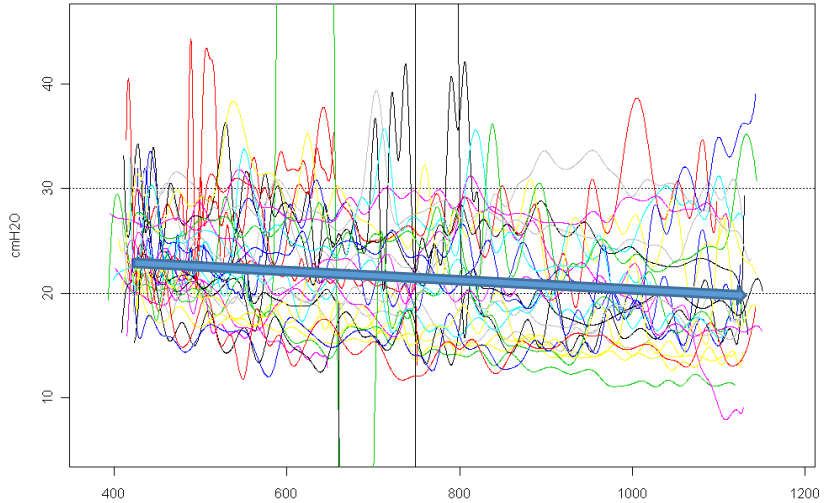


*Sole, M.L., Su, X., Talbert, S., Penoyer, D.A. Kalita, S., Jimenez, E., Ludy, J.E., & Bennett, M. (2011). Evaluation of an intervention to maintain endotracheal tube cuff pressure within therapeutic range. American Journal of Critical Care, 20, 109-119.

Cuff Pressure Intervention

1R21NR010262

- Interventions needed for 24/25 subjects
- Average 8 interventions
  - Added air (0.26 mL) to cuffs of 23 subjects
  - Removed air (0.13 mL) from cuffs of 6 subjects
- Control > frequency out-of-range values
- Pressure decreased over time



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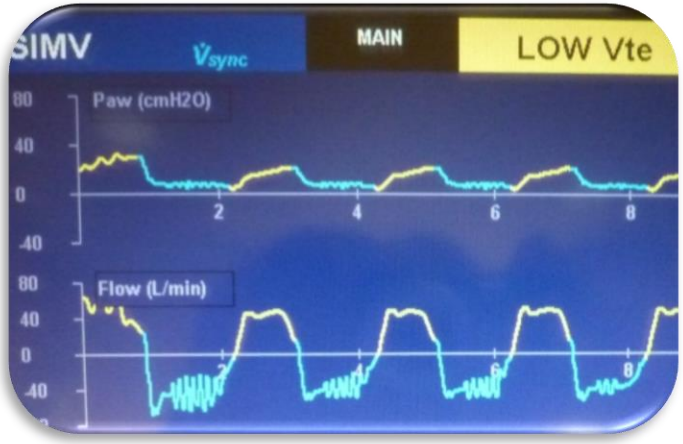
Oropharyngeal Secretion Volume

- 28 subjects; HOB 30°
- Suctioned deep suction catheter; weigh and measure secretions at baseline, 2h, and 4h
- Ave. 8 mL after 4 h

Sole, M.L., Penoyer, D.A., Bennett, M., Bertrand, J., & Talbert, S. (2011). Oropharyngeal secretion volume in intubated patients: The importance of oral suction. American Journal of Critical Care, 20(6):e141-e145.

Cues for ETT Suctioning

- 42 subjects
- Assess hourly for suction cues using respiratory guidelines for suctioning
- Findings
  - Coarse crackles over trachea best indication of need for suction (> 1 mL mucus)
  - Sawtooth waveform indicates need for suction, but not consistently present
  - Coarse breath sounds NOT recommended for assessment



*Sole, M.L., Bennett, M., & Ashworth, S. (2015). Clinical indicators for endotracheal suctioning in adult patients receiving mechanical ventilation. American Journal of Critical Care, 24, 318-324.

Pepsin / Amylase Markers of Aspiration

- Pilot study 13 subjects
  - Paired oral and tracheal specimens twice in 4 hours
- Development of laboratory
  - Collaboration with pediatric GI specialist!
  - Methods for gathering specimens
  - Decision points for positive and negative values
- Findings
  - Pepsin in tracheal secretions of 54% of subjects
  - Amylase in tracheal secretions of 39% of subjects
  - Aspiration despite cuff pressure and HOB elevation

Sole, M.L., Conrad, J., Middleton, A., Bennett, M., Allen, K., Ashworth, S., & Mehta, D.I. (2014). Pepsin and amylase in oral and tracheal secretions: A pilot study. American Journal of Critical Care,23(4), 334-338.

