

The Disparity of Telemedicine Adoption During the COVID-19 Pandemic

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Speaker Background

- B.S. in Computer Science
- Ph.D. in Biomedical and 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

- **Innovation for a better care**
- **Data Science in Medicine**
- **AI & Health Informatics**

Data analysis

- **Analysis for a better care**
- **Retrospective cohort analysis**
- **Public Health population studies**

Technology - AI-based Predictive Algorithms

- AI achieves great performance in healthcare field
 - Predicting diagnosis, long-term survival, prognosis, etc.
 - A lot more projects to go
- My Previous experience in Machine learning & Clinical decision support
 - Predicting adverse events using clinical trials [\[1\]](#)
 - Using images to detect bone cancer [\[2\]](#), and breast cancer [\[3\]](#)
 - Senior adult falls diagnosis [\[4\]](#)
 - Evaluating health news quality in AI [\[5\]](#)

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

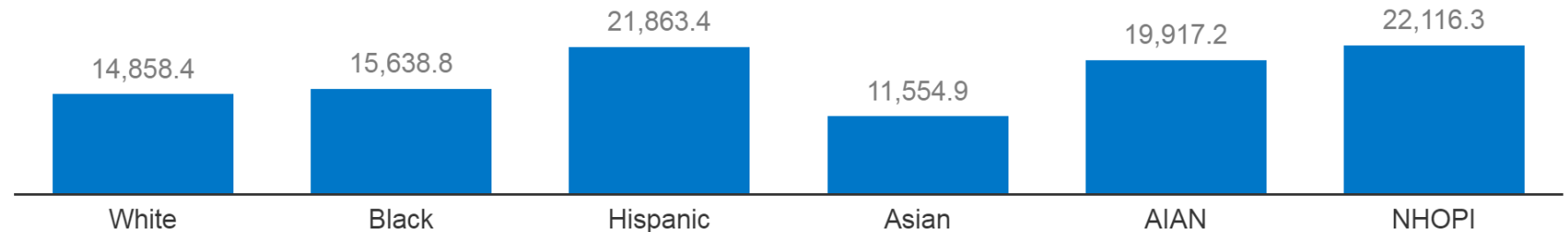
COVID-19 Infection varies by race

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](#)

