

# The Disparity of Telemedicine Adoption During the COVID-19 Pandemic

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# Speaker Background

- B.S. in Computer Science
- PhD. In Health informatics
- 7-year research experience
  - Medical College of Wisconsin
  - University of Wisconsin Milwaukee
- 4-year teaching experience
  - Data Science in Medicine

# Research expertise

## Technology

- **Innovative tools for a better care**

## Data analysis

- **Analysis for a better care**

# Technology

- Adopting Technology for a better care
  - Clinical Decision Support
  - Medical Imaging
  - Clinical text processing

# Health Care Analysis

- Analysis for a better care
  - Improve healthcare outcome
  - Finding healthcare gaps
  - Population study, socioeconomic study, cohort analysis.

# The Disparity of Telemedicine Adoption During the COVID-19 Pandemic

- Introduction
- Methods
- Results
- Discussion
- Future Work
- Grant opportunities
- Conclusion

# Introduction

COVID-19 health care outcomes

Telemedicine Services

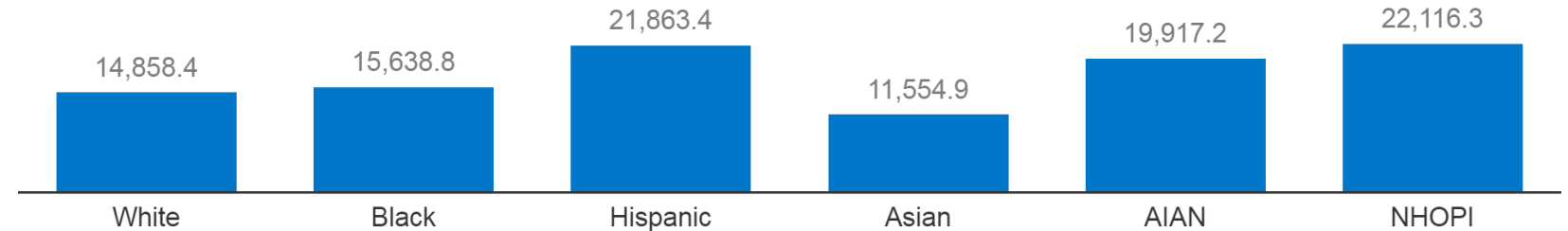
# COVID-19 Infection varies by race

Hispanic, Black and other racial minorities had the highest infection rates

Figure 1

## Cumulative COVID-19 Age-Adjusted Infection Rates by Race/Ethnicity, 2020-2022

Rates per 100,000 population



NOTE: Persons of Hispanic origin may be of any race but are categorized as Hispanic for this analysis; other groups are non-Hispanic. AIAN refers to American Indian or Alaska Native. NHOPI refers to Native Hawaiian or Other Pacific Islander. Case data as of August 1, 2022. Age-adjusted rates standardized to 2019 U.S. Census Bureau population estimates.

SOURCE: KFF analysis of Centers for Disease Control and Prevention, COVID-19 Response. COVID-19 Case Surveillance Restricted Data Access, Summary, and Limitations, released on August 4, 2022. The CDC does not take responsibility for the scientific validity or accuracy of methodology, results, statistical analyses, or conclusions presented. • [PNG](#)

**KFF**

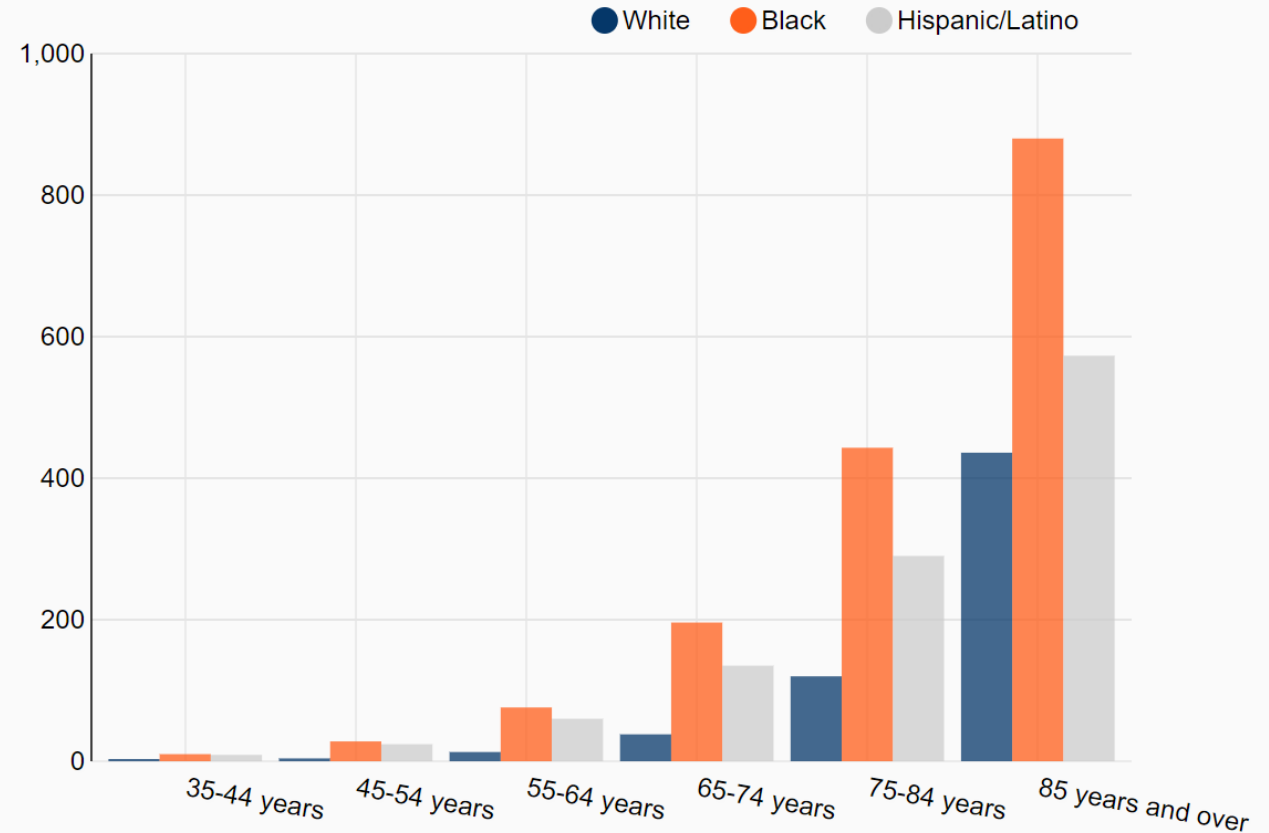


# Death Rates

- The pandemic impacts racial minorities

**Figure 1. COVID-19 death rates by age and race**

Rates per 100,000



Source: CDC data from 2/1/20-6/6/20 and 2018

Census Population Estimates for USA

BROOKINGS



# Telemedicine

- Telemedicine rises under COVID-19 Pandemic.
- Telemedicine has benefits.
- Telemedicine was designed to expand the care.
- Does it really work for all populations?

# Current Gaps

- Unequal telemedicine adoption
- The digital divide
- Measurement of disparity



# Questions

- What affect Telemedicine adoption?
- How to improve the care coverage?



# Study Goal



Discover  
underserved  
populations



Provide Evidences  
of healthcare  
disparities



Promote equal  
access to  
telemedical care

# Methods



How to systematically find the gap of telemedicine services?

# Hypotheses

- Patients who are older are less likely to use telemedicine services
- Patients who are not insured
- Patient with lower income .....
- Patient living in rural area ....
- Patient who do not speak English...



