# Non-inferiority study of Telemedicine versus in-person Cognitive Behavioral Therapy for Insomnia

**Sairam Parthasarathy, MD**

Murray and Clara Walker Chair and Chief of the Division, of Pulmonary, Allergy, Critical Care and, Sleep Medicine at the University of Arizona , College of Medicine in Tucson, Arizona.

# Insomnia epidemiology

## Insomnia is prevalent and persistent

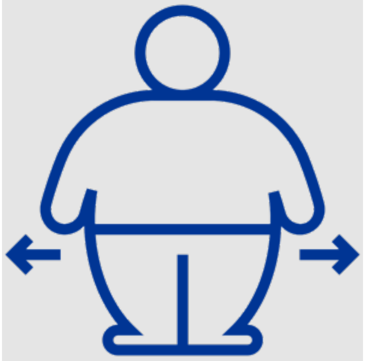
- Insomnia Disorder prevalence in adults: **13-15%**[1,2]
- **30 million Americans** have diagnosable chronic insomnia[1,2]
- Symptoms persist for **≥3 years in 40%** of patients[6]

## Insomnia is a primary care problem

- When patients seek care, **83%** approach their primary care provider[7]
- Insomnia occurs in **10-26%** of adult **primary care** patients[3-5]
- Only **31%** of patients with sleep problems discuss with their physician[7]

[1]Morin, *Can J Psychiatry* 2011; 56:540-548. [2]Roth, *Biol Psychiatry* 2011; 69:592-600. [4]Simon GE, *Am J Psychiatry*, 1997;154:1417-23. [4]Shochat T, *Sleep*, 1999;22 Suppl 2:S359-65. [5]Wittchen HU*Fortschr Med Orig*, 2001;119(1):9-19. [6]Morin, *Arch Int Med* 2009;169:447-53. [7]Morin, *Sleep Med*. 2006; 7: 123-130.

# Insomnia is associated with increased risk of…



Obesity[1-2]

Hypertention[3-5]

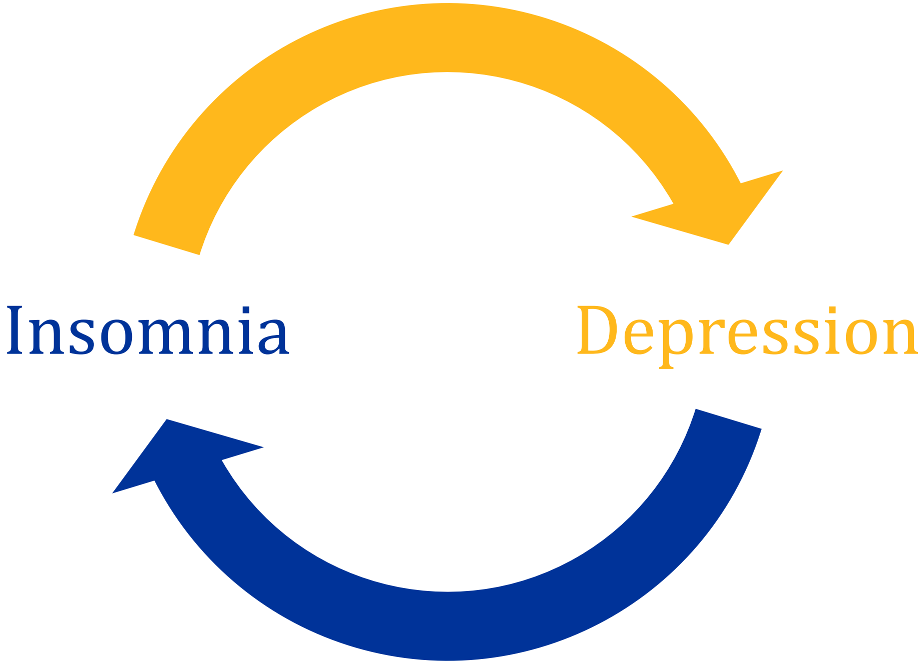
Falls[6-11]

Cognitive decline[12-15]

Mortality[16,17]

[1]Patel SR, et al. *Int J Obesity*. 2008;32:1825-34. [2]Fogelholm M, et al. *Int J Obesity*. 2007;31:1713-21. [3]Fung MM, et al. *Hypertension*. 2011;58:596-603. [4]Lofaso F, et al. Chest. 1996;109:896-900. [5]Redline S, et al. *Sleep*. 2005;28:1122-30. [6]Avidan AY, et al. *J Am Geriatr Soc*. 2005;53:955-62. [7]Brassington GS, et al. J Am Geriatr Soc. 2000;48:1234-40. [8]Latimer Hill E, et al. *J Gerontol A Biol Sci Med Sci*. 2007;62:62-6. [9]Stone KL, et al. Arch Internal Med. 2008;168:1768-75. [10]Stone KL, et al. J Am Geriatr Soc. 2014;62(2):299-305. [11]Stone KL, et al. *J Am Geriatr Soc.* 2006;54:1177-83. [12]Blackwell T, et al. Sleep. 2011;34:1347- 56. [13]Blackwell T, et al. *J Gerontol A Biol Sci Med Sci*. 2006;61:405-10. [14]Blackwell T, et al. *Sleep.* 2014;37:655-63. [15]Diem SJ, et al. *Am J Geriatric Psychiatry*. 2016;24:248-58. [16]Vgontzas A, MD, Duanping Liao, MD, PhD, Slobodanka Pejovic, MD, Susan Calhoun, PhD, Maria Karataraki, PsyD, Maria Basta, MD, Julio Fernández-Mendoza, PhD, et al. *Sleep*. 2010. 33: 1159–1164. [17] Parthasarathy S, et al. *Am J Med*. 2015: 128: 268-275.e2

# Insomnia and depression




Insomnia predicts subsequent depression

- Adults of all ages[1]
  - Meta-analysis of 17 studies
  - Odds ratio = 2.10 (1.86 – 2.38)
- Older adults[2]
  - Odds Ratio = 2.6 (1.9 – 3.7)
  - Risk comparable to that of prior depression, new onset medical illness, cognitive impairment

[1]Baglioni, *J Affect Disord* 2011; 135:10-19. [2]Cole & Dendukuri, *Am J Psychiatry*, 2003; 160: 1147-1156

# Economic costs of insomnia

U.S. annual cost of insomnia **>$100 Billion**

**Additional Annual Healthcare Costs**

**>$2000** Direct Costs

**>$1000** Indirect Costs

per person with insomnia

**Workplace Costs**

**$63 Billion**

**$2280** Per employee in lost productivity

**Workplace Accidents and Errors**

**23.7%** of costs of workplace errors and accidents

Average accident cost

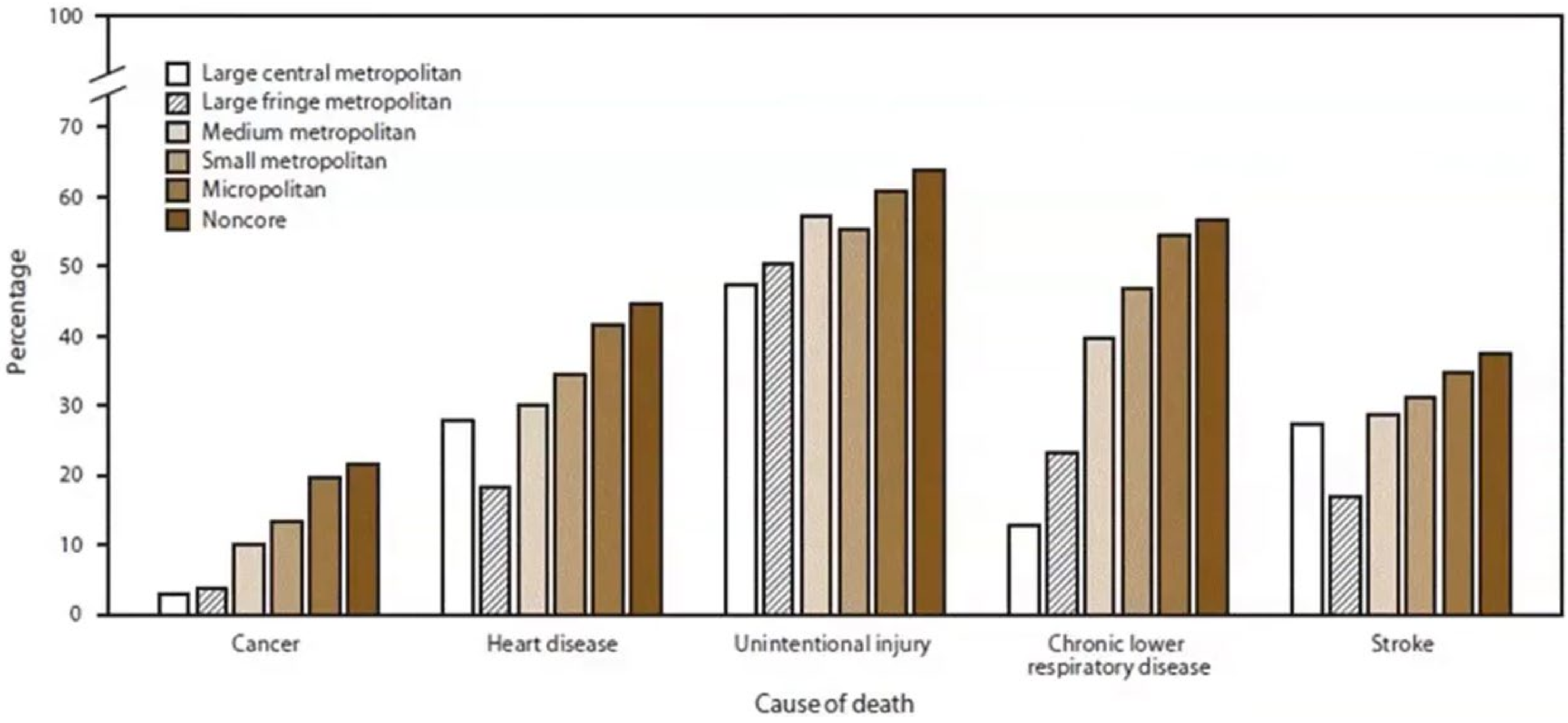
**$32,062**

Ozminkowski, et al., *SLEEP*, 2007; 30(3): 263-273. Kessler, et al., *SLEEP*, 2011; 34 (9): 1161-1171. Shahly, *Arch Gen Psychiatry*, 2012. Pearson, et al., *JAMA Intern Med*, 2006. Gehrman, et al., *SLEEP*, 2013; 36 (7): 109-1018. Meng, et al., *Hypertens Res*. 2013 Nov; 36 (11): 985-995.