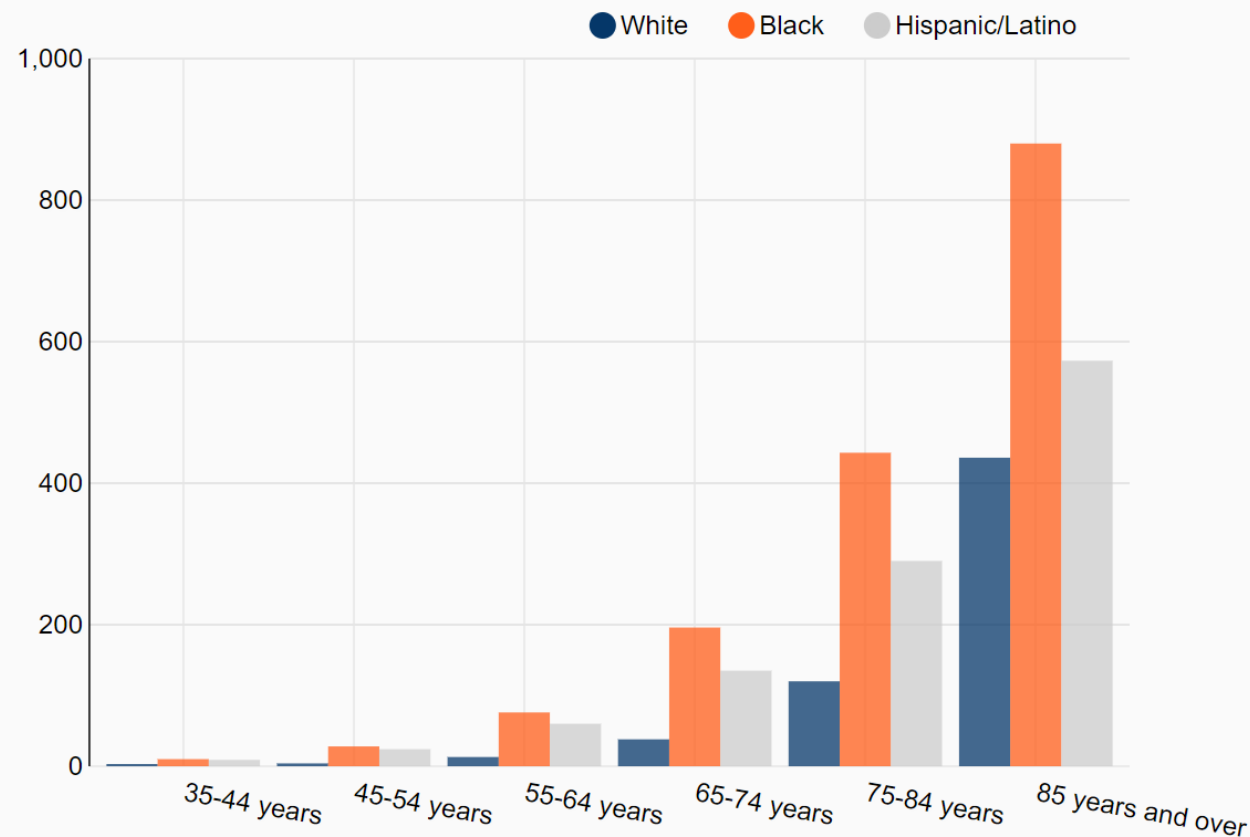
KFF

Death Rates

- The pandemic impacts racial minorities
- The healthcare disparity in different races

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's 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



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



Rural-Urban Continuum Codes

- A community classification (Metropolitan / Non-metropolitan)