# Methods: Data Source

- Retrospective cohort study
- Froedtert hospital, Wisconsin
- Clinical Translational Science Institute
- 2.3M patients
- Time range: March 2020 – March 2022



# Social and Economic Factors

Social and Economic Factors	Data Source
Sex	Electronic Health Records
Race	Electronic Health Records
Age	Electronic Health Records
Ethnicity	Electronic Health Records
Insurance Status	Electronic Health Records
Language (English/Non-English)	Electronic Health Records
Area Deprivation Index	U.S. Census Bureau data
Rural-Urban Continuum Codes	U.S. Census Bureau data

# Area Deprivation Index

○ Evaluate socioeconomic status in community

○ 0 - 100



Income

+



Education

+



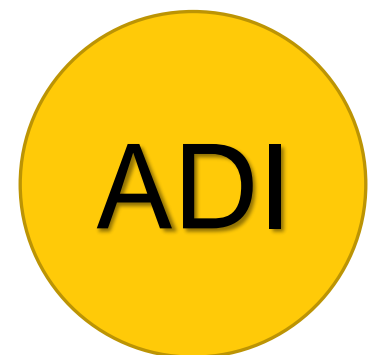
Employment

+



Housing

=



# Rural-Urban Continuum Codes

- A community classification (Metropolitan / Non-metropolitan)



Rural area

VS



Urban area

# Odds Ratio

- A measurement of association
- Often used in clinical trials
- E.g., Can evaluate the efficacy of a new drug.

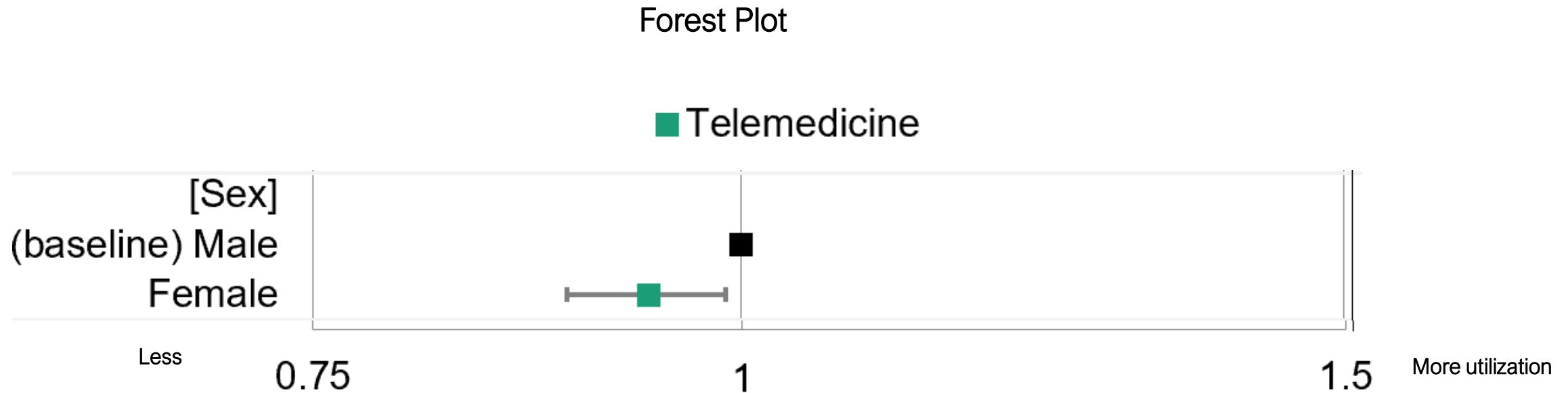
## Outcome

Predictor	Outcome	
	Success	Fail
Control	40	60
Treatment	80	20

$$\text{Odds Ratio} = \frac{80 \times 60}{40 \times 20} = 6.0$$

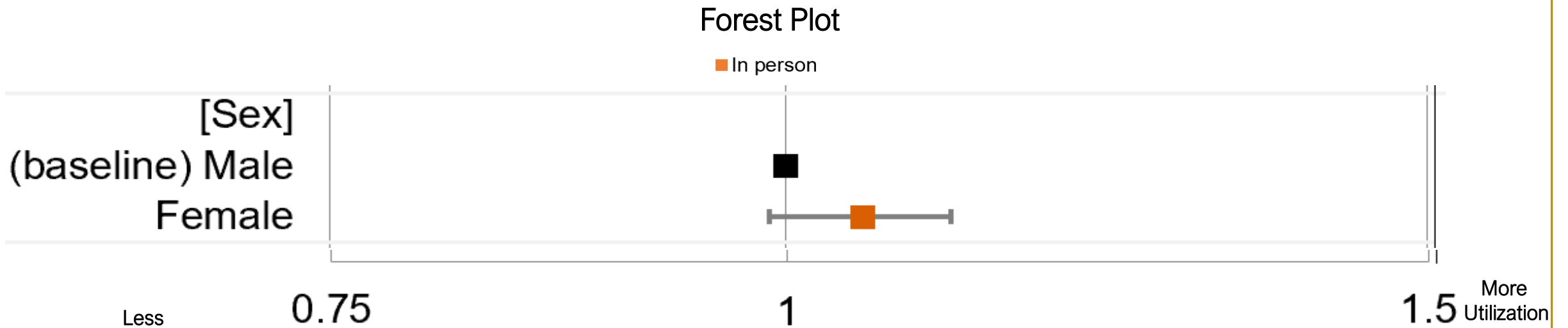
Treatment group is 6 times compared to the control group

# Apply Odds Ratio to Telemedicine



The odds of Female residents choosing Telemedicine is 0.82x  
Compared to male residents

# Apply Odds Ratio to In-person



The odds of Female residents choosing in-person visit is 1.33x  
Compared to male residents

# Creating Hypothesis

- Hypothesis:

- Patients of Factor X are less likely to use telemedicine services

Predictor	Outcome	
	Telemedicine	No Telemedicine
Socioeconomic Factor 1	a	b
Socioeconomic Factor 2	c	d

$$Odds\ Ratio = \frac{ad}{bc}$$

The odds of factor 2 patients choosing Telemedicine is  $\frac{ad}{bc}$  times compared with Factor 1 cohorts.