# Background

- 17% of Americans live in Rural Areas
- 50% higher heart disease; 75% higher respiratory disease
- 20,000 excess disease due to cancer
- 40% more likely to be hospitalized or die due to COVID-19 disparities
- Widening disparities between rural and urban areas
- Access to care, lower insurance, and closure of rural hospitals
- Delays in physical and mental health

# High rates of avoidable or excess deaths



# Background - 2

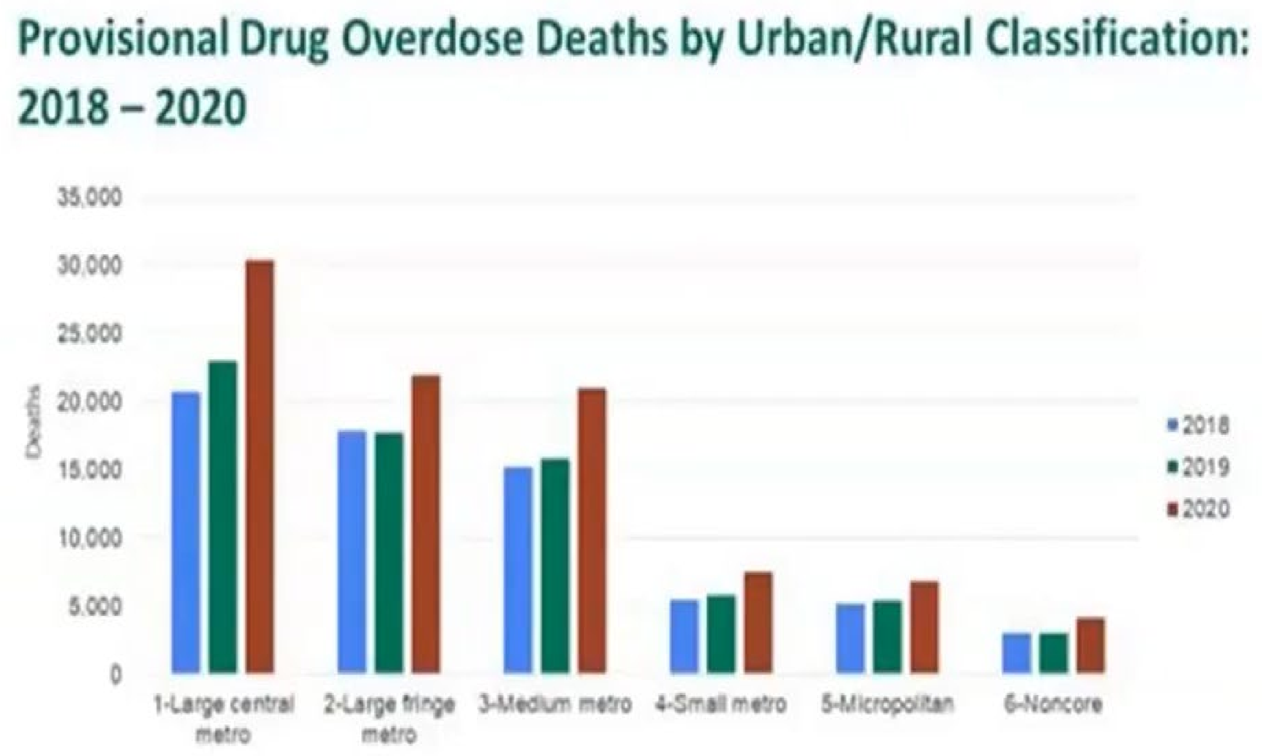
- Suicide and drug overdose are on the rise following the pandemic
- Difficulty sleeping and stress during the COVID pandemic
- More likely to be hospitalized or die due to non COVID disease
- Health disparities –
  - Increased mortality
  - More prevalent chronic disease
  - Reduced life expectancy (~ 3 years less)
- Technological developments give us hope

# Opioid Epidemic in Rural Communities during a Pandemic

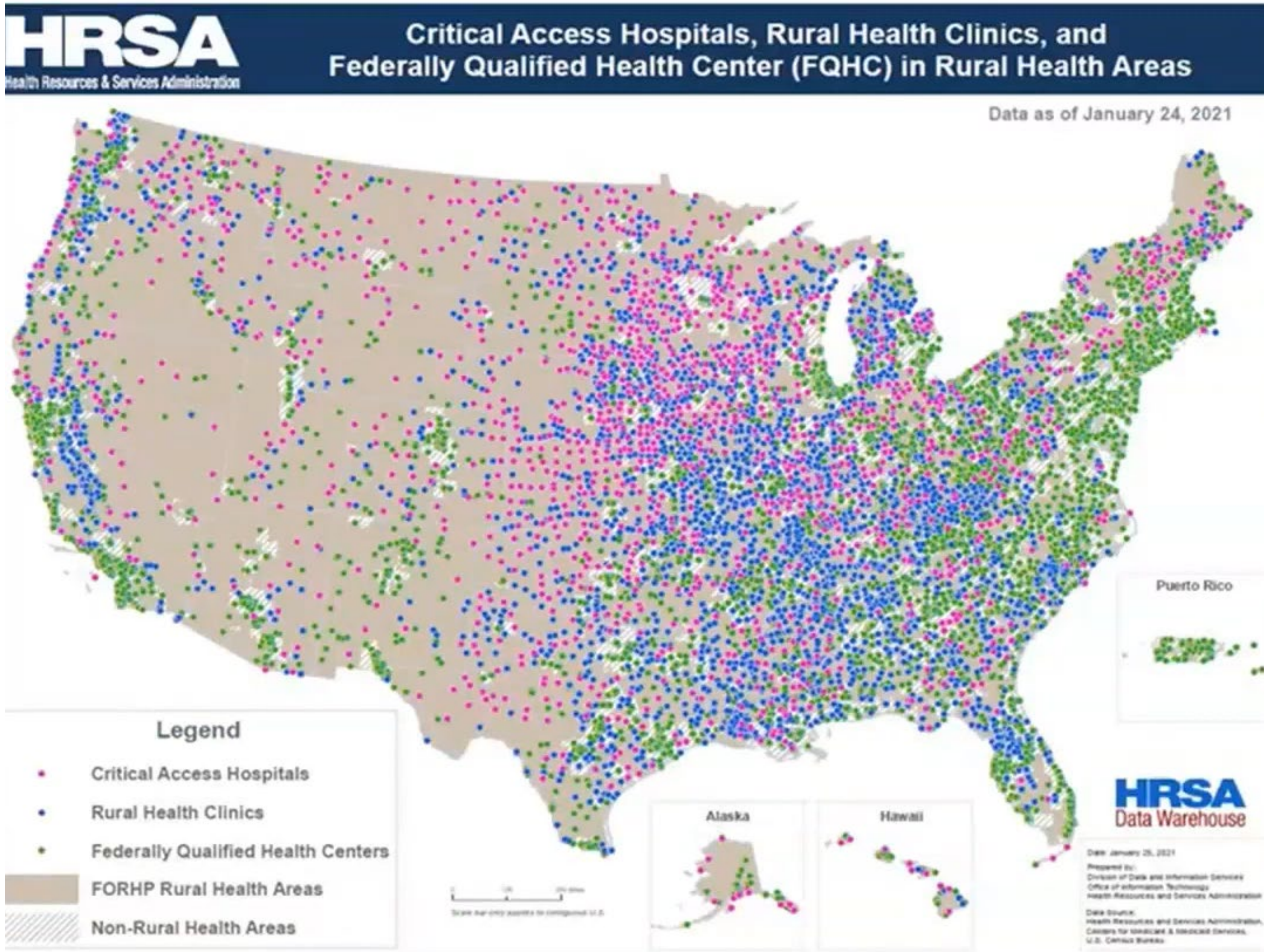
Pandemic has driven increases in death

Rural areas have limited infrastructure

Other substance issues beyond opioids



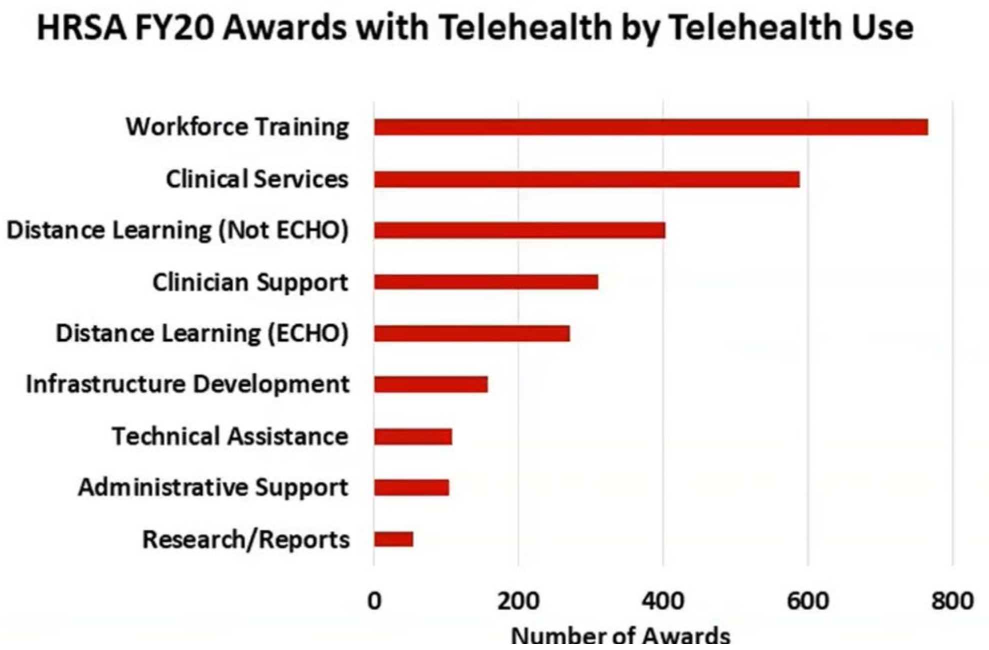
# Regional variation in availability of healthcare resources




Which rural area you live in may affect your access to clinical Resources:

- Critical access hospitals
- Rural Health Clinics
- FQHCs

# Current status





BRIEFING ROOM

Fact Sheet: Biden Administration Takes Steps to Address COVID-19 in Rural America and Build Rural Health Back Better

AUGUST 13, 2021 • STATEMENTS AND RELEASES

Today, the Biden Administration is taking action to improve the health of rural communities by making billions of dollars in American Rescue Plan funding available to meet immediate COVID-19 needs. This funding, which will also help rural hospitals stay open in the long run and improve the care

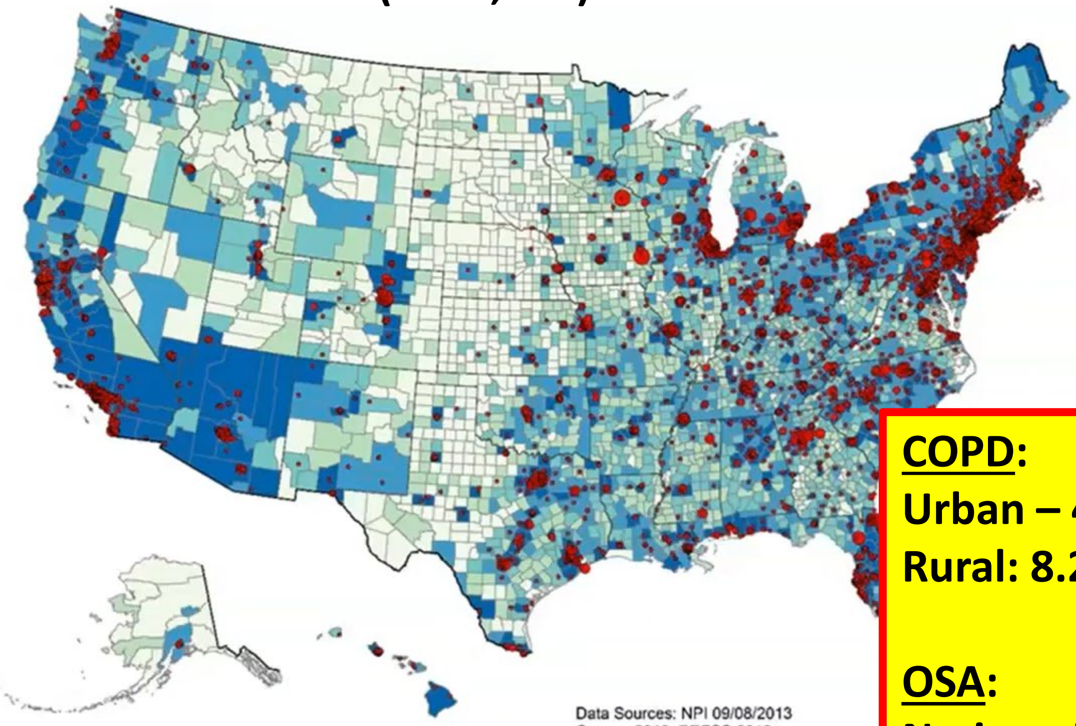
- **Scientific evidence**
- **Adoption and workforce training**
- **Infrastructure**
- **Specialty care**

