



# Experience + Science + What We Learned = Preparation for the Next Pandemic

Carl Hinkson, MSc, RRT-ACCS, NPS, FAARC  
Director, Pulmonary Service Line  
Providence Regional Medical Center Everett  
October 8, 2021



# Disclosures

- Speaking Honoraria from
- Monaghan Medical



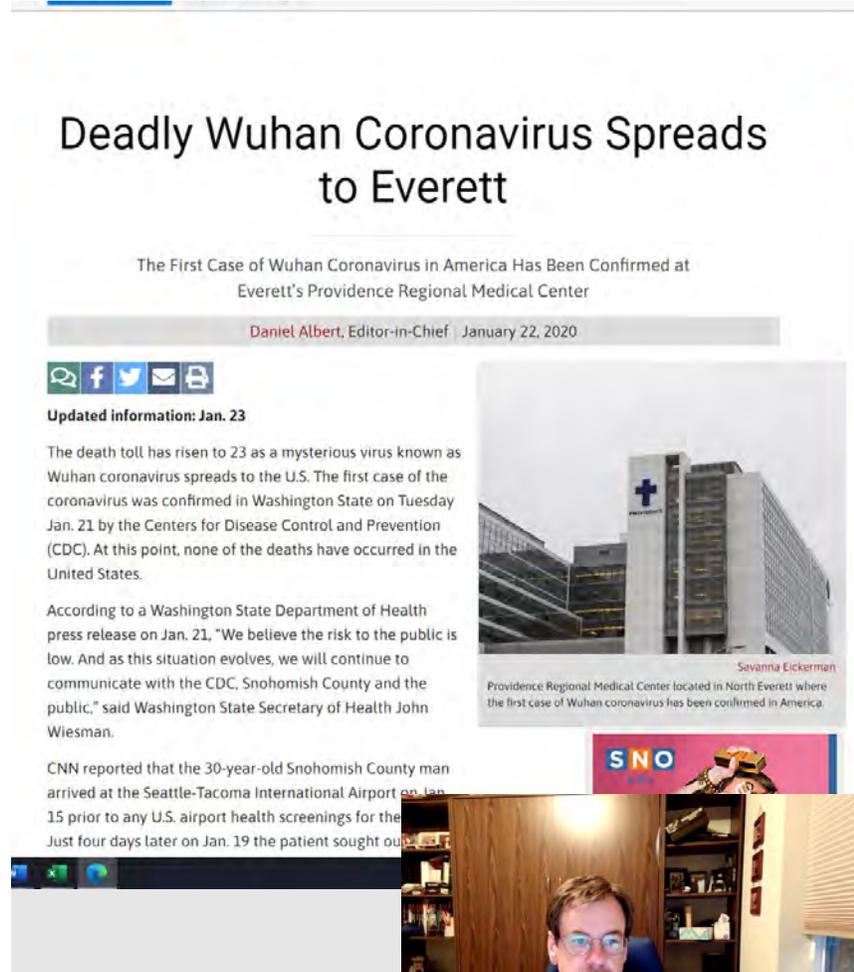
# Objectives

- Review origins of Covid-19 outbreak
- Discuss early preparations & early experiences with Covid-19 pandemic
- Review & Discuss research design Process
- Describe the process to critically evaluate a peer reviewed research article
- List Strategies to be successful in working during a pandemic



# My Covid-19 Journey

- First patient diagnosed with Covid-19 at Everett, WA
- Initially our facility planned to be an “asses & transfer” center, then later converted to “keep & treat
- Late March we saw our first significant “surge”



## Deadly Wuhan Coronavirus Spreads to Everett

The First Case of Wuhan Coronavirus in America Has Been Confirmed at Everett's Providence Regional Medical Center

Daniel Albert, Editor-in-Chief | January 22, 2020

Updated information: Jan. 23

The death toll has risen to 23 as a mysterious virus known as Wuhan coronavirus spreads to the U.S. The first case of the coronavirus was confirmed in Washington State on Tuesday Jan. 21 by the Centers for Disease Control and Prevention (CDC). At this point, none of the deaths have occurred in the United States.

According to a Washington State Department of Health press release on Jan. 21, "We believe the risk to the public is low. And as this situation evolves, we will continue to communicate with the CDC, Snohomish County and the public," said Washington State Secretary of Health John Wiesman.

CNN reported that the 30-year-old Snohomish County man arrived at the Seattle-Tacoma International Airport on Jan. 15 prior to any U.S. airport health screenings for the virus. Just four days later on Jan. 19 the patient sought out

Savanna Eickerman  
Providence Regional Medical Center located in North Everett where the first case of Wuhan coronavirus has been confirmed in America.

SNO  
NEWS OBSERVER

## My Covid-19 Journey-continued

- Multiple surges
- Joined NIH Covid-19 Treatment Guideline Panel
- Covid-19 Continued to evolve & so did our rules
- Staffing Challenges