# Study Groups – 3 Outcomes



Telemedicine



In person




Phone or  
message



# Results: The Disparity of Telemedicine Utilization

# Overall Utilization Rate



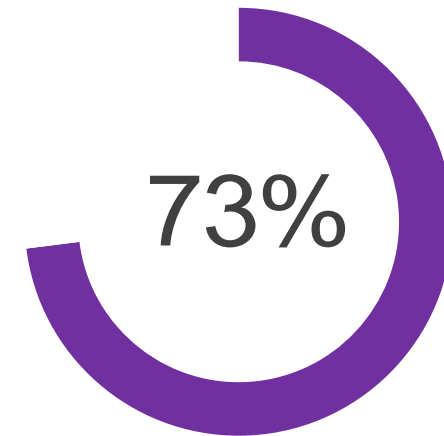
21%

Telemedicine



65%

In-person

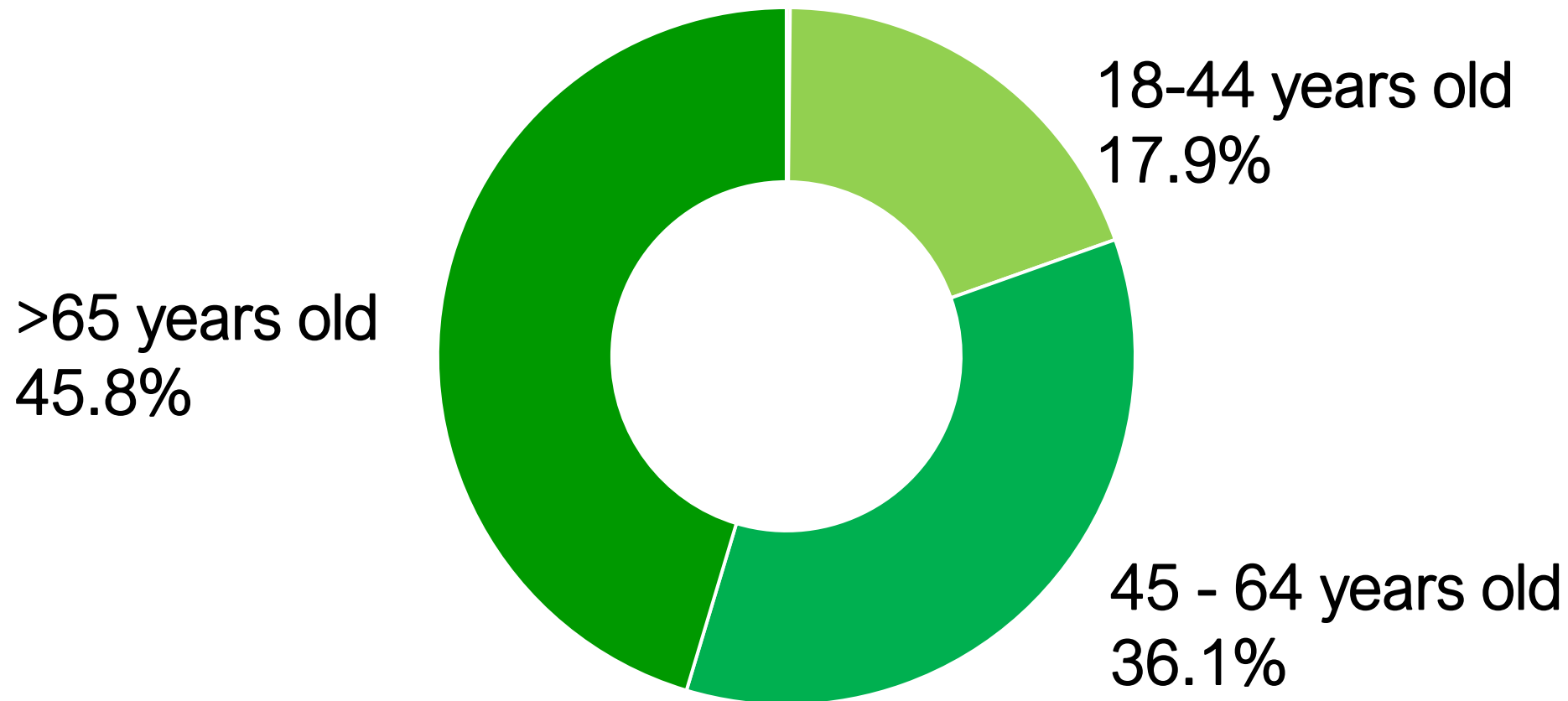


73%

Phone or Message

The numbers are calculated combined with the U.S. Census bureau combined with the Clinical Translational Science Institute of Southeastern Wisconsin using 2020 – 2022 data. Three forms of healthcare include in-person care, telemedical care, and patient phone or message. Patients receiving both telemedicine and in-person care were categorized as telemedicine visits for the purposes of this analysis, regardless of the order of visits. Patients with both telemedicine and phone/message visits are counted as telemedicine visits; Similarly, patients with in-person and phone/message visits are counted as in-person visits.

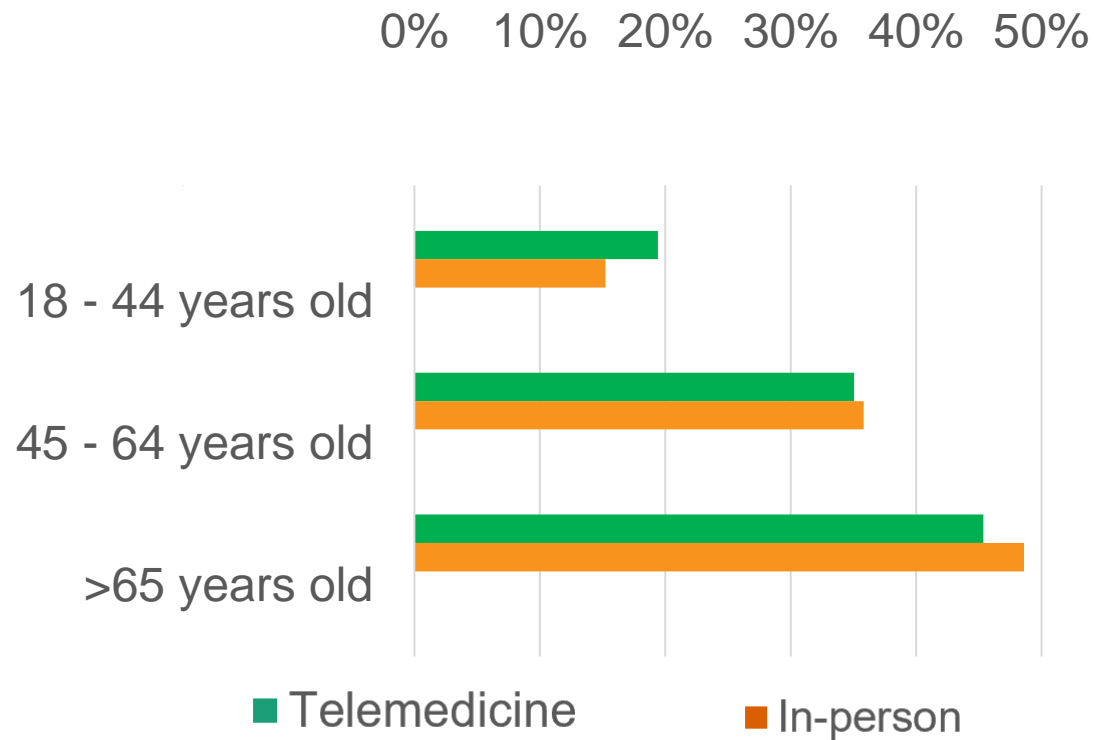
# Age, Telemedicine



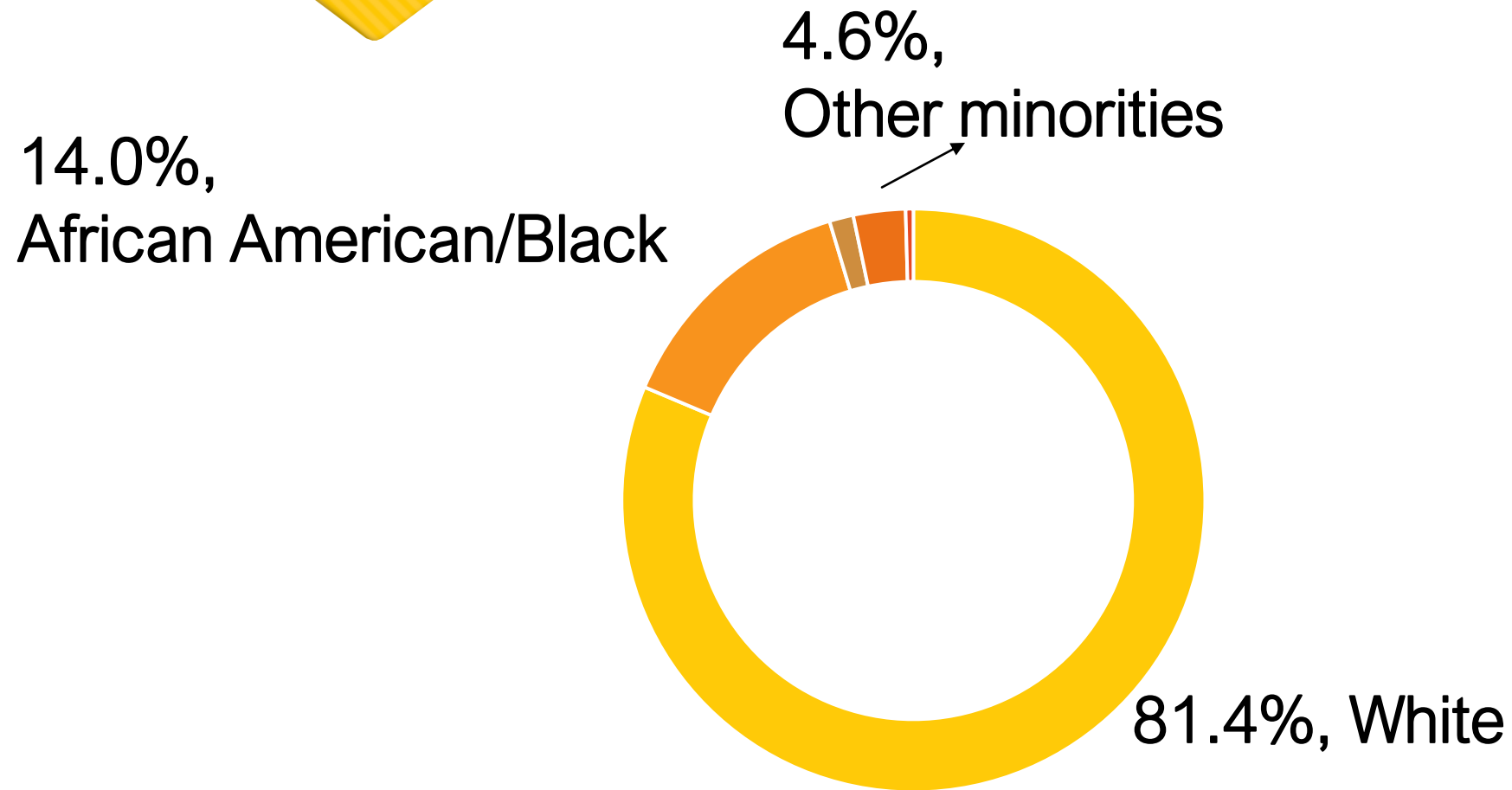
## By Age:

18 – 44 y/o patient prefer telemedicine

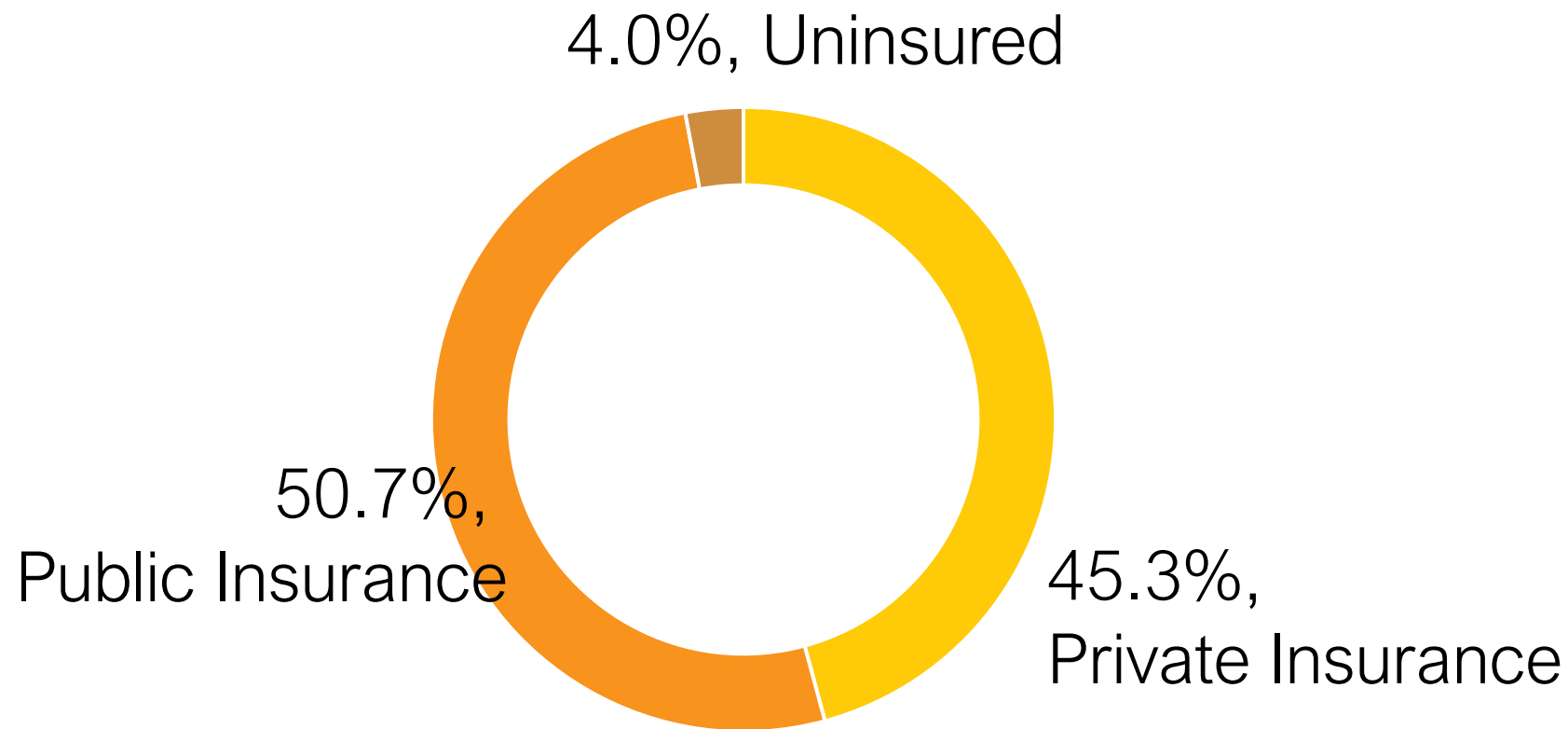
45 - 64, and 65+ y/o patient prefer in-person