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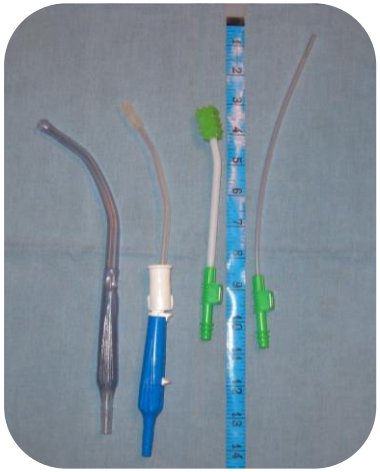
Oral Suction Intervention to Reduce Aspiration and Ventilator Events: NO-ASPIRATE 1R01NR014508-01A1



- RCT of 520 critically-ill ventilated patients to achieve final sample of 400 patients
  - Deep oropharyngeal suction every 4 hours (experimental group)
  - Oral suction with swab every 4 hours (usual care)
- Outcomes: aspiration and ventilator-associated events
  - Tracheal / oral specimens for α-amylase q12h
  - VAE per CDC definitions
- Logistic regression, survival analysis, and GEE
- Have enrolled 490 subjects to date!

ClinicalTrials.gov Identifier: NCT02284178

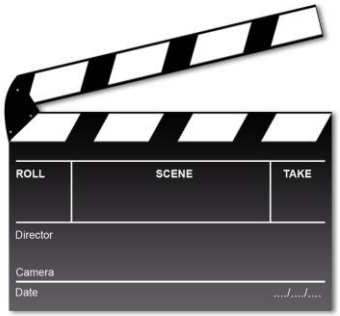
Clinical Research in Critical Care is Challenging!

Strategies: Inquiry, Collaboration, Teambuilding

ABCDF bundle!

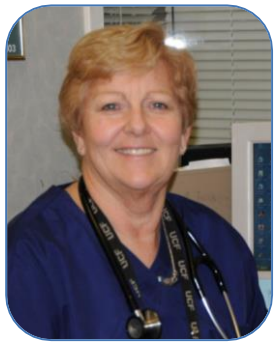
Action

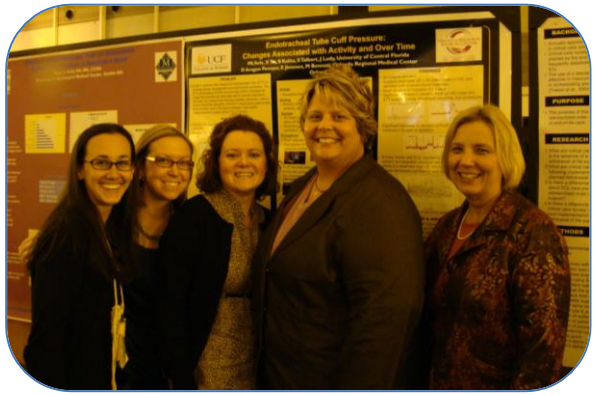
- Self-direction
- Take advantage of opportunities
  - CNS role
  - Better way to do things
- Establish formal affiliation with hospitals
- Establish relationships with IRBs



Build Infrastructure

- Colleagues
- Students
- Other disciplines
- Seek others (e.g., engineering)
- Consultants





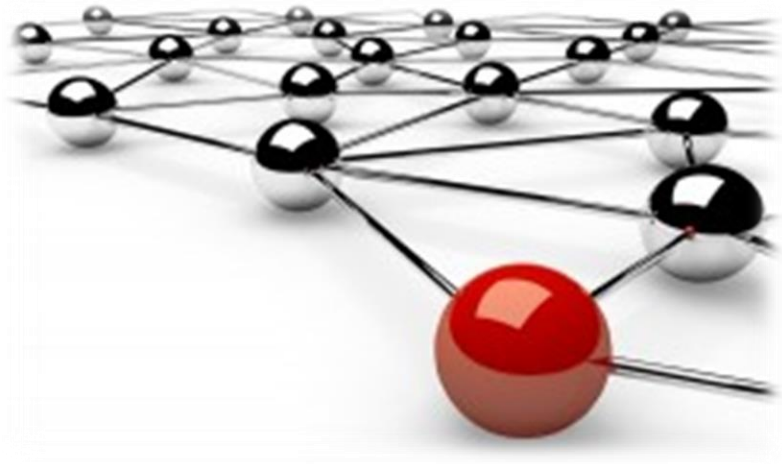
Back-to-Basics / Bedside

What is best for the patient?

- Many practices based on OLD data from studies with small sample sizes
- Correlate physiological data with the clinical condition
- Partner with clinicians

Collaborate

- Avoid the “lone researcher”
- Inter-professional teams essential
- Include those practicing at bedside!
- Use national experts as consultants
- Think beyond the usual
  - Pediatric gastroenterologist!
  - Genetic analysis expert!
  - Epidemiologist



Connect
Create,
Clever
CNS

Discover and Disseminate

- Self-discovery
- Scientific discoveries
  - Must publish and present results
- Don’t accept failure

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Funding

- Pilot work
- Clinical studies
- Large-scale studies
  - Intramural
  - Endowed chair funds
  - Professional organizations
  - Corporations/industry
  - Federal government

Future Goals

- Evidence-based nursing care
  - Prevention of microaspiration
    - Endotracheal tube cuff
    - Management of subglottic suction endotracheal tube
  - Best practices for endotracheal suctioning
  - Best practices for management of patient with tracheostomy
- Changes in lung flora over time

Success is as Easy as ABC

- **A**ct; **A**sk
- **B**ack-to-basics; **B**edside approach; **B**uild infrastructure
- **C**ollaborate; **C**onnect; **C**reate; **C**lever; **CNS**; **C**olleagues
- **D**iscover; **D**isseminate; **D**on’t accept failure
- **F**unding critical

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