**WE'RE SO SHORT STAFFED  
IF I WENT TO JAIL**



*Instagram@Ollviabosschick*

**THEY PROBABLY B  
JUST TO COME T**



# Covid-19 through the pandemic

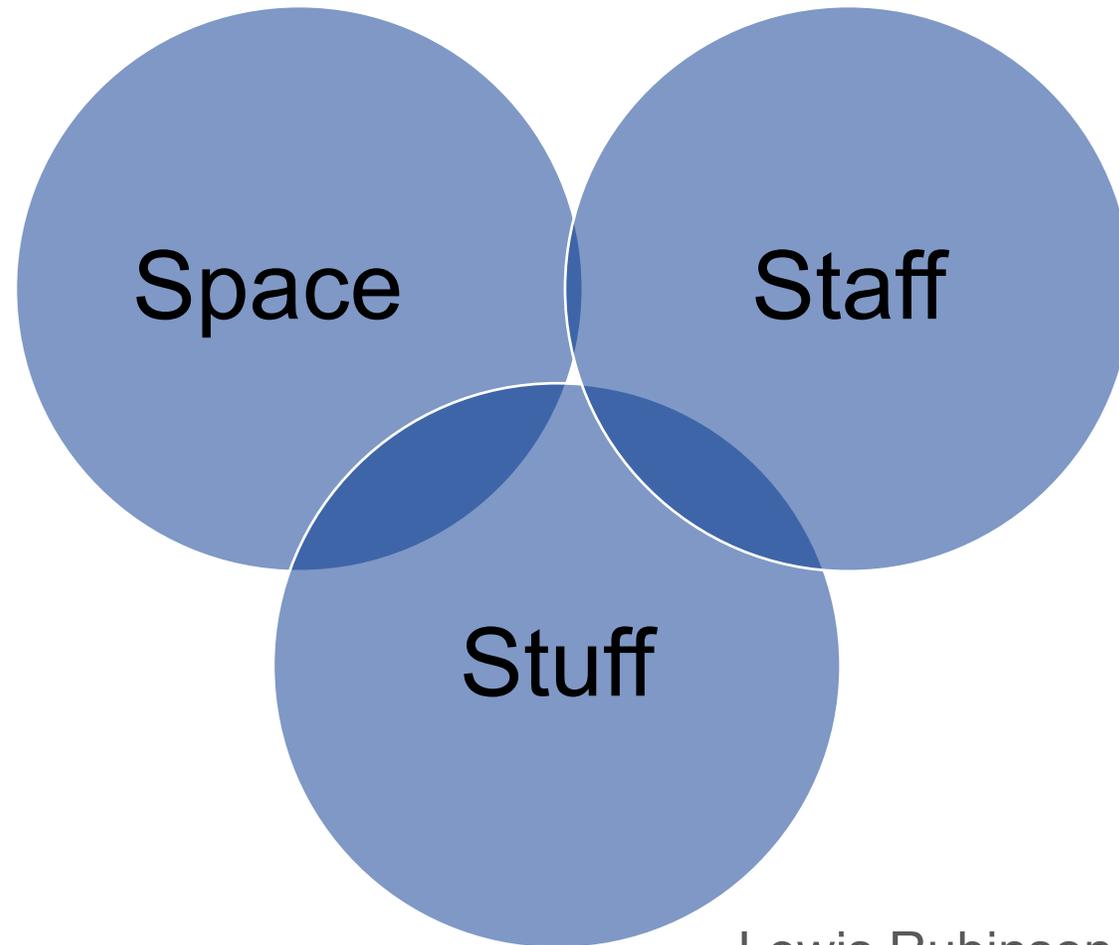


# Challenges with COVID-19

- Novel virus / no experience
- How do these patients present?
- No research...
- Multiple health organizations / multiple recommendations
  - WHO vs. CDC vs. NIH vs. local county
- Political interests
  - State-wide
  - National



# Disaster Basics- What I knew Pre-Covid-19



-Lewis Rubinson, MD



# History of Mechanical Ventilation During Surge

- Polio Epidemic early 1950's
- SARS
  - 20% of patients required MV
- Japan nerve agent attack
- Katrina hurricane
- September 11, 2001

Source: Branson RD, et al. Respir Care 2008



Fig. 3. Manual ventilation following hurricane  
erence 28, with permission.)



# History of Mechanical Ventilation During Surge

- 2010 survey of US hospitals estimated ventilator capacity:
  - 62,000 full feature
  - 100,000 less feature ventilator
- US Strategic National Stockpile (SNS)
  - 40,000
- During Covid-19 surge US gov. authorized Defense Production Act; ordered 200K ventilators