- **Reimbursement (fee-for-service /value based care)**
- **Access to broadband**
- **Licensure**

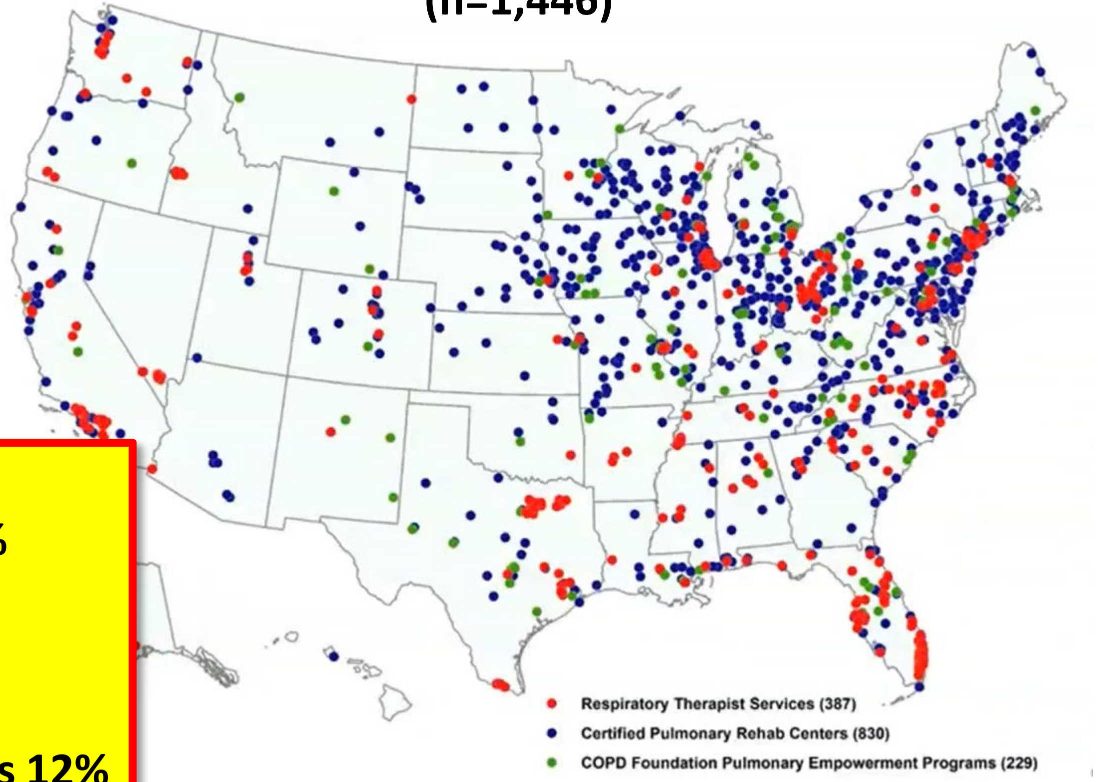
# Geographic Access

## Specialists and Resources

**Pulmonologists**
**(n=12,392)**




**Pulmonary Rehabilitation**
**(n=1,446)**




**COPD:**
**Urban – 4.7%**
**Rural: 8.2%**

**OSA:**
**Nationwide is 12%**

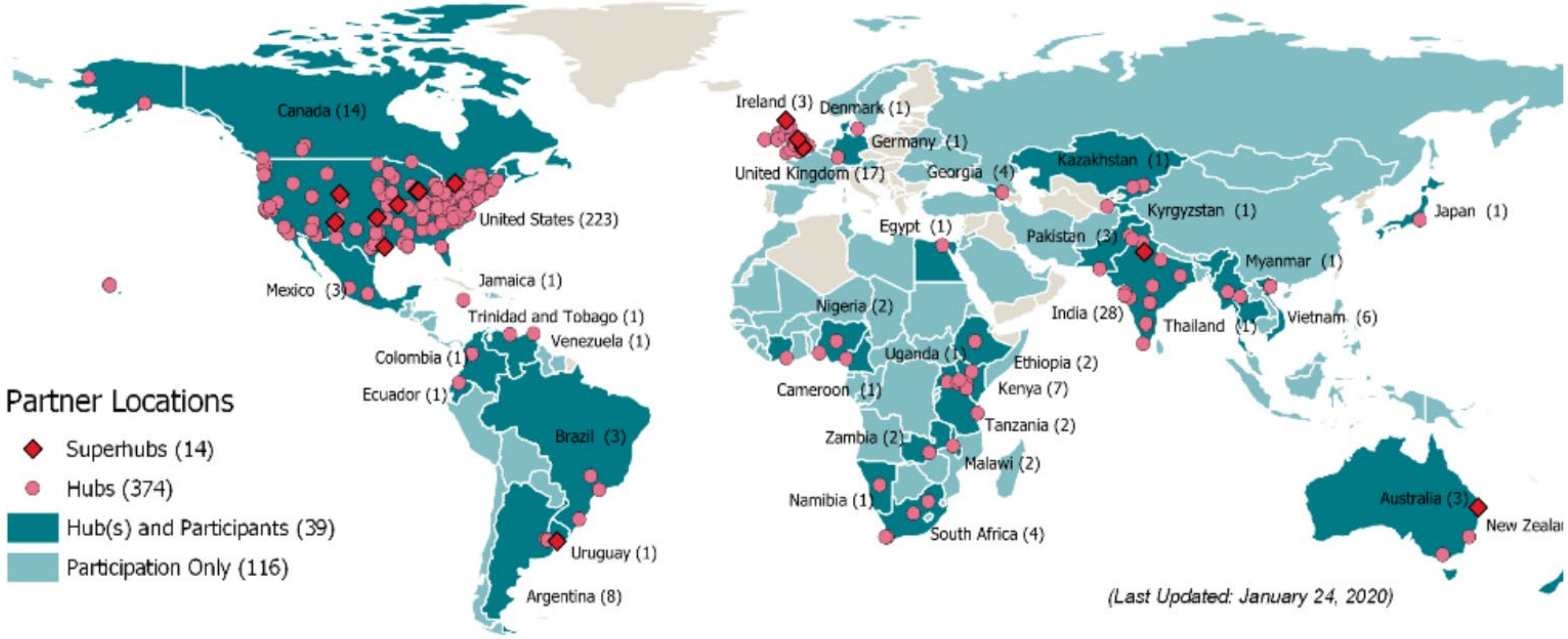
# Questions?

1. **What is the uptake of different types of provider-to-provider telehealth in rural areas?**
2. What is the effectiveness of provider-to-provider telehealth for rural patients?
3. What strategies are effective and what are the barriers and facilitators to implementation and sustainability of provider-to-provider telehealth in rural areas?
4. What are the methodological weaknesses of studies of provider-to-provider telehealth for rural patients and what improvements in study design (e.g., focus on relevant comparisons and outcomes) might increase the impact of future research?

# History of Telemedicine


- Tohono O'odham Nation
- Funded by NASA
- Satellite technology
- Physician consultation
- Newborn

Project ECHO®




In 2013, when Project ECHO first rolled out Zoom, ECHO had 13 Domestic Hubs, 1 International Hub, and one multi-site VA program.

ECHO now has over 220 hubs, more than 135 domestic hubs, and over 80 international hubs in 32 countries

# Provider-to-Provider Consultations $

(Falls outside Telehealth – per CMS*)

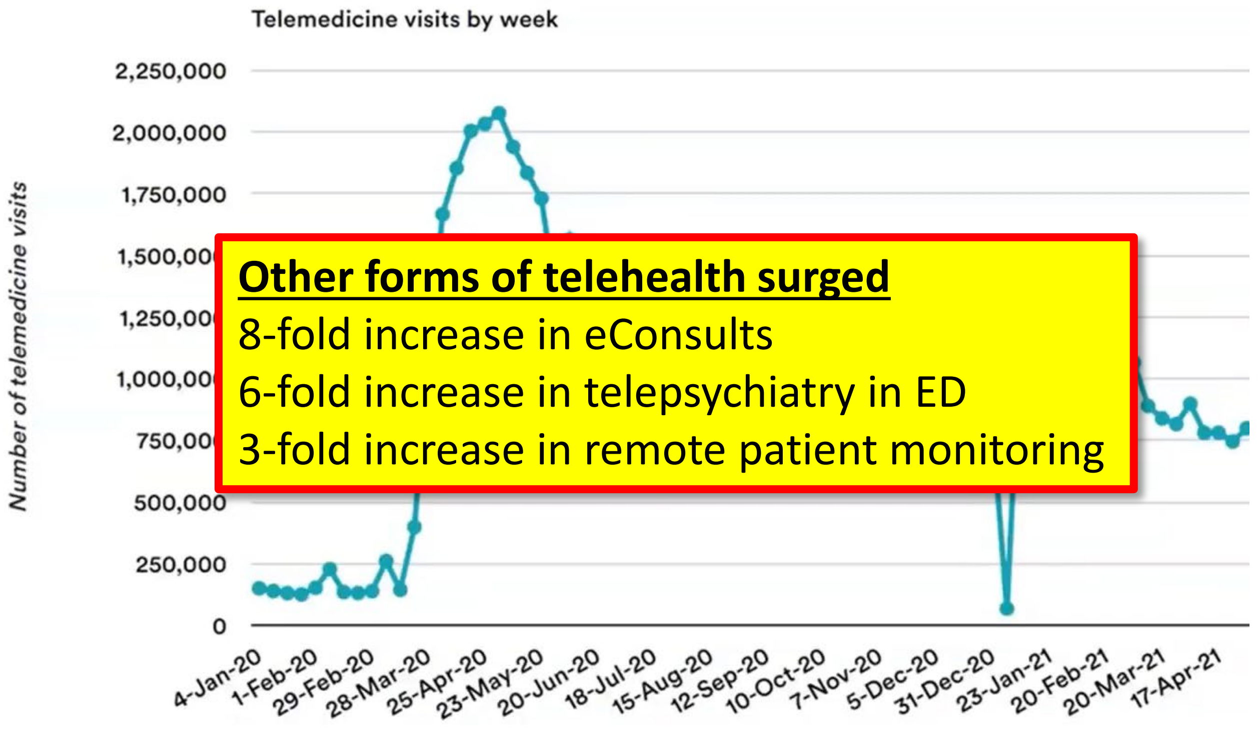
- Code 99452 devalues primary care time
  - 5 min of consultant's time (code 99451) has the same 0.70 RVU as 30 min of primary care (code 99452)
- For codes 99446-99449, greater than half of the time must be spent in "medical consultive verbal or internet discussion"
- Code 99451 may be billed if **more than** 50% of time is spent in data review/analysis
- Major issues include perceptions of fraud, and increased burden for primary care

| Code | Description #; @ | 2021 wRVU | Total National non-facility RVUs | Total National facility RVUs | |
|---|---|---|---|---|---|
| 99446 | Interprofessional telephone/Internet/electronic health assessment and management service provided by a consultative physician, including a verbal and written report to the patient's treating/requesting physician or other qualified health care professional; 5-10 minutes of medical consultative discussion and review | 0.35 | 0.54 | 0.54 | MD, DO |
| 99447 | 11-20 minutes of medical consultative discussion and review | 0.70 | 0.97 | 0.97 | MD, DO |
| 99448 | 21-30 minutes of medical consultative discussion and review | 1.05 | 1.54 | 1.54 | MD, DO |
| 99449 | 31 minutes or more of medical consultative discussion and review | 1.40 | 2.10 | 2.10 | MD, DO |
| 99451 | Interprofessional telephone/Internet/electronic health assessment and management service provided by a consultative physician, including a written report to the patient's treating/requesting physician or other qualified health care professional, 5 minutes of medical consultative discussion and review | 0.70 | 1.04 | 1.04 | MD, DO |
| 99452 | Interprofessional telephone/Internet/electronic health record referral service(s) provided by a treating/ requesting physician or other qualified health care professional, 30 minutes | 0.70 | 1.05 | 1.05 | NP, PA |