Rural area

VS



Urban area

Measurement of disparity

Odds Ratio

Odds Ratio

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

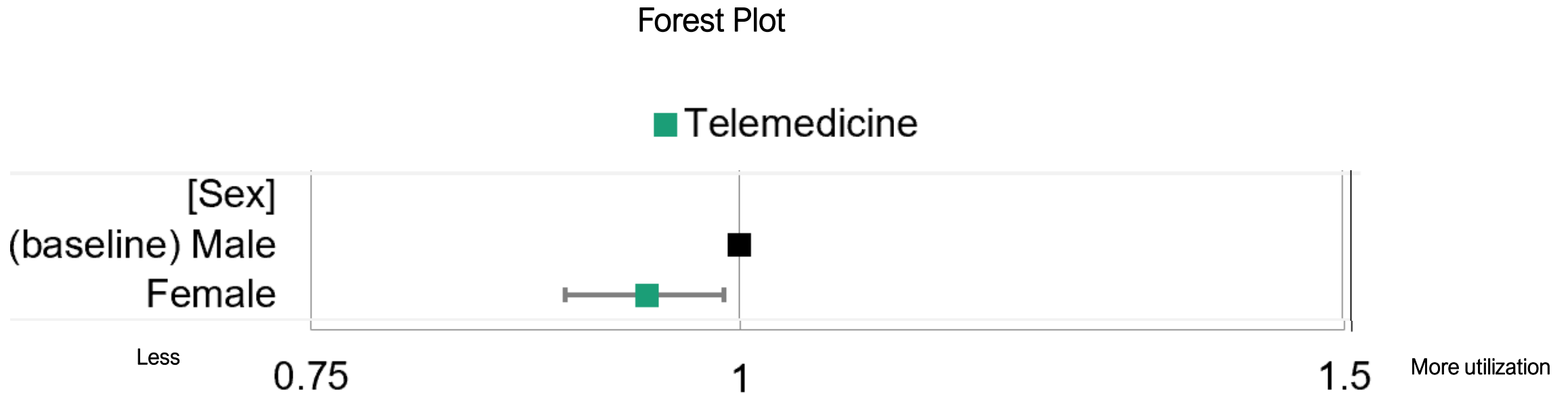
Outcome

	Success	Fail
Control	40	60
Treatment	80	20

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

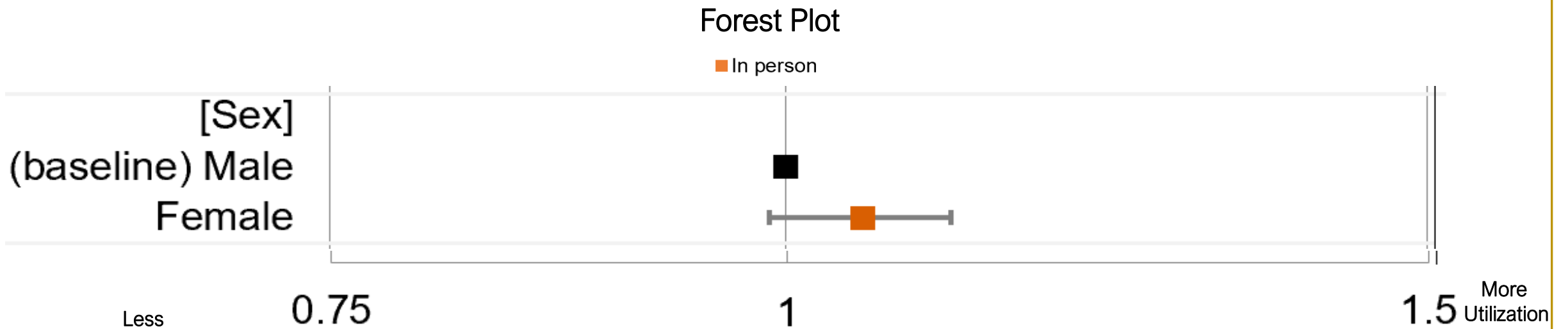
Treatment group is 6 times compared to the control group

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

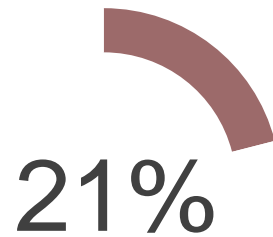
		Outcome	
		Telemedicine	No Telemedicine
Predictor	Socioeconomic Factor 1	a	b
	Socioeconomic Factor 2	c	d

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

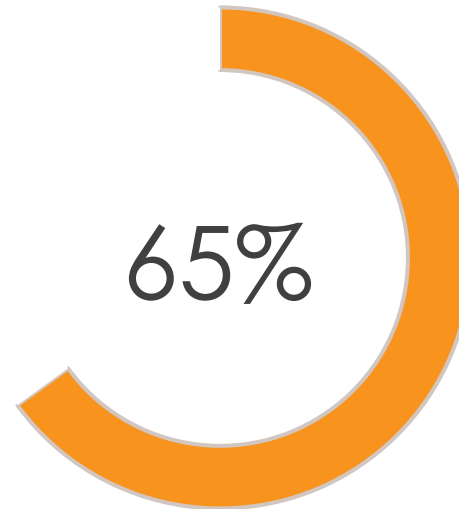
The odds of factor 2 patients choosing Telemedicine is $\frac{ad}{bc}$ times compared with Factor 1 cohorts.