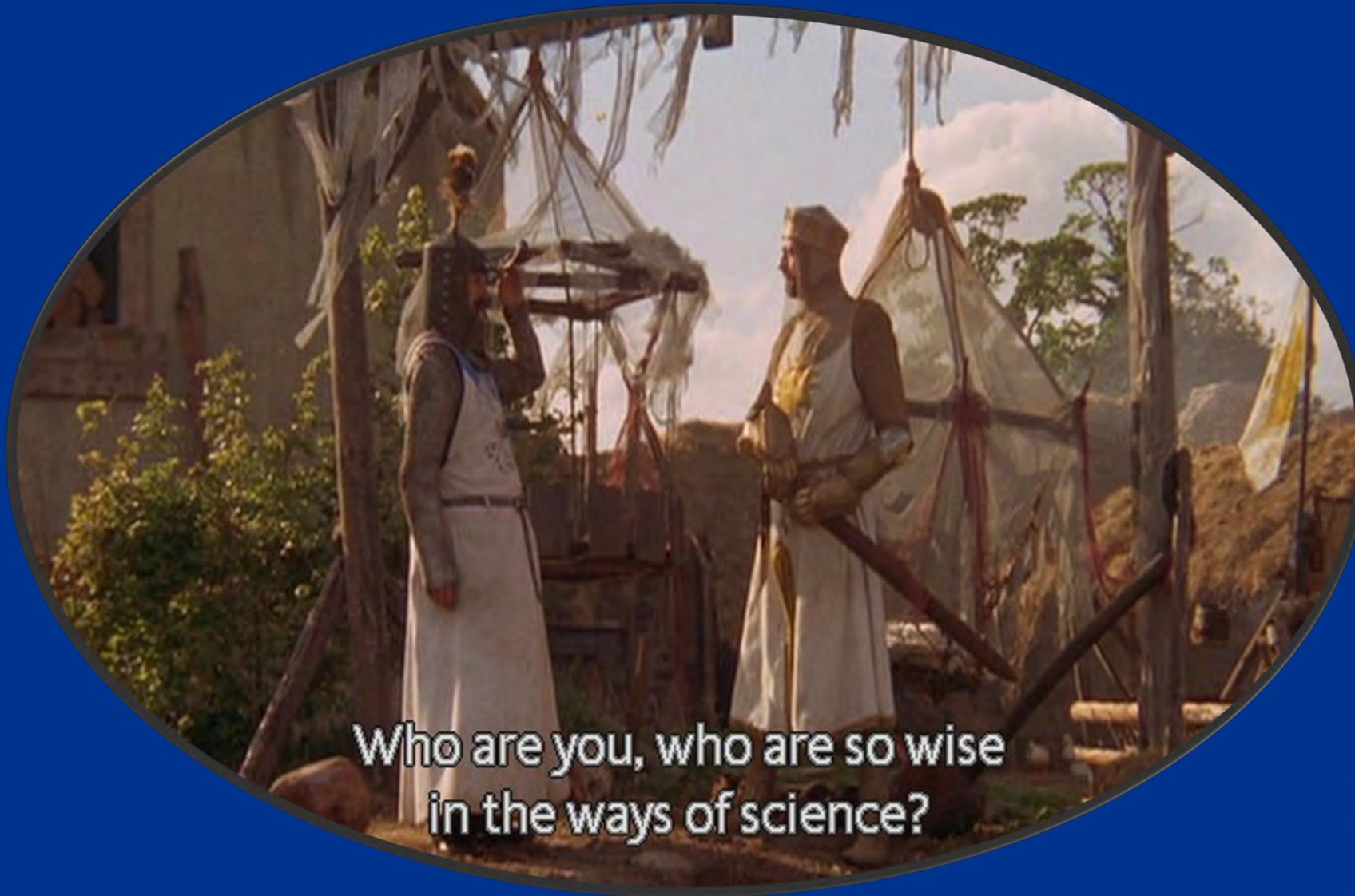
Source: Branson RD, et al. Chest 2020



# Objectives

- Review origins of Covid-19 outbreak
- Discuss early preparations & early experiences with Covid-19 pandemic
- **Review & Discuss research design Process**
- Describe the process to critically evaluate a peer reviewed research article
- List Strategies to be successful in working during a pandemic





Who are you, who are so wise  
in the ways of science?



# Sources of information in the time of Covid-19

Social media posts

Expert opinion (interviews)

Press releases

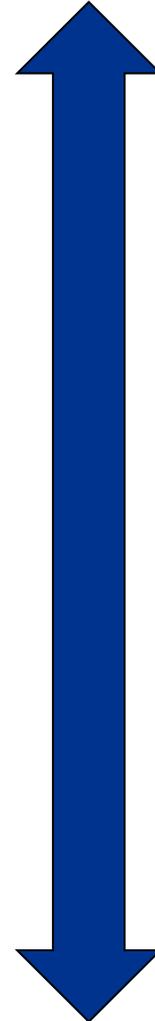
Trade magazines

Textbooks

Research abstracts

Grey journals

“Peer-reviewed” research



Lower Quality

Higher Quality



# Press Releases

## Spotlight

Bench to Bedside  
With SIDP

C difficile

COVID Vaccine Race

## Clinical

See All >

Coronavirus

Blood-Borne Diseases

Food-Borne Infections

Gastrointestinal  
Infections

Healthcare-  
Associated Infections

Prevention

Respiratory Diseases

Sexually Transmitted  
Diseases

Skin & Soft Tissue  
Diseases

Zoonotic & Vector-  
Borne Diseases

# Therapy for Respiratory Failure in COVID-19 Patients Meets Benefit, Shows Benefit

April 5, 2021  
John Parkinson



Biopharmaceutical company, NeuroRx, reported positive data from its phase 2/3 trial for its therapy, aviptadil acetate (Zyesami), in patients with severe COVID-19.

NeuroRx recently announced it had met its primary endpoint of successful recovery from respiratory failure at days 28 (P = .014) and 60 (P = .013) for its phase 2/3 trial for its investigational therapy aviptadil acetate (Zyesami). Across all patients and sites, aviptadil showed and also demonstrated a meaningful benefit in survival (P = < .001) after controlling for ventilation status and treatment site. The therapy was intravenously-administered.



“Zyesami has now demonstrated itself in a phase 2/3 trial, conducted under FDA Fast Track Designation, not only to shorten hospitalization (as was previously reported) but also to save lives and increase the likelihood of patients returning safely home to their families,” Jonathan Javitt, MD, MPH, Chairman and CEO of NeuroRx, said.

Aviptadil is a therapy targeting the lungs for patients in COVID-19 respiratory distress, and was developed by NeuroRx in collaboration with Relief Therapeutics.

Aviptadil contains a vasoactive intestinal polypeptide (VIP), a natural occurring



MY NCBI FILTERS

184,479 results

RESULTS BY YEAR



TEXT AVAILABILITY

- Abstract
- Free full text
- Full text

ARTICLE ATTRIBUTE

- Associated data

ARTICLE TYPE

- Books and Documents
- Clinical Trial
- Meta-Analysis
- Randomized Controlled Trial

Use COVID-19 filters from PubMed Clinical Queries to refine your search

Treatment Mechanism Transmission More filters

See more SARS-CoV-2 literature, sequence, and clinical content from NCBI

False-positive **COVID-19** results: hidden problems and costs.

1 Surkova E, Nikolayevskyy V, Drobniowski F.

Cite Lancet Respir Med. 2020 Dec;8(12):1167-1168. doi: 10.1016/S2213-2600(20)30453-7. Epub 2020 Sep 29.  
Share PMID: 33007240 **Free PMC article.** No abstract available.

Update in **COVID-19** in the intensive care unit from the 2020 HELLENIC Athens International symposium.

2 Rello J, Belliato M, Dimopoulos MA, Giamarellos-Bourboulis EJ, Jaksic V, Martin-Loeches I, Mporas I, Pelosi P, Poulakou G, Pournaras S, Tamae-Kakazu M, Timsit JF, Waterer G, Tejada S, Dimopoulos G.

Share Anaesth Crit Care Pain Med. 2020 Dec;39(6):723-730. doi: 10.1016/j.accpm.2020.10.008. Epub 2020 Oct 22.  
PMID: 33172592 **Free PMC article.** Review.

The 2020 International Web Scientific Event in **COVID-19** pandemic in critically ill patients aimed at updating the information and knowledge on the **COVID-19** pandemic in the intensive care unit. Experts reviewed the latest literature relating to the C ...

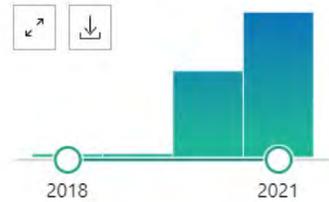
A systematic review and meta-analysis of children with **coronavirus** disease 2019



MY NCBI FILTERS

1,199 results

RESULTS BY YEAR



Use COVID-19 filters from PubMed Clinical Queries to refine your search  
Treatment Mechanism Transmission More filters  
See more SARS-CoV-2 literature, sequence, and clinical content from NCBI