**<u>Provider-to-Patient telemedicine:</u>**
Patient needs to be in a facility (2020 US Congress)
CMS Support – A major barrier for Adoption
Category 3 codes – Permanence of telehealth codes

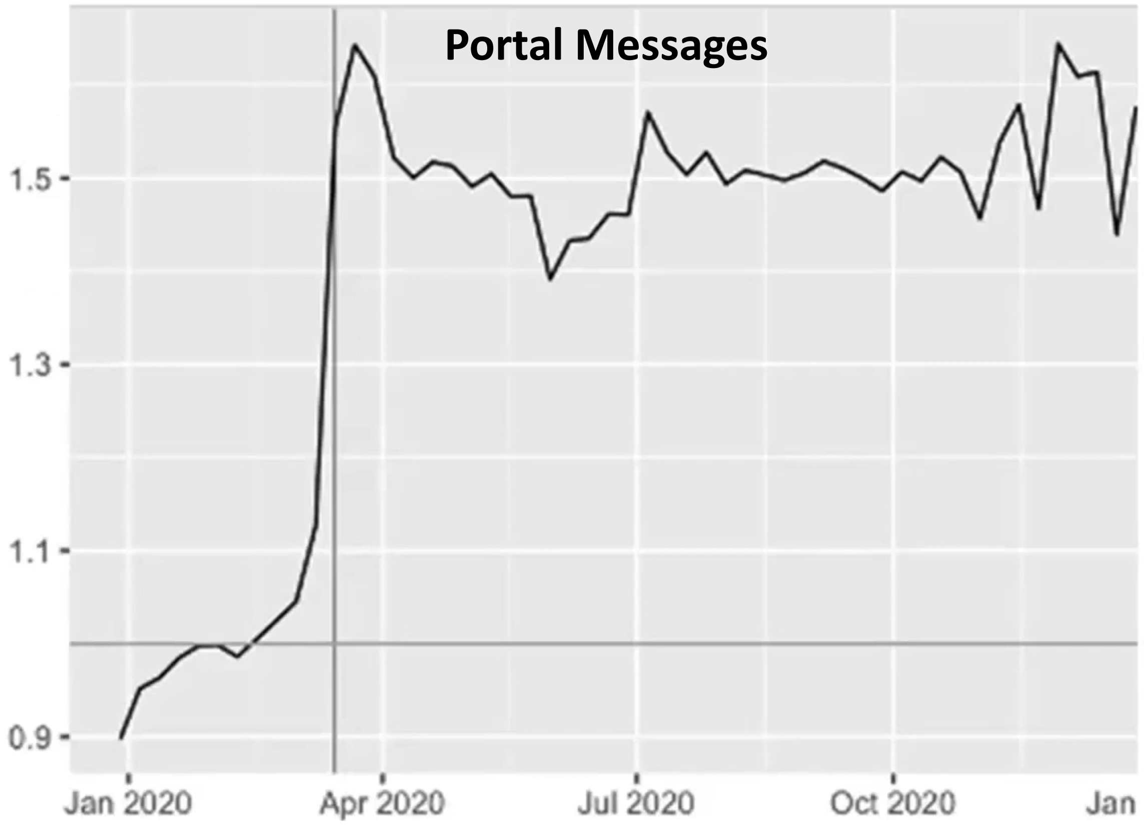
**$ 2018 CMS; * 1834M Social Security Act; # 14-day rule; @ Patient consent**

## Provider-to-Patient Telemedicine COVID-19 pandemic

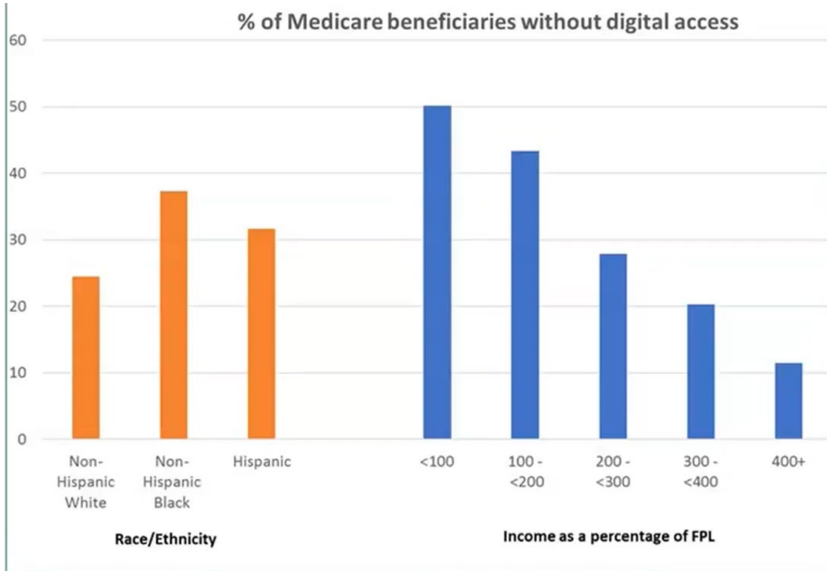


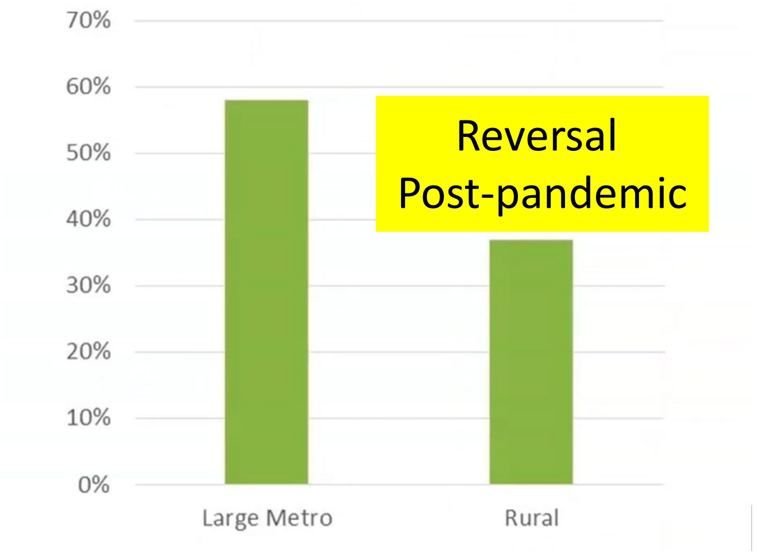

**<u>Other forms of telehealth surged</u>**
8-fold increase in eConsults
6-fold increase in telepsychiatry in ED
3-fold increase in remote patient monitoring

## Variations in Telehealth Use by Specialty



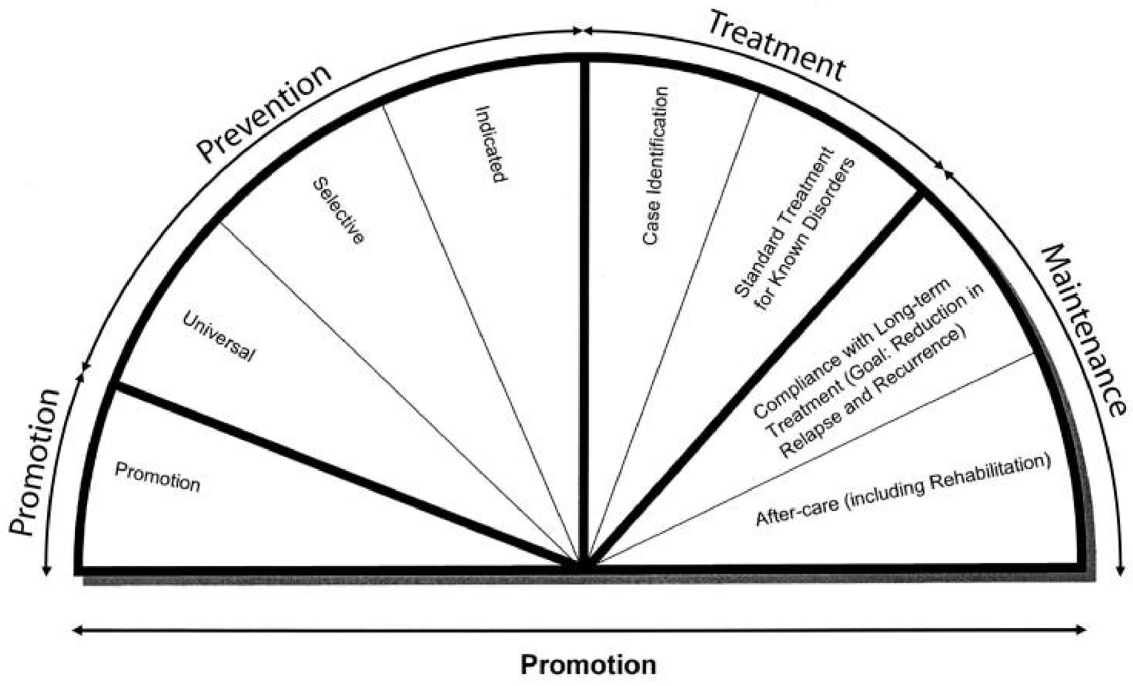
# Digital Divide



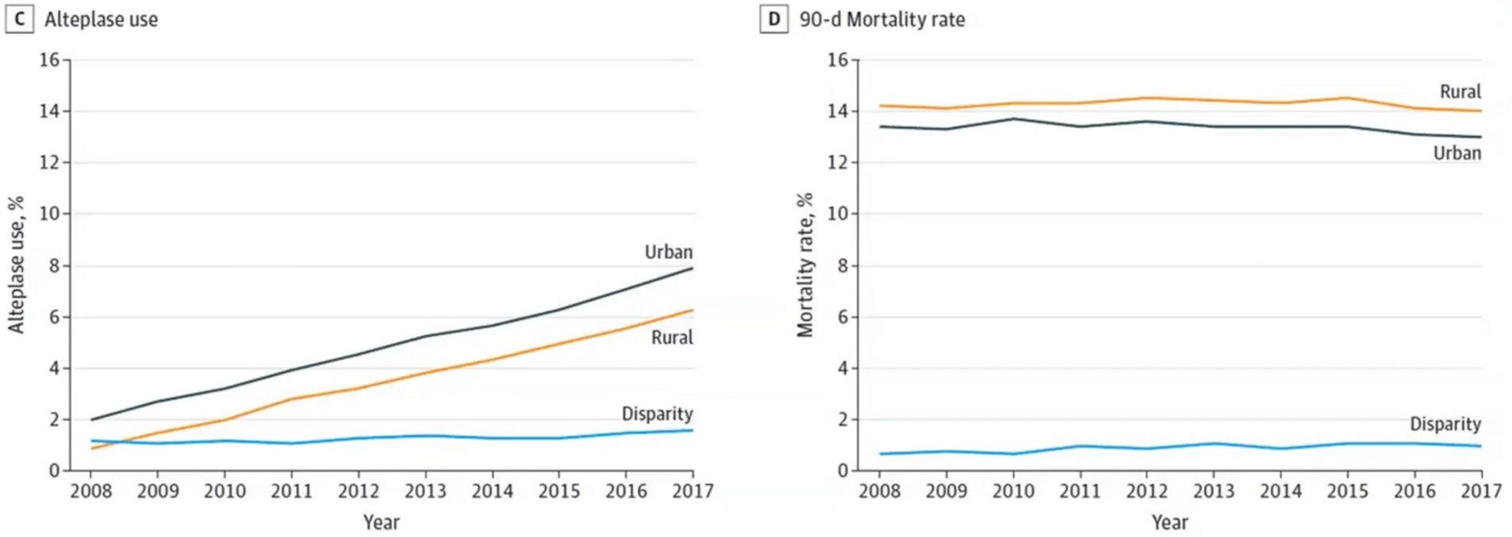

Roberts ET, Mehrotra A. *JAMA Intern Med*. 2020;180(10):1386-1389.; Josh Gray, STAT News

# Inexhaustible resource of telehealth to reduce mental health disparities




Muñoz RF. *J Med Internet Res*. 2010;12(5):e60.