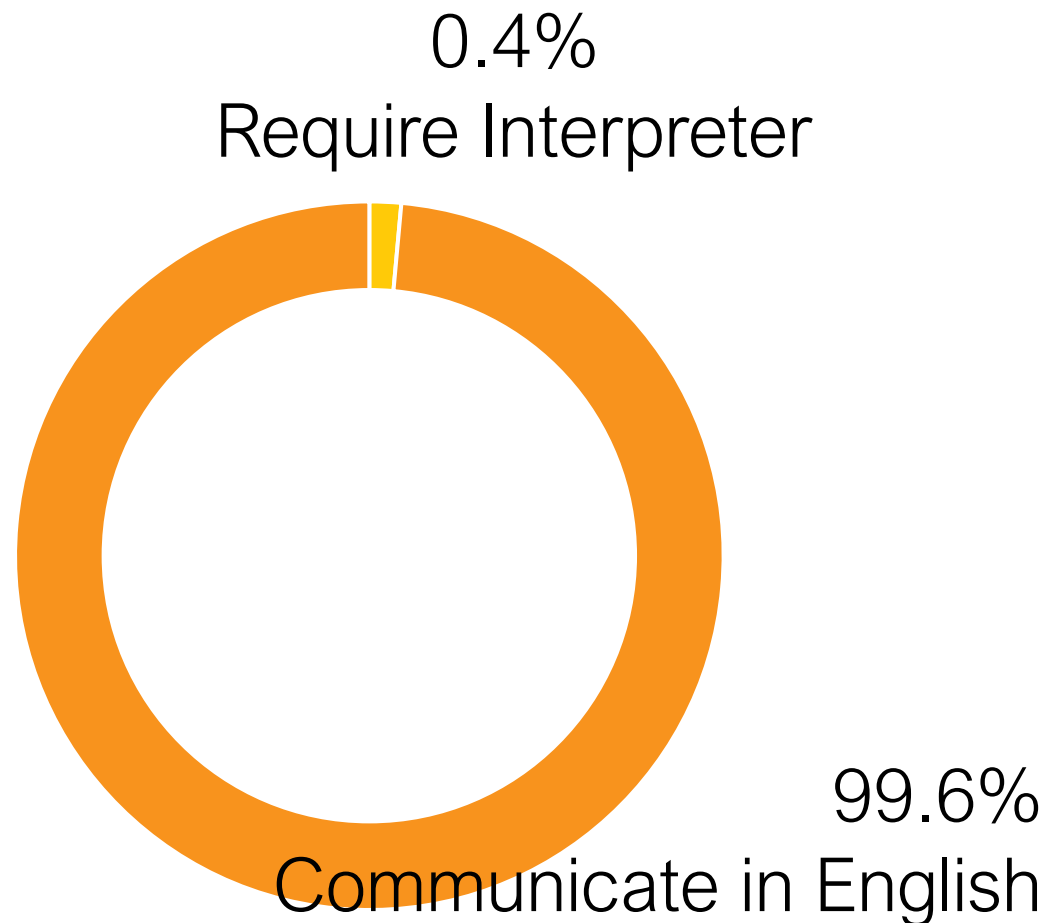
# Demographics: Race



# Demographics: Insurance

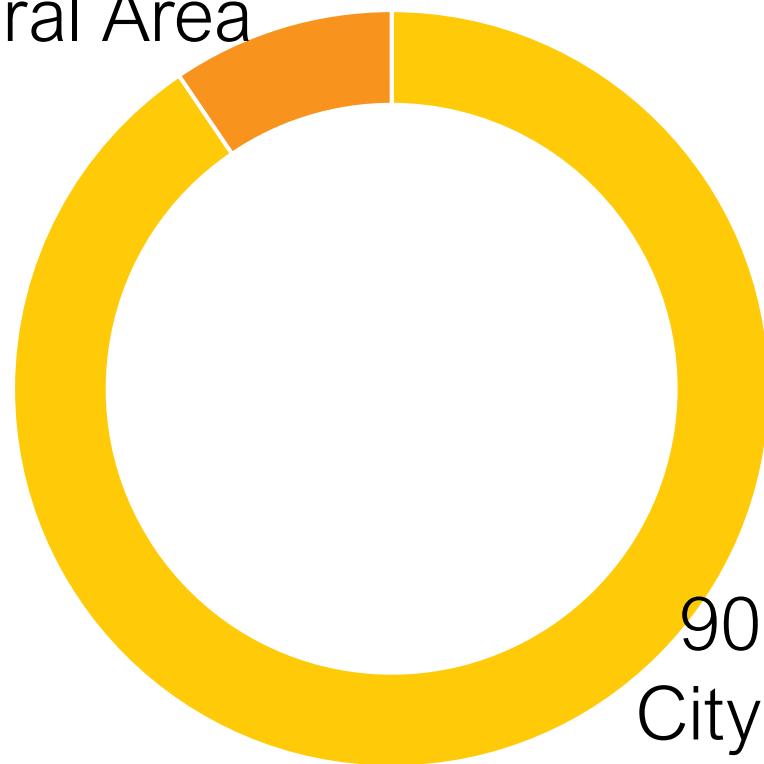


# Demographics: Language Assistance



In person:  
~4% require interpreter

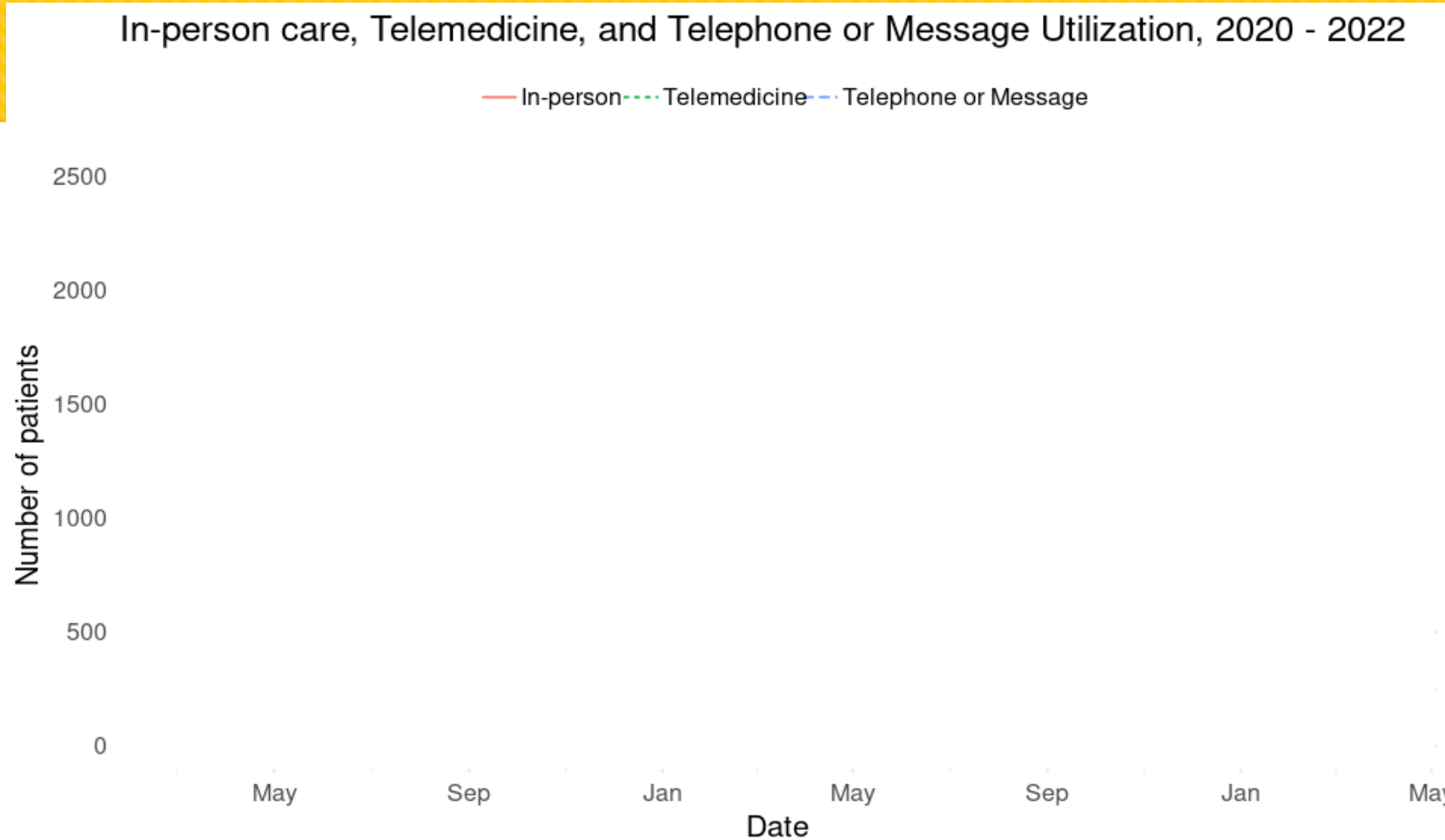
9.5%  
Rural Area