TEXT AVAILABILITY

- Abstract
- Free full text
- Full text

ARTICLE ATTRIBUTE

- Associated data

ARTICLE TYPE

- Books and Documents
- Clinical Trial
- Meta-Analysis
- Randomized Controlled

Filters applied: Clinical Trial. Clear all

- 1 **Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine.**  
Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S, Perez JL, Pérez Marc G, Moreira ED, Zerbini C, Bailey R, Swanson KA, Roychoudhury S, Koury K, Li P, Kalina WV, Cooper D, Frenck RW Jr, Hammitt LL, Túreci Ö, Nell H, Schaefer A, Ünal S, Tresnan DB, Mather S, Dormitzer PR, Şahin U, Jansen KU, Gruber WC; C4591001 Clinical Trial Group.  
N Engl J Med. 2020 Dec 31;383(27):2603-2615. doi: 10.1056/NEJMoa2034577. Epub 2020 Dec 10.  
PMID: 33301246 **Free PMC article.** Clinical Trial.  
BACKGROUND: **Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)** infection and the resulting **coronavirus** disease **2019 (Covid-19)** have afflicted tens of millions of people in a world ...
- 2 **Effect of Bamlanivimab as Monotherapy or in Combination With Etesevimab on Viral Load in Patients With Mild to Moderate COVID-19: A Randomized Clinical Trial.**  
Gottlieb RL, Nirula A, Chen P, Boscia J, Heller B, Morris J, Huhn G, Cardona J, Mocherla B, Stosor V, Shawa I, Kumar P, Adams AC, Van Naarden J, Custer KL, Durante M, Oakley G, Schade AE, Holzer TR, Ebert PJ, ...



covid-19



Search

Advanced Create alert Create RSS

User Guide

Save

Email

Send to

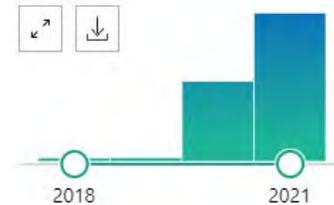
Sorted by: Best match

Display options

MY NCBI FILTERS

693 results

RESULTS BY YEAR



Use COVID-19 filters from PubMed Clinical Queries to refine your search

Treatment Mechanism Transmission More filters

See more SARS-CoV-2 literature, sequence, and clinical content from NCBI

Filters applied: Randomized Controlled Trial. Clear all

TEXT AVAILABILITY:

- Abstract
- Free full text
- Full text

ARTICLE ATTRIBUTE

- Associated data

ARTICLE TYPE

- Books and Documents
- Clinical Trial
- Meta-Analysis
- Randomized Controlled Trial

Effect of Hydrocortisone on Mortality and Organ Support in Patients With **Severe COVID-19**: The REMAP-CAP **COVID-19** Corticosteroid Domain Randomized Clinical Trial.

1  
Cite  
Share

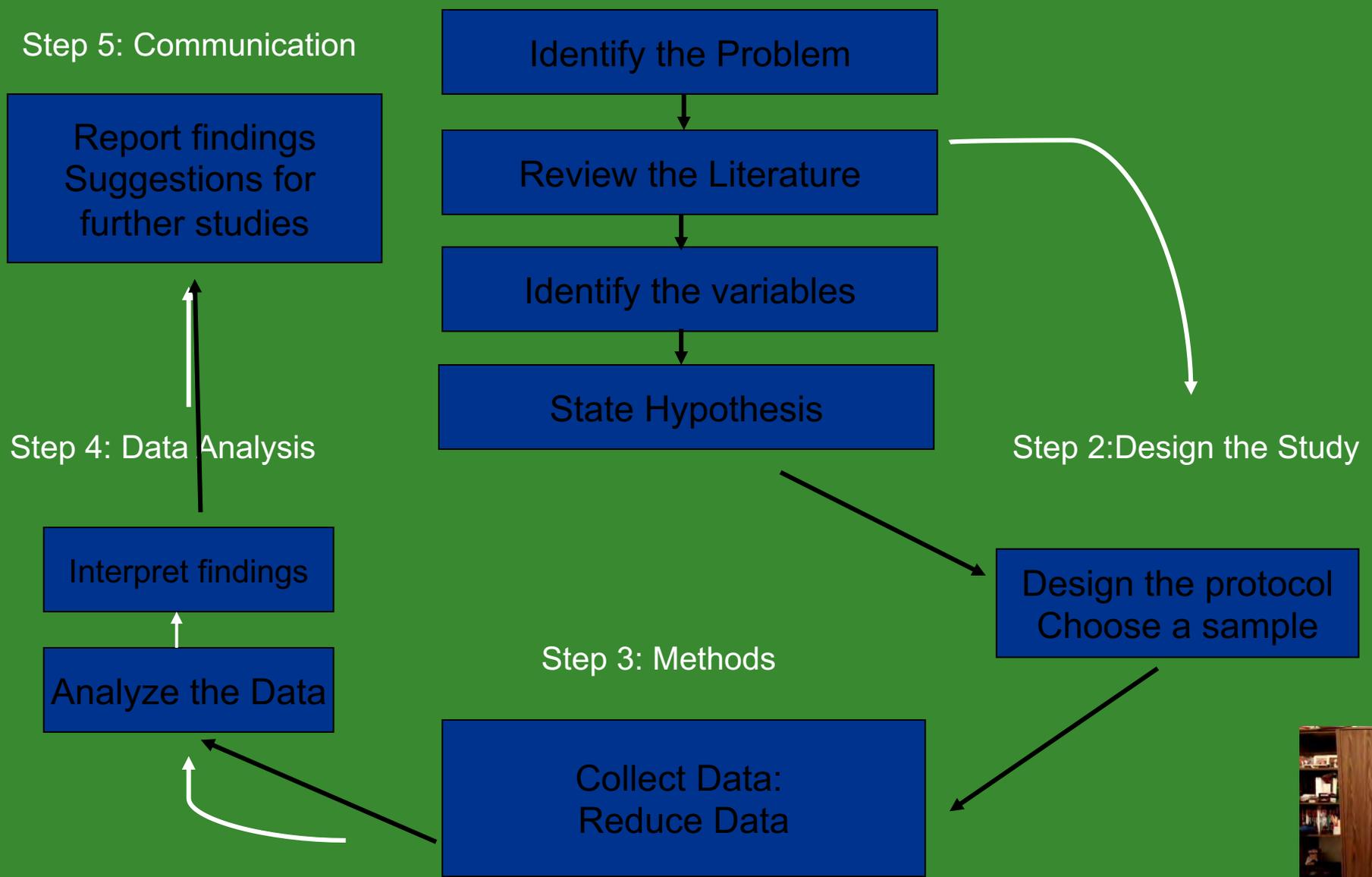
Angus DC, Derde L, Al-Beidh F, Annane D, Arabi Y, Beane A, van Bentum-Puijk W, Berry L, Bhimani Z, Bonten M, Bradbury C, Brunkhorst F, Buxton M, Buzgau A, Cheng AC, de Jong M, Detry M, Estcourt L, Fitzgerald M, Goossens H, Green C, Haniffa R, Higgins AM, Horvat C, Hullegie SJ, Kruger P, Lamontagne F, Lawler PR, Linstrum K, Litton E, Lorenzi E, Marshall J, McAuley D, McGlothin A, McGuinness S, McVerry B, Montgomery S, Mouncey P, Murthy S, Nichol A, Parke R, Parker J, Rowan K, Sanil A, Santos M, Saunders C, Seymour C, Turner A, van de Veerdonk F, Venkatesh B, Zarychanski R, Berry S, Lewis RJ, McArthur C, Webb SA, Gordon AC; Writing Committee for the REMAP-CAP Investigators, Al-Beidh F, Angus D, Annane D, Arabi Y, van Bentum-Puijk W, Berry S, Beane A, Bhimani Z, Bonten M, Bradbury C, Brunkhorst F, Buxton M, Cheng A, De Jong M, Derde L, Estcourt L, Goossens H, Gordon A, Green C, Haniffa R, Lamontagne F, Lawler P, Litton E, Marshall J, McArthur C, McAuley D, McGuinness S, McVerry B, Montgomery S, Mouncey P, Murthy S, Nichol A, Parke R, Rowan K, Seymour C, Turner A, van de Veerdonk F, Webb S, Zarychanski R, Campbell L, Forbes A, Gattas D, Heritier S, Higgins L, Kruger P, Peake S, Presneill J, Seppelt I, Trapani T, Young P, Bagshaw S, Daneman N, Ferguson N, Misak C, Santos M, Hullegie S, Blatz M, Rebbe G, Brown K, Alexander B, Basile K, Girard T, Horvat C, Huang D, Linstrum K,