# P2P for Tele-stroke





- ED makes referral
- Video visit for interview and exam along with local provider
- Remote review of CT scan and other imaging

Wilcock et al, JAMA Neurol 2020; May 1;78(5):527-535.

# COVID Pandemic

**Acute clinical care**

- Surge line
- Admin triage
- Emergency P2P communication
- Discussion of care/stabilization
- Transfer for management

**Current COVID Management**

- P2P Warmline
- P2P COVID Grand Rounds

# P2P For COVID related Information

**Elizabeth Connick, MD**
Chief, Division of Infectious Diseases
Professor, Medicine
Professor, Immunobiology
Professor, BIO5 Institute
Program Director, Infectious Diseases Fellowship

**Danielle deMontigny Avila, MD**
Clinical Assistant Professor, Medicine - (Clinical Series Track)

**Nirav Merchant**
Director, UA Data Science Institute (Data7) Co-PI for NSF CyVerse Interim Director, CB2


**Puneet Shroff, MD**
Clinical Associate Professor, Medicine
Associate Clinic Director, Allergy Clinic – Banner University Medical Group Tucson

**Lauren E. Estep, MD**
Clinical Assistant Professor, Medicine

**Sairam Parthasarathy, MD**
Professor, Medicine
Chief, Division of Pulmonary, Allergy, Critical Care and Sleep Medicine
Director, Center for Sleep and Circadian Sciences, UA Health Sciences

**ADHS; AzCRH; CDC-RFA-OT21-2103**


https://ceal.arizona.edu/provider-education

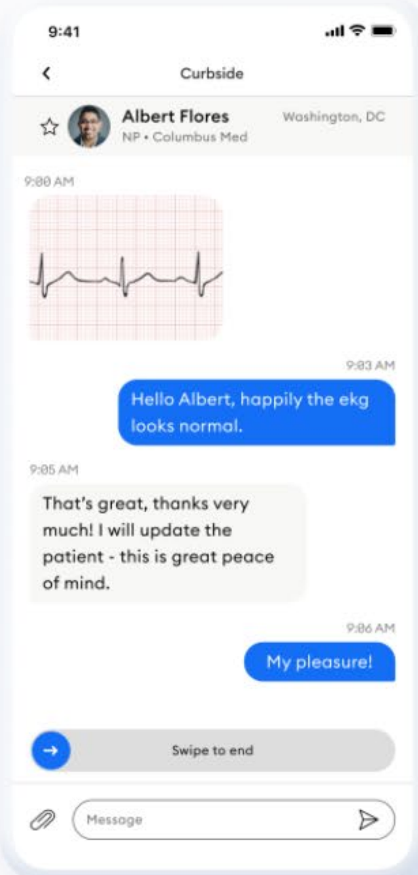

PicassoMD

Solution | Providers | Insurers | Contact | Resources | Join PicassoMD | Login

# Triage.
# Transition.
# Trust.

PicassoMD instantly connects healthcare providers for clinical decision support, referrals and care coordination.

Learn More

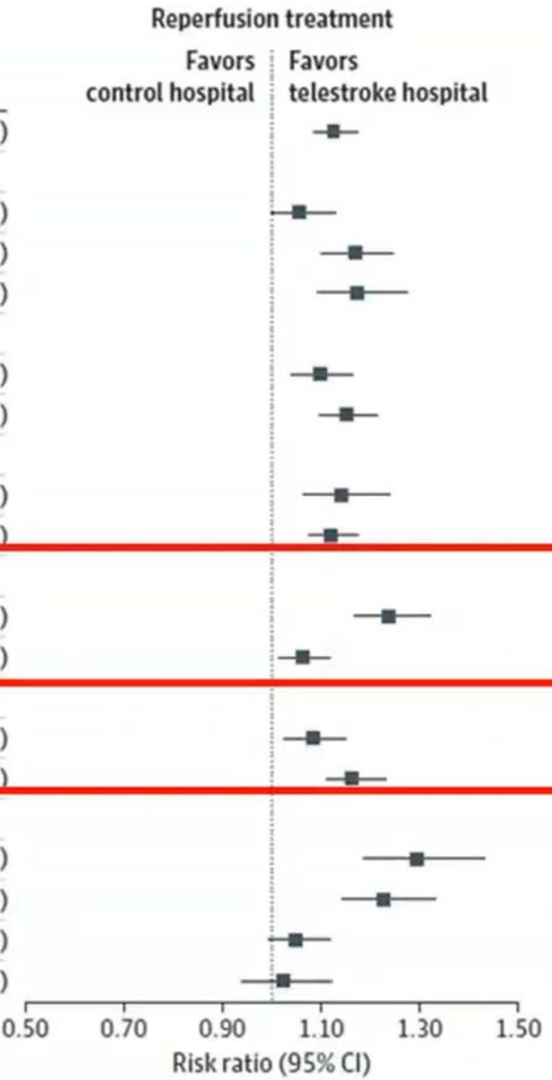


# Questions?

1. What is the uptake of different types of provider-to-provider telehealth in rural areas?
2. **What is the effectiveness of provider-to-provider telehealth for rural patients?**
3. What strategies are effective and what are the barriers and facilitators to implementation and sustainability of provider-to-provider telehealth in rural areas?
4. What are the methodological weaknesses of studies of provider-to-provider telehealth for rural patients and what improvements in study design (e.g., focus on relevant comparisons and outcomes) might increase the impact of future research?

# P2P for Tele-stroke

| Subgroup | Patients, No. | Risk ratio (95% CI) |
|---|---|---|
| Overall | 153 272 | 1.13 (1.09-1.17) |
| Age, y | | |
| <75 | 52 422 | 1.06 (1.00-1.13) |
| 75-84 | 54 102 | 1.17 (1.10-1.25) |
| ≥85 | 46 748 | 1.18 (1.09-1.27) |
| Sex | | |
| Male | 65 154 | 1.10 (1.04-1.17) |
| Female | 88 118 | 1.15 (1.10-1.22) |
| History of atrial fibrillation | | |
| Yes | 35 086 | 1.15 (1.06-1.24) |
| No | 118 186 | 1.12 (1.08-1.18) |
| Patient residence | | |
| Rural | 60 012 | 1.24 (1.17-1.32) |
| Urban | 93 260 | 1.07 (1.02-1.12) |
| Thrombectomy era | | |
| Before 2015 | 85 600 | 1.09 (1.03-1.15) |
| 2015 And after | 67 672 | 1.17 (1.11-1.23) |
| 6-mo Hospital stroke volume | | |
| 1-11 | 27 180 | 1.30 (1.19-1.43) |
| 12-23 | 38 480 | 1.23 (1.14-1.33) |
| 24-52 | 58 286 | 1.05 (0.99-1.12) |
| 53-163 | 29 326 | 1.03 (0.94-1.12) |




Wilcock et al, JAMA Neurol 2021;78(5):527-535

| Hospital Characteristics | With Telestroke Capacity | Without Telestroke Capacity | p-value[1] |
|---|---|---|---|
| | N=1306 | N=3445 | |
| Location of Hospital | | | |
| Urban | 856 (30.2%) | 1979 (69.8%) | <0.01 |
| Rural | 450 (23.5%) | 1466 (76.5%) | |
| Number of Beds (Quartile) | | | |
| 0-25 (Quartile 1) | 201 (14.8%) | 1154 (85.2%) | <0.01 |
| 26-72 (Quartile 2) | 167 (22.2%) | 586 (77.8%) | |
| 73-186 (Quartile 3) | 415 (38.4%) | 666 (61.6%) | |
| 187+ (Quartile 4) | 523 (33.5%) | 1039 (66.5%) | |
| Ownership | | | |
| For-Profit | 303 (37.1%) | 514 (62.9%) | <0.01 |
| Non-Profit | 780 (28.2%) | 1984 (71.8%) | |
| Government | 194 (19.3%) | 809 (80.7%) | |
| Intensive Care Unit in Hospital | | | |
| Yes | 843 (33.5%) | 1672 (66.5%) | <0.01 |
| No | 434 (21.0%) | 1635 (79.0%) | |

**Barriers:**
Administrative costs
Distortions
Out of pocket costs for patients,

Richards et al, JAMA Neurol 2020

# Summary of Evidence

- Provider to Provider Telehealth to support direct patient care **may provide benefits** for:
  - Inpatient care
  - Neonates in rural hospitals
  - Outpatient management of depression and diabetes
  - Emergency care for stroke/heart attack/chest pain as well as trauma

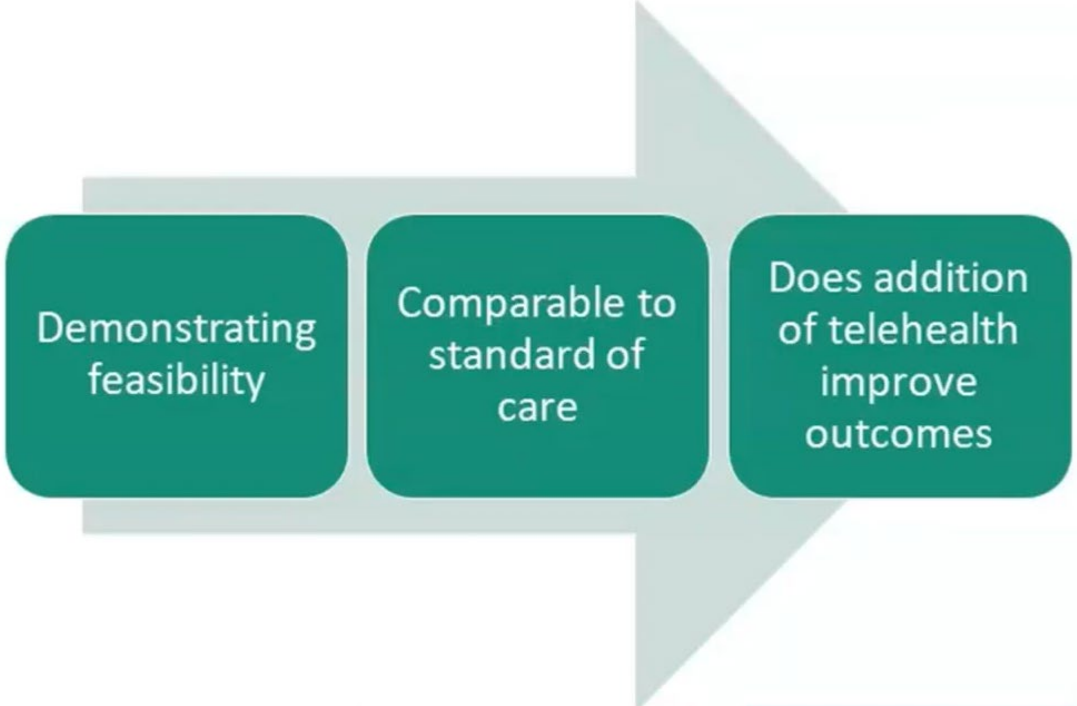
- Telehealth for **provider education and mentoring** (including ECHO programs/video for instruction and collaboration) may
  - **improve** patient outcomes
  - **change** provider behavior
  - **increase** provider knowledge and confidence in treating specific conditions

- Other uses, outcomes or populations: Insufficient evidence to support conclusions

- Harms or unexpected negative outcomes: Not reported

## What if the evidence for effectiveness?

## Need RCTs to drive health policy!




**Replacement:**
RCT telehealth
vs
in-person

**Complement:**
RCT (telehealth + in-person) vs. in-person

Which condition?