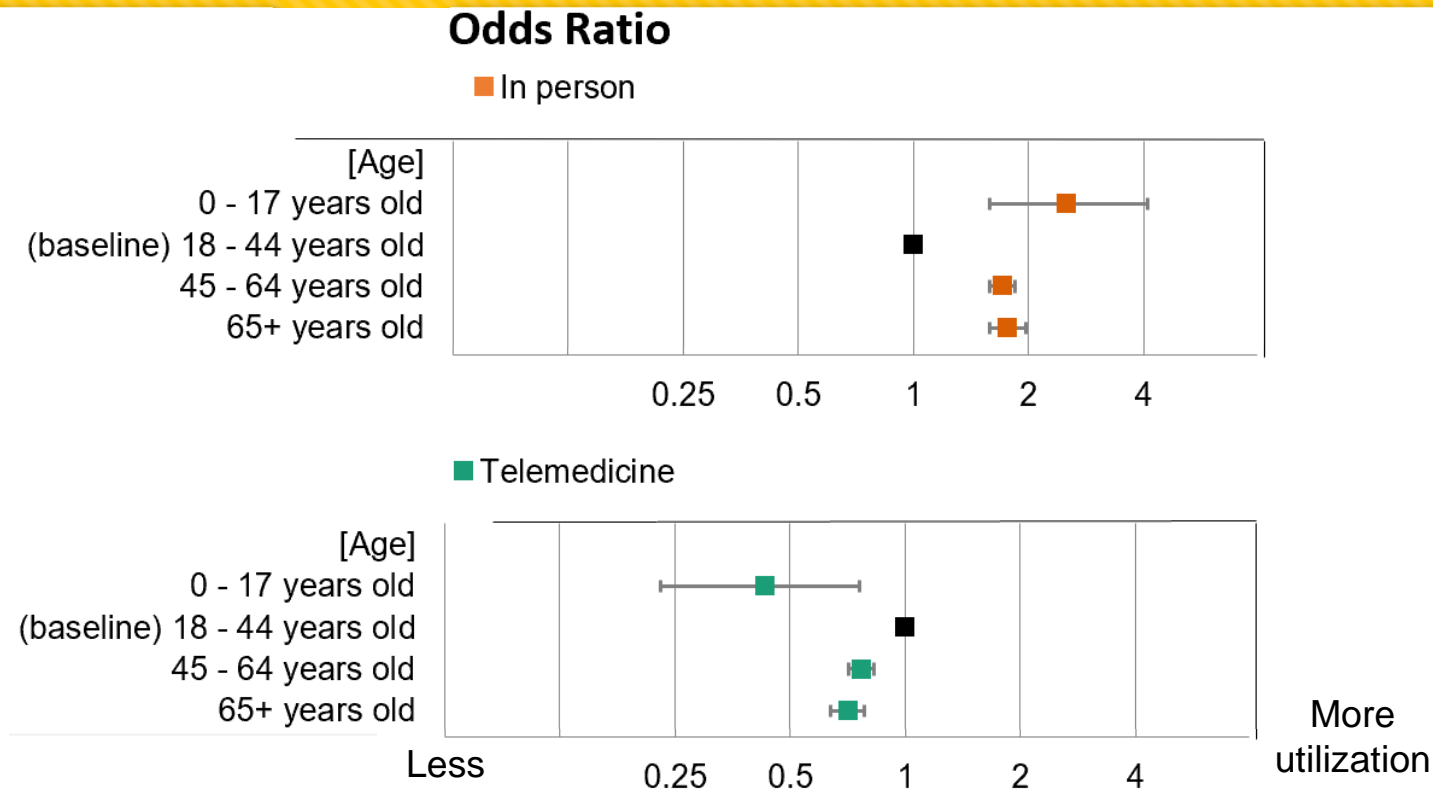
90.5%  
City Area



# Results by Time: Weekly Utilization

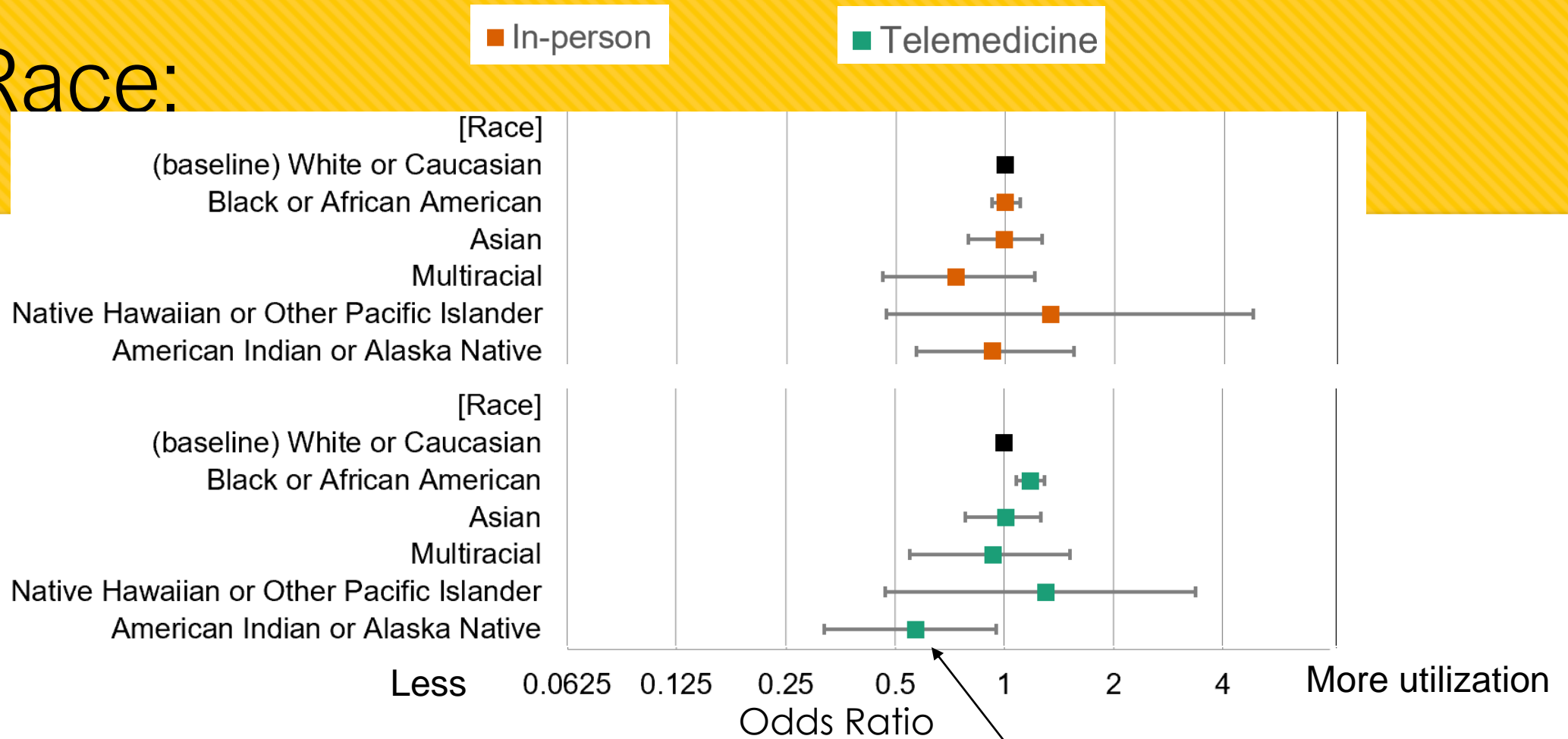


# By Age, Interpreting the chart



65+ years old group are 0.71x (95% CI: [0.64,0.78]) likely to use telemedicine compared with patients age from 18 to 44.