# Scientific Method

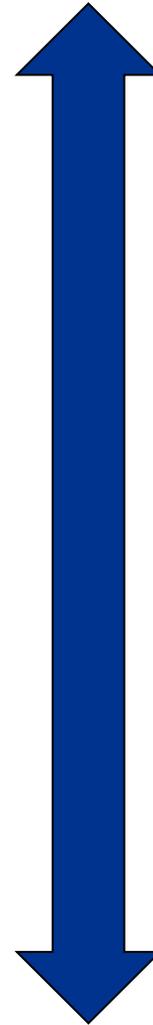


# Scientific Method



# Types of Research

Bench studies  
Computer models  
Case Reports  
Case Series  
Retrospective  
Pre / post design  
Observational trial  
Clinical Trials  
Single center  
Multi center  
Meta-analysis



Lower Quality

Higher Quality



# Types of Research

- Bench Studies
- **Good at Predicting device behaviors**
- **Limited generalizability to real patients**
- Computer modeling
- **Based upon assumptions**
- Case report
- **One patient → one paper**
- Case series
- **Several patients → one paper**



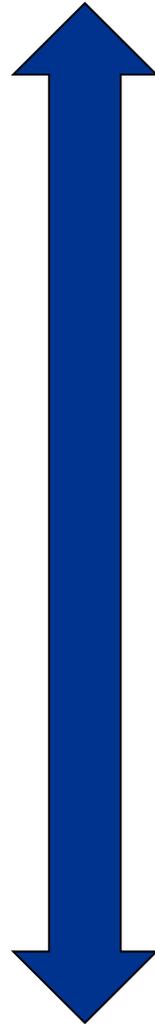
# Types of Research

- Retrospective / observational
- **Review of data after care has been provided**
  
- Pre-post design
- **Most quality improvement projects**
- **Time changes**
  
- Cross-over design
- **Patients undergo multiple setups**
- **The patient is the control**



# Types of Research

Bench studies  
Computer models  
Case Reports  
Case Series  
Retrospective  
Pre / post design  
Observational trial  
Clinical Trials  
**Single center**  
**Multi center**  
Meta-analysis



Less control over test variable

More control over test variable



# Randomized Controlled Trials

What makes a good RCT

## Blinding

- Most common in drug trials

## Randomization

- Each subject has an equal opportunity to be in intervention vs. control
- Clean data collection
- Limitations of bias

## Block randomization

- Deal's provider bias

## Quasi randomization



# Peer Review Process

Considered “highest” level of publication

**Manuscript is submitted**

**Sent to content experts – blinded**

- Considered an “honor” & service to science
- Judges study design, grammar, formatting, etc

**Comprehensive review takes place**

**Feedback provided to editor**

- Reject
- Reject & resubmit with major or minor changes
- Accept

**Resubmit or not**



# Peer Review Process

Challenges to quality publications

**Publish or perish environment**

**Academics need peer reviewed publications for advancement/  
promotion**

Impact Factor

Cost is prohibitive

**Journals limit how many publications they accept**



# Statistics –key concepts

## Descriptive

**Mean (average)**

**Mode**

**Median**

**Standard deviation**

## Inferential

**Make conclusion**

## Levels of data

### Nominal

- Color
- Gender

### Ordinal

- 10 ten best episode of star trek

### Interval

- Wealth

### Ratio

- Can be arranged and & true zero value



All those tests produce a number:

# p-Value!

“p” = probability

A p value of  $< 0.05$  means that your results had a 5% chance of happening at random

Values of  $< 0.05$  or  $0.01$  are usually termed “significant”. They are the cut-off values!

$p \leq 0.05$ : you can claim there is a difference between x and y.

$p \geq 0.06$  you cannot claim there is a difference between x and y.



# Odds Ratio

**Establishes relationship between A & B**

**If relationship is equal, OR will be 1.0**

**< than or > 1.0 means indicates difference**

**Results:** The enrollment of patients in the hydroxychloroquine group was closed on June 5, 2020, after an interim analysis determined that there was a lack of efficacy. Death within 28 days occurred in 421 patients (27.0%) in the hydroxychloroquine group and in 790 (25.0%) in the usual-care group (rate ratio, 1.09; 95% confidence interval [CI], 0.97 to 1.23;  $P = 0.15$ ). Consistent results were seen in all prespecified subgroups of patients. The results suggest that patients in the hydroxychloroquine group were less likely to be discharged from the hospital alive within 28 days than those in the usual-care group (59.6% vs. 62.9%; rate ratio, 0.90; 95% CI, 0.83 to 0.98). Among the patients who were not undergoing mechanical ventilation at baseline, those in the hydroxychloroquine group had a higher frequency of invasive mechanical ventilation or death (30.7% vs. 26.9%; risk ratio, 1.14; 95% CI, 1.03 to 1.27). There was a small numerical excess of cardiac deaths (0.4 percentage points) but no difference in the incidence of new major cardiac arrhythmia among the patients who received hydroxychloroquine.