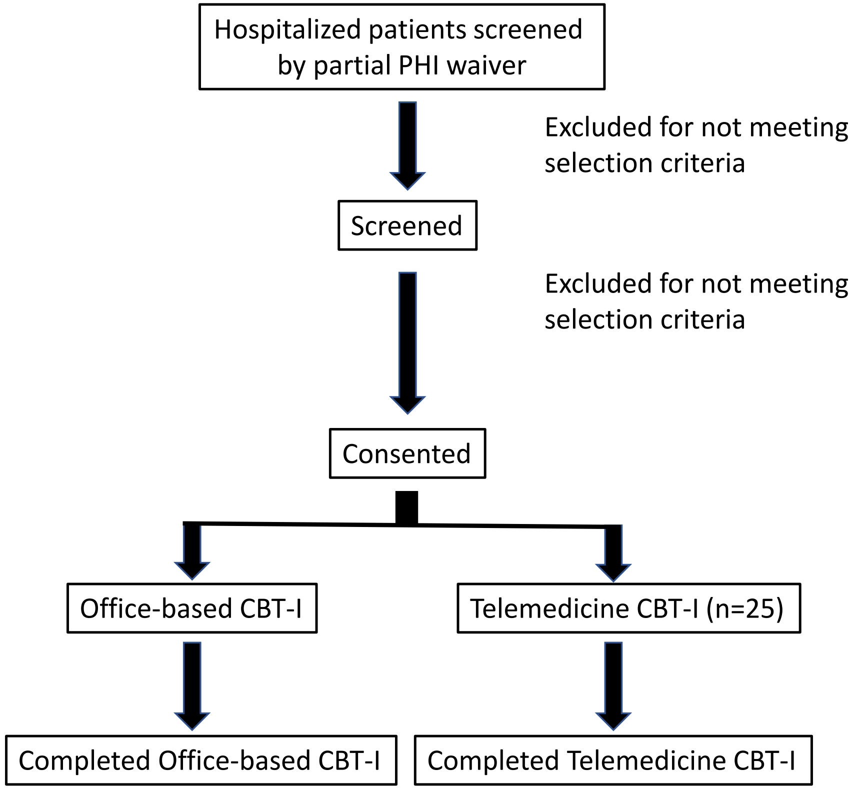
Which Patient?

What type of telehealth?

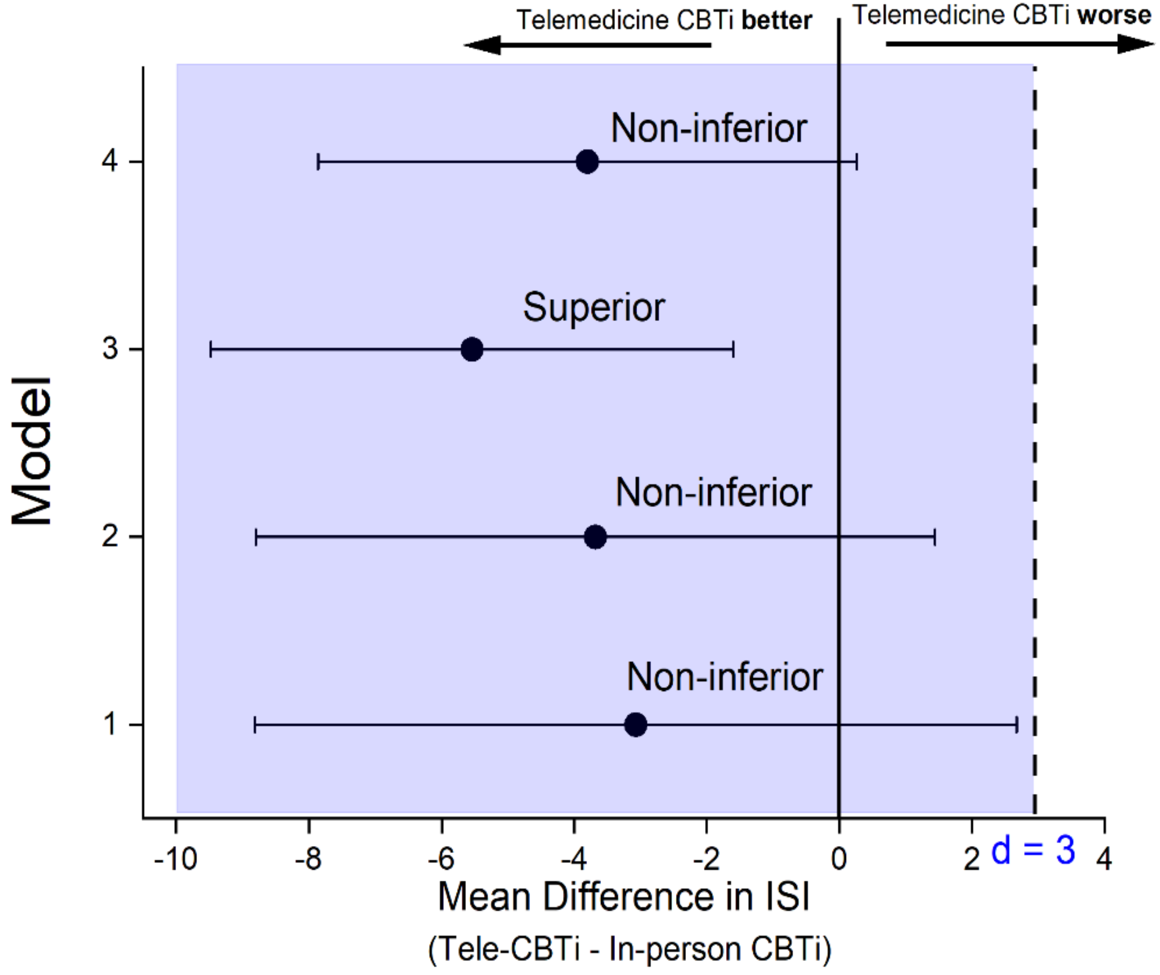
Outcomes?

Mixed methods?
Qualitative + Quantitative

# Non-inferiority study of telemedicine vs in-person CBTi for insomnia




| | Baseline | Week 2 | Week 6 |
|---|---|---|---|
| **Telemed CBT-I** | 18.7 (5.3) | 12.5 (4.3) | 8.3 (8.0) |
| **CBT-I** | 20.7 (4.4) | 16.6 (4.0) | 14.5 (7.1) |



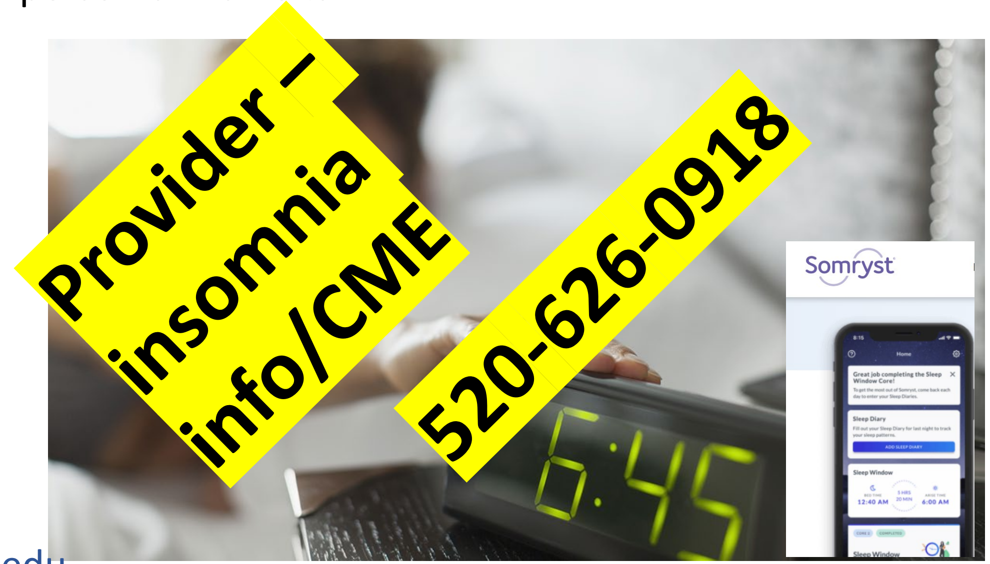

**Berryhill et al [Unpublished]**

# Comparing Three Ways to Treat Insomnia in Adults Living in Rural Areas – **COZI-R study**

Seeks adult volunteers, ages 18 – 80 with chronic insomnia for a research study.

The purpose of the study is to learn which type of treatment is most effective at treating chronic insomnia; 1) Cognitive Behavioral Therapy (CBT-i), 2) Medication (Trazadone or Zolpidem), or 3) Combination of both, CBT-I + Medication.

Study involves filling out online questionnaires, sleep diaries, and follow up assessments AFTER 9 weeks, 6 months, and 12 months and surveys at 1 and 9 months, after taking medication and completing internet based cognitive behavioral therapy, or both. All visits/questionnaires are completed online. There are no in-person clinic visits




Cognitive Behavioral Therapy is provided free of charge.

Participant's insurance company will be billed for medication.

Compensation for study completion is ($75.)

**Contact Information:**
Natalie Provencio-Dean, MS
**520-626-0918** or cozi-az@email.arizona.edu
University of Arizona IRB-HSR # 2101355063

**Principal Investigator*:*** Sairam Parthasarathy, MD spartha1@arizona.edu

https://cozi.medicine.arizona.edu/

**PCORI-CER-2018C2-13262**

# Provider-to-Provider Telehealth Models

- **ECHO/ECHO like models**
  - Provider presents a case to panel of specialists
- **Store-and-Forward**
  - Capture of information and sent to another provider (specialist)
  - Asynchronous and used to replace a service that would take place in-person
- **eConsult**
  - Information regarding a patient’s condition sent to another provider (specialist) to evauate
  - Asynchronous and not replacing in-person service, curbside consult
  - Communications Technology-Based Services (CTBS)

# Questions?

1. What is the uptake of different types of provider-to-provider telehealth in rural areas?
2. What is the effectiveness of provider-to-provider telehealth for rural patients?
3. **What strategies are effective and what are the barriers and facilitators to implementation and sustainability of provider-to-provider telehealth in rural areas?**
4. What are the methodological weaknesses of studies of provider-to-provider telehealth for rural patients and what improvements in study design (e.g., focus on relevant comparisons and outcomes) might increase the impact of future research?