Results: The Disparity of Telemedicine Utilization

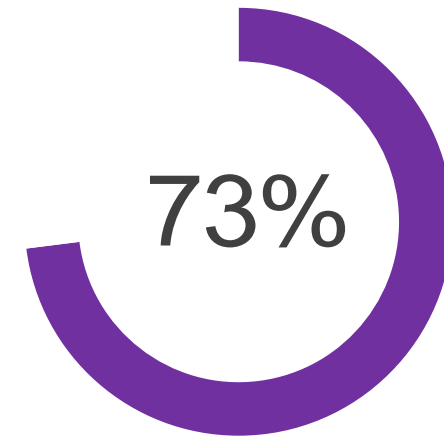
Overall Utilization Rate



Telemedicine



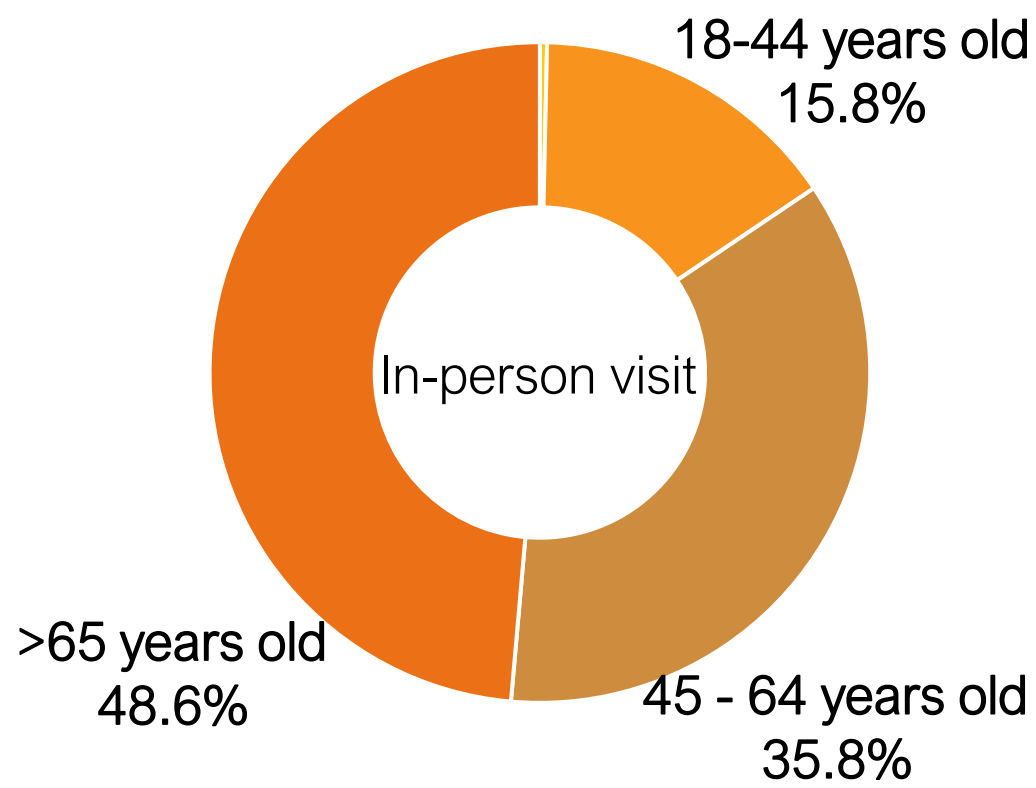
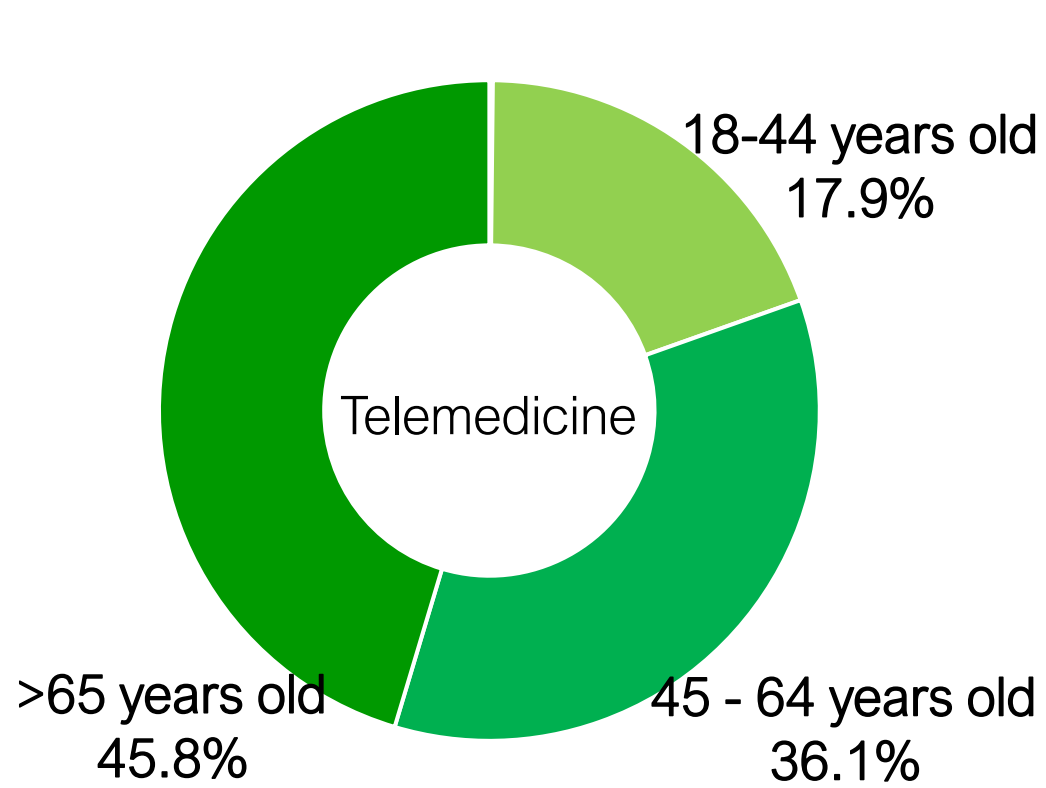
In-person