## Inferential stats

To decide that something made a difference, researchers conduct equations called “statistical tests”

**Student’s t-test**

**Chi squared test**

**Fisher exact test**

**McNemar’s test**

**Spearman rank test**

**Mann-Whitney rank sum test**

**Wilcoxon signed rank test**



## Correlational relationships

**$R^2$ : used to mathematically decide if two variables are “correlated”**

- 0 = not very correlated
- 1.0 = correlated

**Simply shows that two variable are related, should not make some decisions based upon correlation alone**





# Pennsylvania Society For Respiratory Care



[HOME](#) [MEMBERSHIP](#) [CONTINUING EDUCATION](#) [LICENSURE / LEGISLATION](#) [JOB POSTINGS](#) [PSRC AWARDS](#) [PSRC OFFICIARY](#) [MORE LINKS](#)



## Pennsylvania Respiratory Research Collaborative



### **Next Meeting Date**

The next meeting is being scheduled for Wednesday, July 14, 2021 from 11am - 1:00pm and will be held virtually. To register to attend this event, [CLICK HERE](#). (NOTE: If you haven't already done so, please be sure you have joined the collaborative by using the link below prior to RSVP'ing for the meeting.)

### **What IS the "PA Respiratory Research Collaborative"?**

Research and Quality Improvement (QI) within Respiratory Therapy departments is inconsistent both around the country and within Pennsylvania. Research and QI projects are dependent not only on the individuals but also on the resources and mentorship available to them. Unfortunately, there are not enough individuals, resources and mentors available around the state.

However, high level QI projects resulting in great improvements within individual hospitals IS being performed! While many of these projects have resulted in submission of abstracts and poster presentations at conferences such as the American Association for Respiratory Care International Congress, very few of the respiratory therapists take the next step and submit their work for publication. This has led to a tremendous lack of research on respiratory therapy related topics BY respiratory therapists! The PSRC has created the Pennsylvania Respiratory Research Collaborative (PRRC) with the ultimate goal of increasing the amount of research being performed and published by respiratory therapists in the Commonwealth.

[CLICK HERE](#) to view *How To JOIN & Get Involved / Who Can Participate in the PRRC*

[CLICK HERE](#) to view the *Goals of the PRRC*

[CLICK HERE](#) to view the *PRRC Charter*

[CLICK HERE](#) to view *Publications*



# Objectives

- Review origins of Covid-19 outbreak
- Discuss early preparations & early experiences with Covid-19 pandemic
- Review & Discuss research design Process
- Describe the process to critically evaluate a peer reviewed research article
- List Strategies to be successful in working during a pandemic



# Questions to ask when reading a study?

What is it the authors are trying to study?

What is the research question?

Why did the authors think it was important to study?

Will the study design answer the questions the researchers are asking?



## Questions to ask when reading a study?

Are the correct variables being collected? Should they have been looking at something else?

**Bench study vs. people study vs. computer model**

Did the authors report all the results you would have expected them to?

**eg. did they leave something out?**



## Questions to ask when reading a study?

Does the research make an appropriate comparison?

**Did they compare apples to apples, or apples to oranges?**

What do the authors have to gain from this research?

**Pharma / device vendors**

**Special interest foundations**

**Government entities**



Questions to ask when reading a study?

Did the authors do an adequate job of comparing and contrasting their research with other's research?

So what? Does this even make a difference?



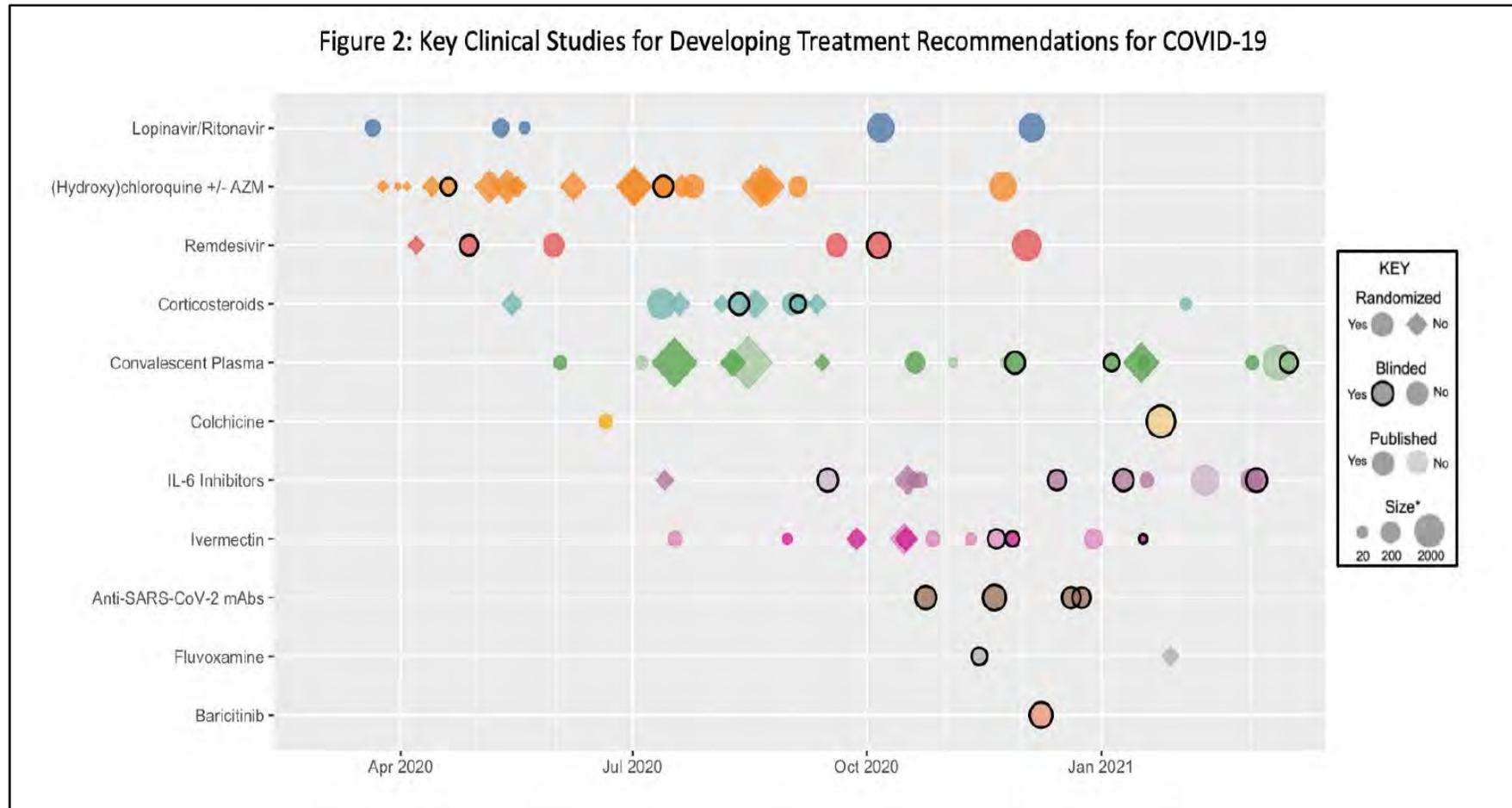
# Common Denial Phrases for negative studies