# By Race:

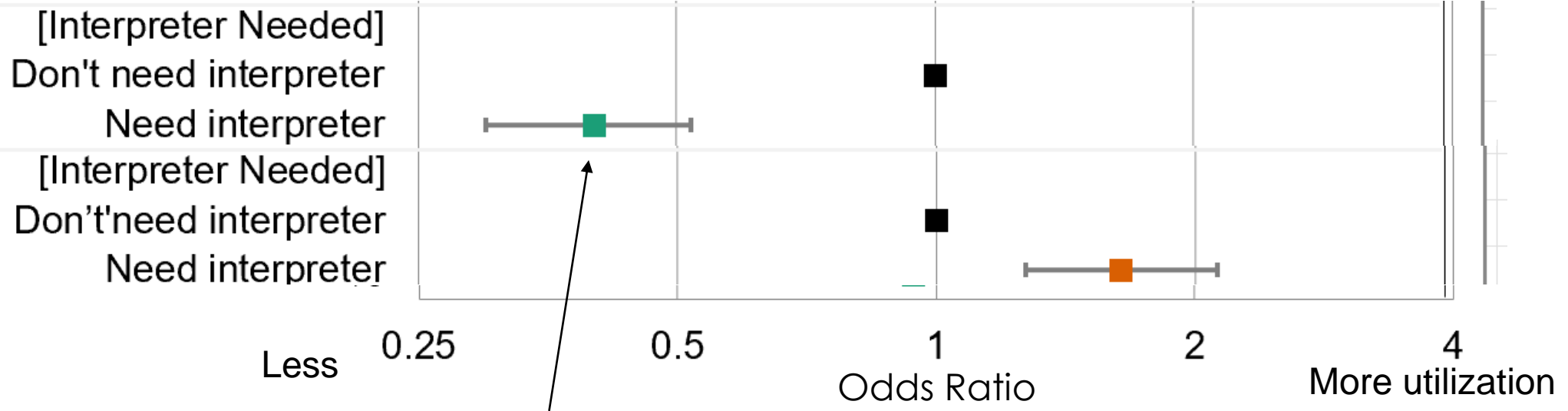


American Indian and Alaska Native are Underserved populations

# By Language

■ Telemedicine

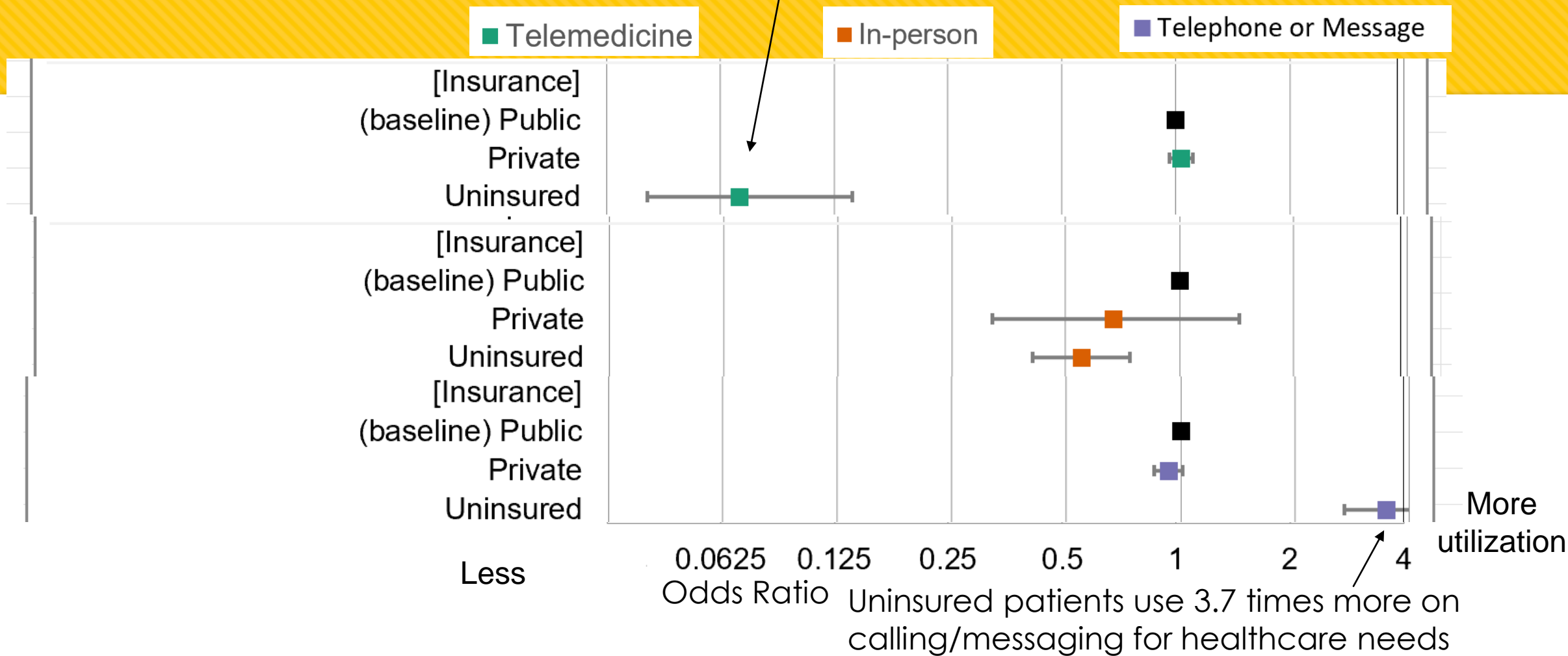
■ In-person



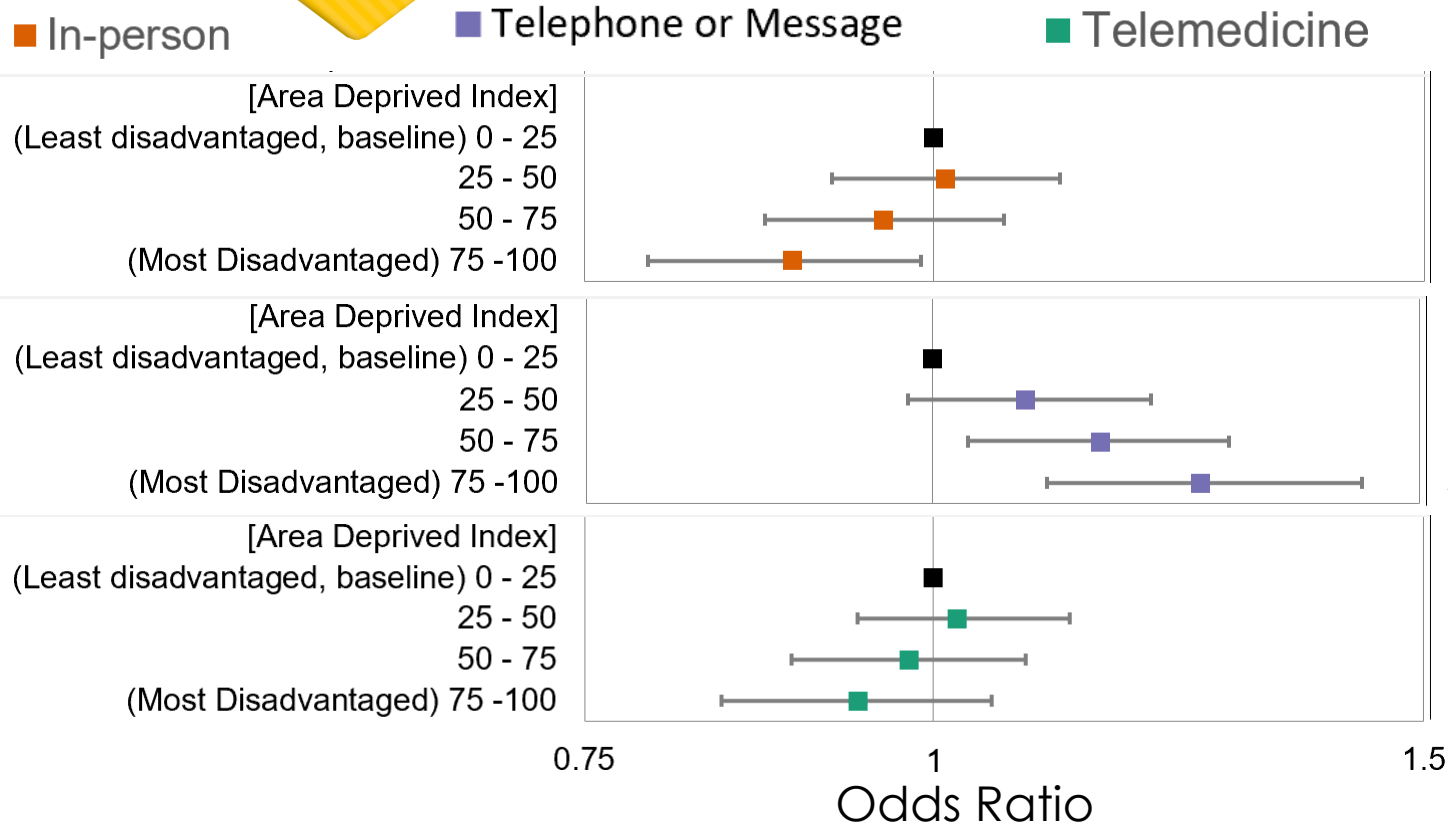
Patients who don't speak English are underserved population  
(Telemedicine may not address their care needs  
Due to Non-English speakers. )

# By insurance type

Uninsured patients almost do not use Telemedicine (0.07x odds compared with insured patients)



# By Area Deprived Index



Summary:  
Patient in lower socioeconomic Status will choose less in-person Care, less telemedicine care. And more Telephone or messages.

# By Rural-urban Continuum Code

Patients in rural area go to hospital less frequently. (0.89x)

■ In-person

■ Telemedicine

■ Telephone or Message

[Rural-Urban Living Areas]  
(baseline) Metropolitan Counties  
Non-Metropolitan Counties

[Rural-Urban Living Areas]  
(baseline) Metropolitan Counties  
Non-Metropolitan Counties

[Rural-Urban Living Areas]  
(baseline) Metropolitan Counties  
Non-Metropolitan Counties

Less 0.75

1

1.5

Odds Ratio

Non-metropolitan residents have more phone calls (1.26x)

More utilization

# Discussion

Study review and How I measured healthcare disparity



# Telemedicine Utilization:

- Coverage remains low (~21%)
- Phone and in-person care are major forms (60-70%)
- Telemedicine cannot compete

# Reason of limited telemedicine?

- Treatment & diagnosis impossible via telemedicine
  - Physical therapy, inpatient examinations, lab test, and many treatment options are not possible via telemedicine
- Solution
  - Make use of the online consultation services for complicated cases  
Convenient, cost-effective, and can include more specialties

# Discovery of population gaps

- We demonstrated the telemedicine exacerbated disparities in:
  - Uninsured (0.07x)
  - People who do not speak English (with a 0.30 odds ratio compared to baseline)
  - Racial minority (American Indian and Alaska Native, 0.55x)
  - Low socioeconomic status (Lowest quartile, 0.84x)
  - Older age (65y/o+, 0.89x)
  - Rural residences (0.89x)