# Definitions

**Telehealth:**

Use of information and telecommunications technology to provide health care across time and/or distance; many possible combinations:

- Modes (asynchronous, real-time video, and many others)
- Functions (consultations, mentoring)
- Clinical indications (from mental health to remote surgery)

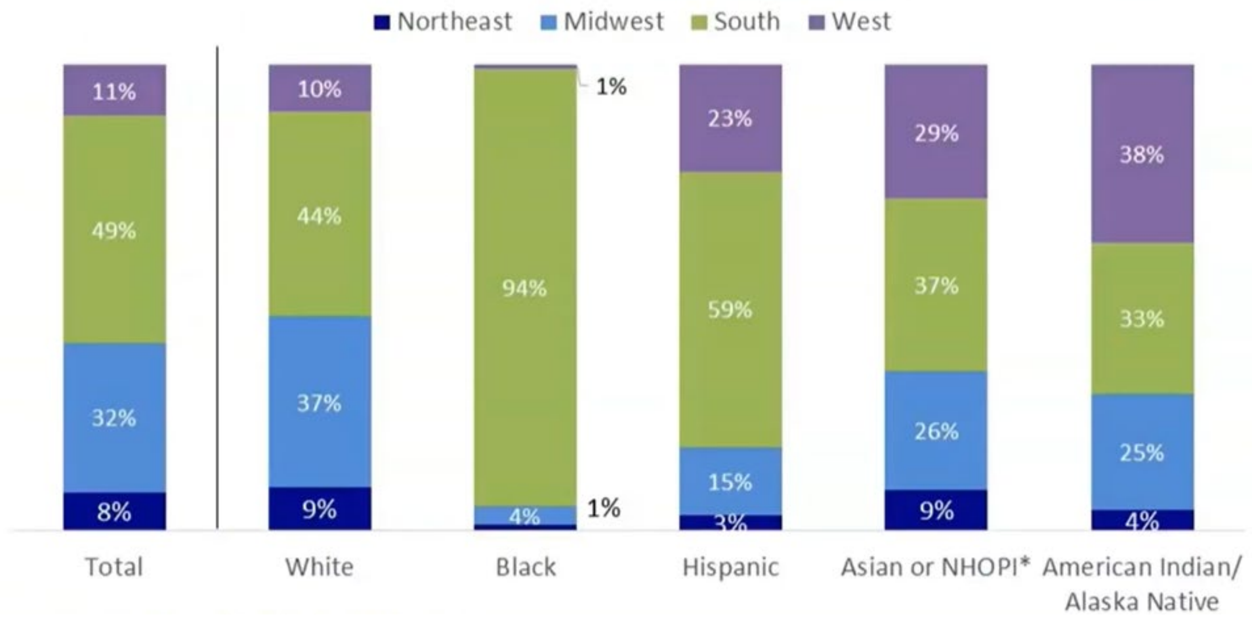
**Provider-to-Provider:**

Any form of interactive support using telecommunications technology provided to health care professionals while they are caring for patients and populations.

# Barriers

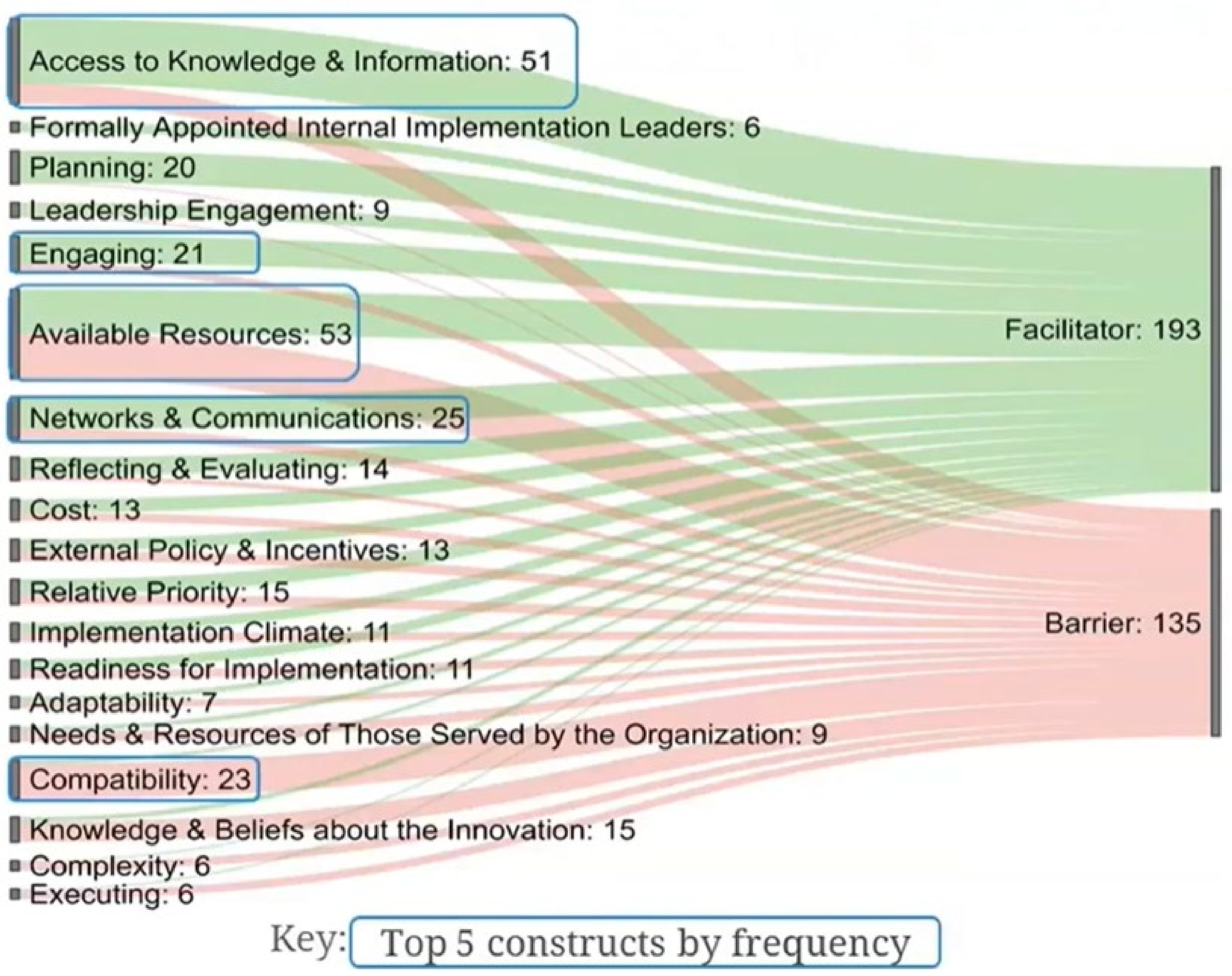
- Not reimbursable (R)
- Regulatory limitations (R)
- Not covered
- Patient location ineligible
  - Alaska and Hawaii for CTBS [Medicare]);
  - 17 states for eConsults
  - ECHO - NM
- Provider ineligible
- Low fees

# Disparities by race/ethnicity and region




- Accessible technology (e.g., disability, language access)
- Initial investment and upgrades
- Training and maintenance
- Where you live matters
- Provider availability for distant sites
- Reimbursement
- Patient needs
- Data collection, analysis and reporting

# Barriers – Summary - 2



# Barriers - Summary

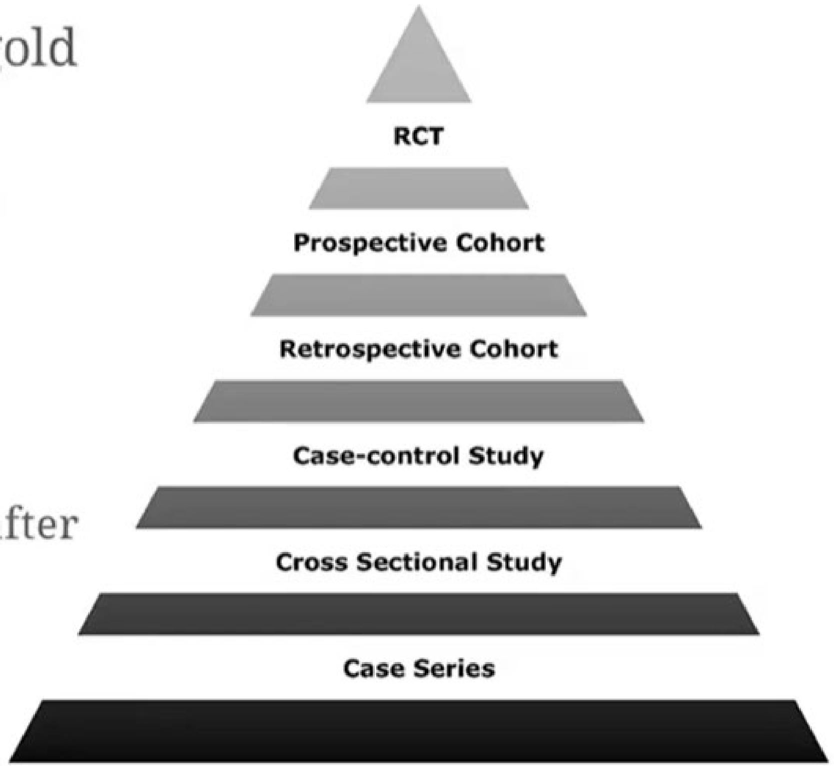
- Facilitators and Barriers are similar across settings and uses
- 2 Most frequently cited barriers
  - Level of resources available for implementation and on-going operations
  - Access to digestible information and knowledge about the intervention and how to incorporate it into work-flow
- Unique to rural P2P telehealth
  - Lack of consulting providers' familirarity with limitations in rural areas
  - Resources and commitment required may be difficult to rural provider
  - Technology and support must be tailored for frequency of use

# Questions?

1. What is the uptake of different types of provider-to-provider telehealth in rural areas?
2. What is the effectiveness of provider-to-provider telehealth for rural patients?
3. What strategies are effective and what are the barriers and facilitators to implementation and sustainability of provider-to-provider telehealth in rural areas?
4. **What are the methodological weaknesses of studies of provider-to-provider telehealth for rural patients and what improvements in study design (e.g., focus on relevant comparisons and outcomes) might increase the impact of future research?**

# Study Design Considerations

- RCT considered the gold standard design for reducing risk of bias
- Included studies
  - 23% RCTs
  - 38% cohort studies (prospective or retrospective)
  - 39% pre-post/before-after design




- Use strongest possible research designs
  - Adequate sample sizes for primary, important outcomes
  - Multisite, cluster-randomization if appropriate
- Detailed descriptions of telehealth interventions and comparators
- Clear agreement on telehealth goals and corresponding outcomes
  - If 'as good as', use noninferiority (equivalence) design
  - What are the most important outcomes?
    - Is access sufficient or must clinical outcomes improve?
- Outcomes measurement and analysis
  - at multiple time points and/or contemporary comparison groups
  - long-term sustainability of outcomes

# Thank you


## CDC (CDC-OT21-2103 (Subcontract #: CTR056154))
Dan Derksen, MD, Uarizona site-PI
Mona Arora, PhD
Michelle Moore, PhD
Brenda Lambert

## Office of Minority Health (CT-HD-22-089)
Theresa Cullen, MD - PI
Adrianne Ackerman, PhD
Ada Wilkinson-Lee, PhD

## NIH – CEAL (OT2-HL-156812 and OT2-HL-158287)
Chyke Doubeni, MD
Samantha Sabo, Dr.PH
Sabrina Oesterle, PhD

NIH – RECOVER (OT2-HL-161847)
Janko Nikolich, MD, PhD
Kenneth Knox, MD
Eric Reiman, MD, PhD