They didn't study the correct patients

They do the procedure/ drug/ test/ whatever correctly  
(like we would have)

Did not study enough patients

# The Speed of Research During Covid



# Clinical Best Practice

Without new information, best to rely on what you already know to be true

**PPE**

**LPV**

**Rescue strategies**

Leverage resources

**Experiences of others**

**National organizations**

- CDC
- NIH- Covid Treatment guidelines

**Large systems**

The screenshot shows a web browser window displaying the NIH COVID-19 Treatment Guidelines page. The address bar shows 'treatmentguidelines.nih.gov/'. The page features a yellow banner with the text 'COVID-19 is an emerging, rapidly evolving situation' and links to 'Latest public health information from CDC' and 'Latest research information from NIH'. Below this is a grey header with the NIH logo and the title 'COVID-19 Treatment Guidelines', along with a search bar. The main content area has a dark blue background with a microscopic image of a virus. The title 'Coronavirus Disease 2019 (COVID-19) Treatment Guidelines' is prominently displayed, with a white button labeled 'VIEW GUIDELINES' below it. A small credit line 'Credit NIAID-RML' is visible. The footer includes the NIH logo, the URL 'www.covid19treatmentguidelines.nih.gov', and the text 'An official website of the National Institutes of Health'. At the very bottom, a navigation bar contains links for 'Contact Us', 'About NIH', 'Freedom of Information Act', and 'No FEAR Act Data'. The Windows taskbar is visible at the bottom of the browser window.

# Objectives

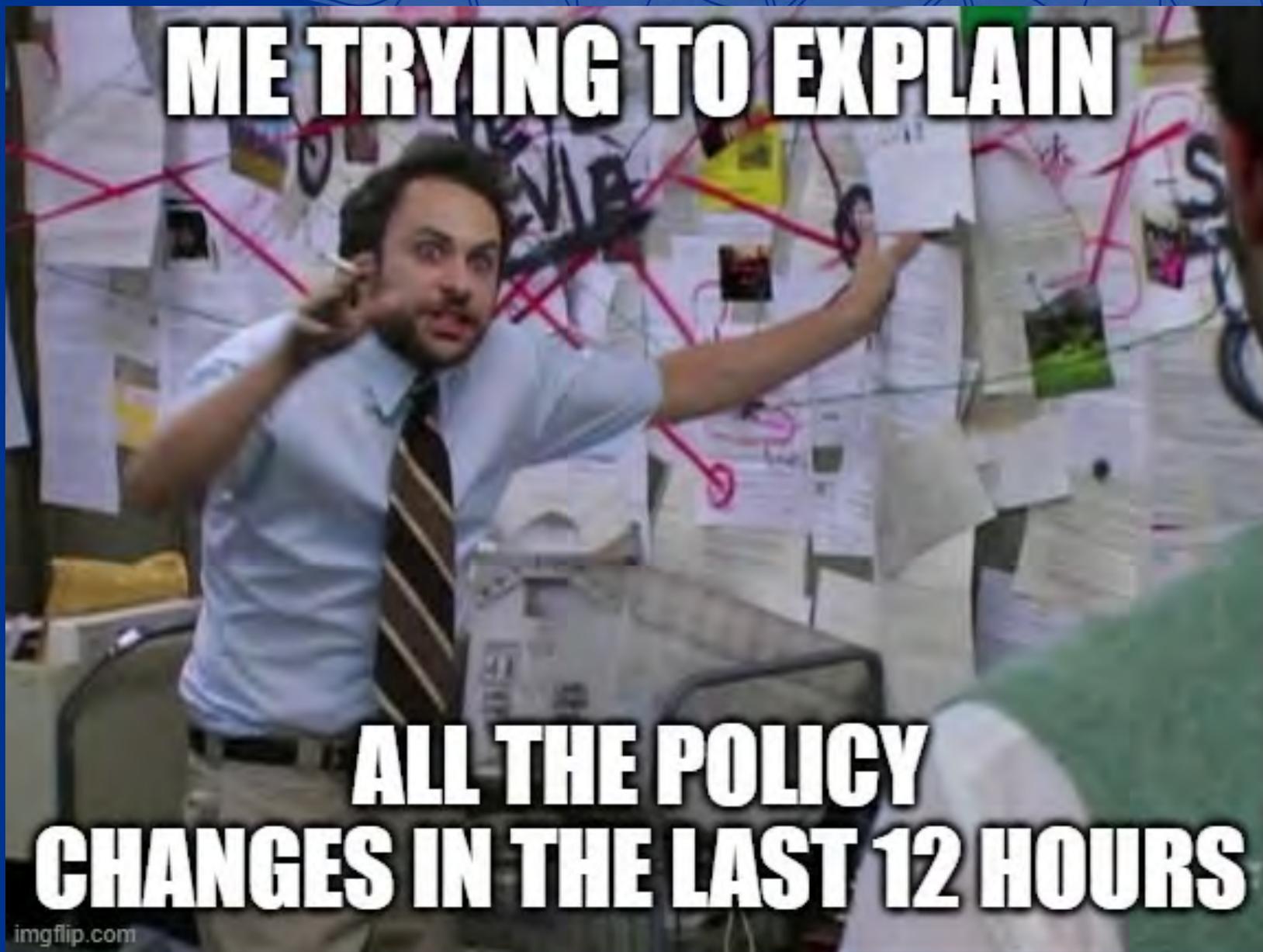
- Review origins of Covid-19 outbreak
- Discuss early preparations & early experiences with Covid-19 pandemic
- Review & Discuss research design Process
- Describe the process to critically evaluate a peer reviewed research article
- List Strategies to be successful in working during a pandemic