# Socioeconomic factors

- Age
- Racial minority
- Low Income -> Insurance
- Rural residences
- Language



# Age

- Solution:
  - Provide easy-to-use technology
  - Offer technical training
  - A caregiver or family member to assist



# Racial minority

- **Education** gaps - Address health literacy
  - providing plain language materials
  - Using visual aids
  - Avoiding technical jargon

# Financial supports

- Ensure basic digital devices and internet
- Partnership with community organizations
- Fight with poverty to address health literacy and promote remote care





## The support of multi-languages

- Use video remote interpreting technology: (an on-time translation voice capturing and translation software)
  - E.g. MS Teams is doing live translation for video transcriptions
- Provide trained medical interpreters

[Announcing live translation for captions in Microsoft Teams](#)



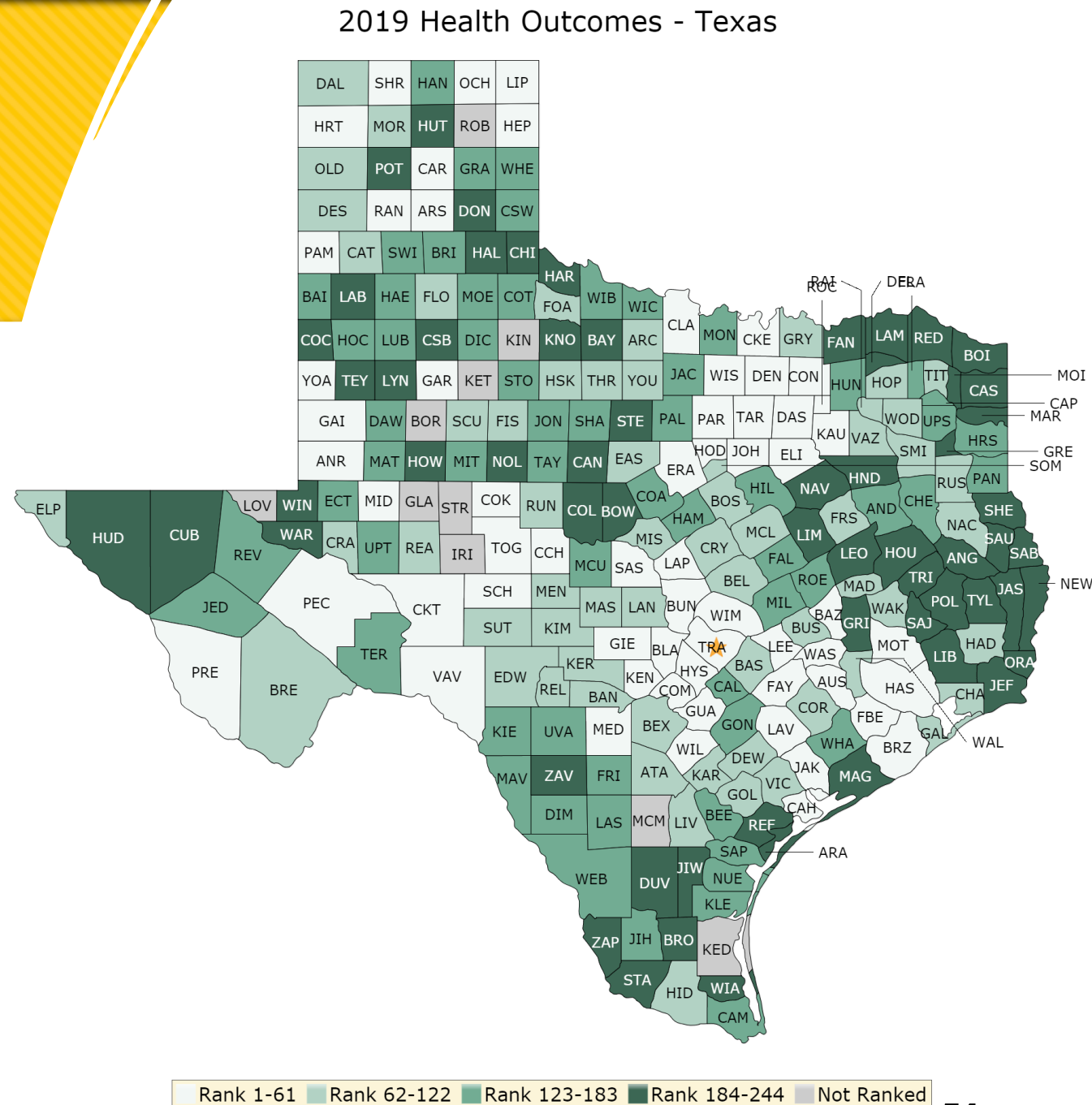
# Conclusion

- Telemedicine: an under-used service have potentials
- Minority socioeconomic groups: Unequal utilization
- Systematic guideline is needed.

# Future Work

# 1. Geospatial Analysis

- Offering [map-based analysis](#)
- visualize the under-served area
- Applies to general or specific socioeconomic factors.



4/17/2023

## 2. Finding gap in Diagnosis

- My research group studied a variety of diagnosis. [1-6]
- Finding the underserved, diagnostic gaps in TX.



[1] [Socioeconomic determinants of tertiary rhinology care utilization](#), American Academy of Otolaryngology head and neck surgery.

[2] <https://pubmed.ncbi.nlm.nih.gov/36477093/>, The Demographics of Menière's Disease: Selection Bias or Differential Susceptibility?

[3] <https://onlinelibrary.wiley.com/doi/full/10.1002/lho2.715>, Analysis of socioeconomic factors in laryngology clinic utilization for treatment of dysphonia

[4] <https://www.sciencedirect.com/science/article/abs/pii/S0165587621003797>, The impact of social determinants of health and clinical comorbidities on post-tympanotomy tube otorrhea

[5] <https://www.ingentaconnect.com/content/wk/mao/2022/00000043/00000009/art00038> Impact of Demographics and Clinical Features on Initial Treatment Pathway for Vestibular Schwannoma

[6] <https://www.ingentaconnect.com/content/wk/mao/2022/00000043/00000010/art00020> Standardization of Outcome Measures for Intratympanic Steroid Treatment for Idiopathic Sudden Sensorineural Hearing Loss

### 3. Including social and cultural factors

Social, cultural factors for different populations:

- Occupation
- Food
- Exercise
- Smoking
- Drinking habits.



4/17/2023

53



## 4. Using technology to addressing the health literacy

Deploying technology to reduce the gap

- E.g. Online, Mobile conversational tools
- I recently submitted an initiative in the [Healthy Longevity Innovation](#), founded by U.S. National Academy of Medicine – To create a AI-based assistant tools for older nursing home seniors





## 5. More collaborations

- Interdisciplinary is key
- health services and population studies.
- Collaborate with other departments

# Grant opportunities

Three upcoming grant opportunities in health disparities



# Current Grant Role

- Co-investigator, *Create a AI-based assistant tools for older nursing home seniors for daily care*, [Healthy Longevity Innovation](#), U.S. National Academy of Medicine
- Consultant, *Discovering the socioeconomic gaps of senior adult falls*, University of Wisconsin-Milwaukee, Center for Health Systems and Technology Solutions
- Team member, Wisconsin's [Clinical & Translational Science Award](#), by NIH

# Social, Behavioral, and Economic Impact of COVID-19 in Underserved and Vulnerable Populations

Notice of Special Interest (NOSI);, NOT-MH-21-330, Due: Sep 8, 2024


- Emphasize the roles and impacts of digital health
- Community-engaged interventions in healthcare settings
- Use large-scale data sources to improve prediction of mitigation efforts
- Assess downstream health and healthcare access effects.



# The Role of Work in Health Disparities in the U.S.

(R01 Clinical Trials Optional) PAR-21-275, Sep 8, 2024

- Support population-based research
- Occupational factors vs health outcomes
- Populations with health care disparities
- How work factor functions as a social determinant of health.



# Health Care Models for Persons with Multiple Chronic Conditions: Advancing Health Care towards Health Equity.

PAR-22-092 (R01 - Clinical Trials Optional), Sep 8, 2024

- Chronic Disease Management for seniors
- Already Established Research Connections
- Provide systematic guidelines
- For Populations that experience health disparities.
- Exploring new health care models for the marginalized population

# Thank You!



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