## American Academy of Sleep Medicine Foundation (169-SRF)
Daniel Taylor, PhD
Christopher Wendel, MS
Sophie Pinkston, PhD
Stefano Guerra, MD, PhD

# Setting

| | Inpatient | Outpatient | Emergency Care | Education/ Mentoring |
|---|---|---|---|---|
| KQ2-Effectiveness | 12 (14%) | 28 (33%) | 25 (30%) | 19 (23%) |

# Study Designs and Risk of Bias

| Study Design | Number of Studies | % |
|---|---|---|
| RCT | 19 | 23 |
| Before-After | 19 | 23 |
| Prospective Cohort | 18 | 21 |
| Retrospective Cohort | 14 | 17 |
| Pre-Post | 14 | 17 |
| **Risk of Bias** | | |
| Low | 5 | 6 |
| Medium | 60 | 71 |
| High | 19 | 23 |

| Clinical Topic N studies | Patient Outcomes: Mortality | Patient outcomes: Hospital use | Patient outcomes: Other clinical | Provider outcomes/ Payer outcomes |
|---|---|---|---|---|
| Multiple conditions 3 | ~ Mortality in hospital[69,70] | ~ Transfers[70]<br>~ Length of stay[69,70]<br>~ Readmission[69] | ~ Drug prescribing outcomes[71] | + Communication ratings[70] |
| Infectious Disease 2 | + Mortality[65] | ~ Transfers[65]<br>– Length of stay[65†]<br>~ 30-day Readmission[65] | + Improved antimicrobial use or infection rate[65,66] | None reported |
| Stroke 1 | None reported | ~ Length of stay[68] | None reported | + Cost[68] |
| Spinal fracture 1 | None reported | + Length of stay[67] | None reported | + Knowledge, skills, confidence[67] |

+ = Improved Outcome with telehealth; ~ = Similar outcome with telehealth; - = Worse outcome with telehealth. **M** = Outcomes were not consistent across studies

| Clinical Topic N studies | Patient Outcomes: Mortality | Patient outcomes: Hospital use | Patient outcomes: Other clinical | Provider outcomes/ Payer outcomes |
|---|---|---|---|---|
| Neonates 4 | None reported | + Transfers[62]<br>~ Length of stay[63,64] | ~ Enteral feeding[63,64]<br>~ Ventilation/ oxygen [63,64]<br>~ Proportion of deliveries at community hospitals[61] | None reported |
| ICU 1 | ~ Mortality in high dependency unit[72]<br>~ Mortality in hospital[72]<br>~ Mortality total[72] | + Transfers[72] | None reported | None reported |

# Education / Mentoring

| Modality | Clinical Topic # of Studies | Provider outcomes | Patient outcomes |
|---|---|---|---|
| ECHO Video-conference | Antibiotic therapy 1 | + Antibiotic prescribing[142] | ~In-hospital mortality[142]<br>~ Mean length of stay[142] |
| | Diabetes 2 | + Self-efficacy in patient coaching/education; identification of psychosocial treatment barriers[128] | + A1c[141] |
| | Liver disease 2 | + Hepatitis C Virus awareness, knowledge, abilities and intention to recommend screening for at-risk patients[135] | ~ Sustained viral response[125]<br>~ Serious adverse events[125] |
| | Mental health 5 | + Change in prescribing[130 132]<br>+ Provider knowledge and self-efficacy[140]<br>+ Autism-specific screening[126]<br>+ Pediatric behavioral health management[132]<br>+ Satisfaction with sessions[132,140,143] | None Reported |

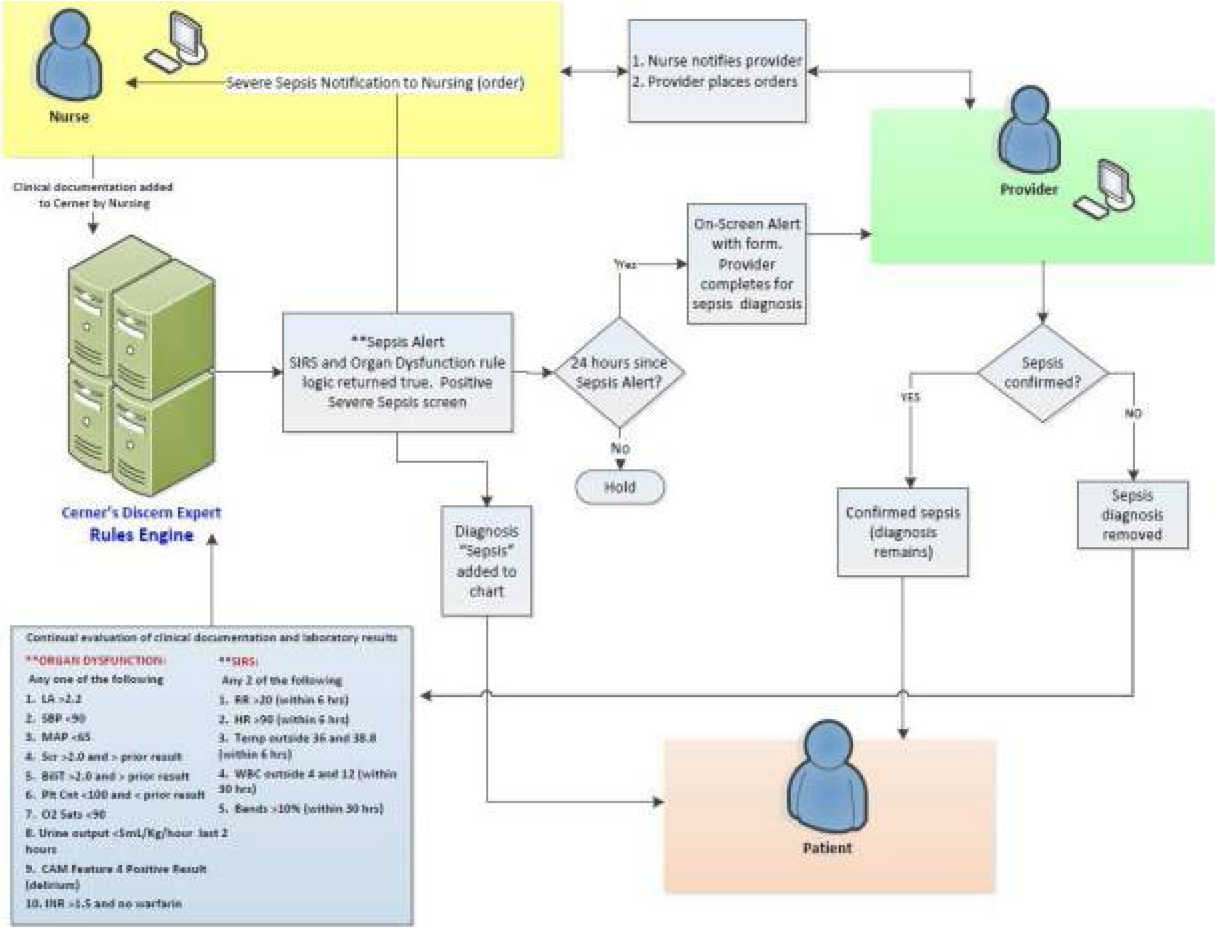
+ = Improved Outcome with telehealth; ~ = Similar outcome with telehealth; - = Worse outcome with
2 telehealth, **M** = Outcomes were not consistent across studies

# Challenges Researching Telehealth

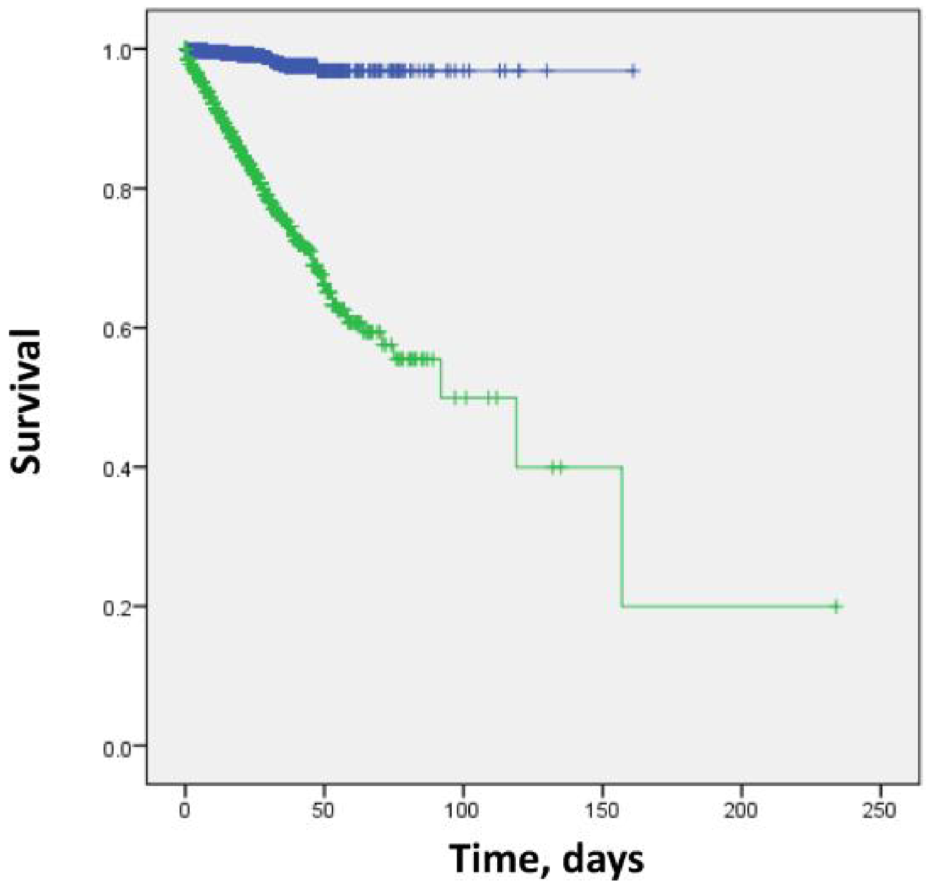
- Telehealth can facilitate a wide range of very different health services and interventions
  - Example: remote ICU vs. SMS remote education
  - Comparisons across uses may not be appropriate
- Limited outcomes
  - Studies are often designed to assess impact on access
  - Not as frequently designed to assess
    - impact on patient, provider or payer outcomes
    - quality of services provided via telehealth

- Individual study design
  - RCTs versus other designs
  - Sample sizes
  - Single-site versus multi-site studies
  - Biases not addressed or minimized
  - Examples: selection, performance, detection, attrition and analysis bias
- Individual study conduct
  - Clarity and fidelity of telehealth intervention and comparator
- Confidence in a body of evidence
  - Across studies
  - Not about whether telehealth works; about whether the conclusion seems stable—will it change with future studies?

# Real-time Automated Sampling of Electronic Medical Records Predicts Hospital Mortality




## Kaplan-Meier Graph by EMR-based Automated Alert




Khurana et al, Am J Med 2016; 129(7); 688-698

# Methodological Weaknesses - Summary

- Studies of provider-to-provider telehealth for rural areas could be improved by addressing methodological weakness
- Key weakness: **Difficult to attribute impact to telehealth** because
  – Most common: Weaker study designs are common
    - Lack of control for confounders
  – Next most frequent: small sample sizes
    - lack of power to detect differences or confirm equivalence
- Data limitations
  – use of retrospective data
  – data produced for care delivery and billing purposes and not research may be incomplete or coded differently across organizations