# Required Skills to Survive Pandemic

- Communication
- Collaboration
- Adaptability – mental flexibility
- Resilience





# Communication

- Rapid changes in policy demand frequent messaging
- Employ multiple strategies
  - Shift huddle – never underestimate the power of the whiteboard
  - Emails
  - One on one communication through rounding
- Be transparent
  - Sometimes the answer is “I don’t know”
  - Lack of transparency results in lack of trust
- **Be open to feedback**
  - Are the strategies working?



# Collaboration

- Equipment sharing
- **Not all facilities impacted at same time, same manner**
- Share policies
- **Aerosol generating procedures**
- **RT extender training**
- Wellness checks
- **Managers / leaders are our own support group**
- **Be your staff's support**
- Community collaboration
- **Local sourced supply**



# Adaptability- Mental Flexibility

- The most pragmatic practice during the pandemic was not the typical “best practice”, but may be the best practice at that moment
- **PPE usage**
- **HFNC / ventilators**
- Frequent changes to supply & information
- **Hospital policy changes**
- **Exposure practices**



# Staffing

- Educate outside stake holders what your people do
- **Why does RT need access to PPE**
  
- Plan ahead
- **Travelers**
- **Per diem**
  
- Productivity is a secondary concern
  
- Keep the students in mind



# Plan RT extenders

- Other disciplines redeployed
- Have a plan on how to use
- Have a plan on how to train
- Scope of practice issues

***Bioterrorism and Other Public Health Emergencies  
Tools and Models for Planning and Preparedness***

## **Project XTREME**

*Model for Health Professionals' Cross-Training for Mass Casualty  
Respiratory Needs*

### **Report**

**Prepared for:**  
Agency for Healthcare Research and Quality  
U.S. Department of Health and Human Services  
540 Gaither Road  
Rockville, Maryland 20850  
[www.ahrq.gov](http://www.ahrq.gov)

**Contract No. 290-00-0014-10**

**Prepared by:**  
Denver Health  
Denver, Colorado

Michael Hanley, M.D., Principal Investigator  
Greg Bogdan, Ph.D., Denver MMRS Coordinator  
Phil Goodman, RRT, MSHSA, Service Line Administrator  
Russell Woodruff, RRT, Director of Respiratory Therapy  
Catherine Dingley, RN, PhD, FNP Coordinator of Nursing Research  
Robin Green, Assistant General Counsel  
Angela M. Keniston, MSPH, Project Manager

**AHRQ Publication No. 07-0017  
March 2007**



# Evaluation of Respiratory Therapist Extender Comfort With Mechanical Ventilation During COVID-19 Pandemic

Karsten J Roberts, Bridgette Johnson, Heather M Morgan, Jody M Vrontisis, Katie M Young, Edward Czerpak, Barry D Fuchs, and Margie Pierce

CRNA' provided 60 minutes didactic

Ventilator stations for "hands on" with 4 different ventilators

8-10 hour job shadows

CRNA's assigned to RT for 12 hour shifts

Qualitative survey to assess CRNA comfort

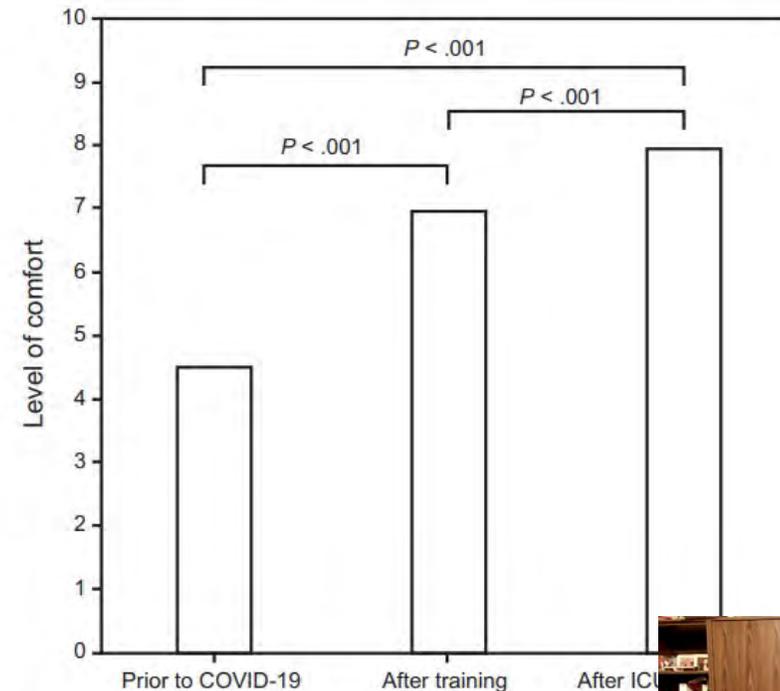


Fig. 2. Wilcoxon signed ranks test comparing mean level of comfort with critical care ventilators.

Source: Roberts KR et al. Respir Care. 2021



# Adaptability- Mental Flexibility

- Case count projections
- **Projected to need around 200 ventilators**
- Working with newer staff
- **Rapid / frequent onboarding**
- Resilience
- **Marathon versus sprint mentality**
- **Burnout is not a very real concern**



## RT Burnout during Covid

- Miller et al. Survey RT's in different health systems & AARC Connect
- N = 220
- Self reported burnout is high: 72.4%
- Poor management & high workload, & staffing biggest impact
- Few differences between Covid-19 hotspots

Source: Miller AG et al. Respir Ca



## Summary

- A firm understanding of the scientific method is key to understanding the large amounts of research coming from this pandemic
- Frequent communication & Collaboration is key to surviving a pandemic
- Frequent collaboration can solve many problems
- Adaptability / flexibility is required to adjust to the different demands to maintain resilience



Questions?  
Carl.Hinkson@providence.org