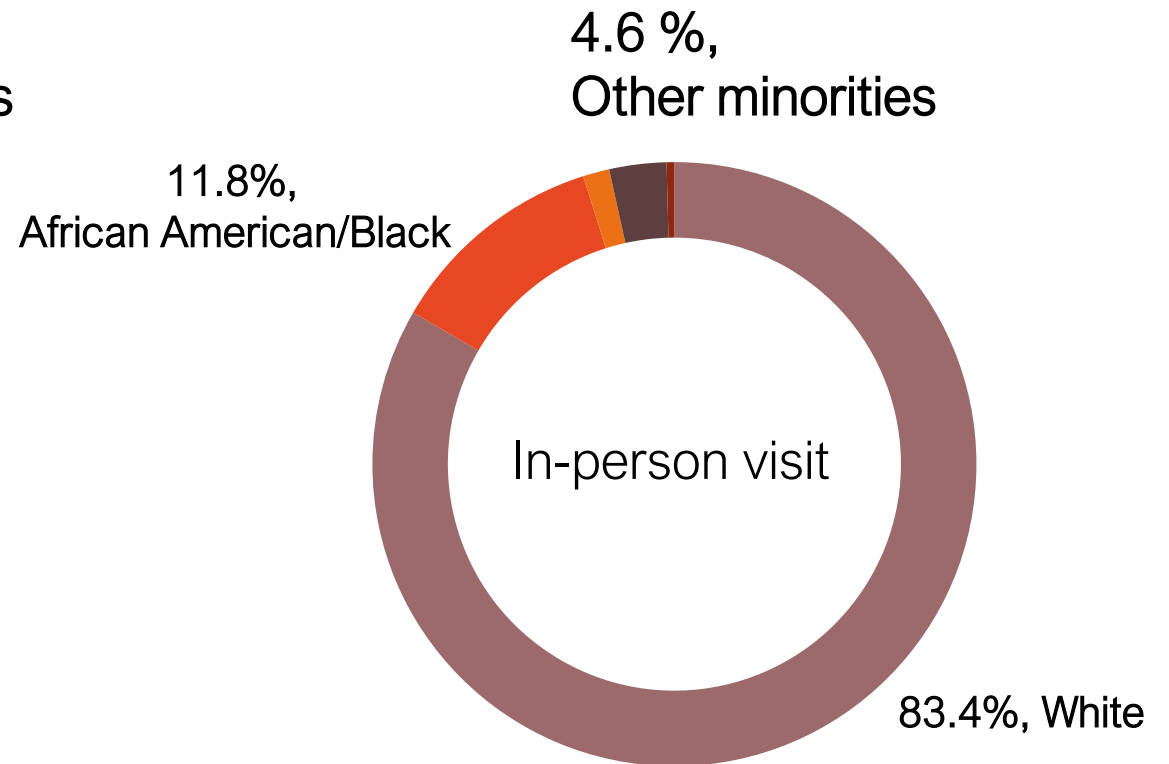
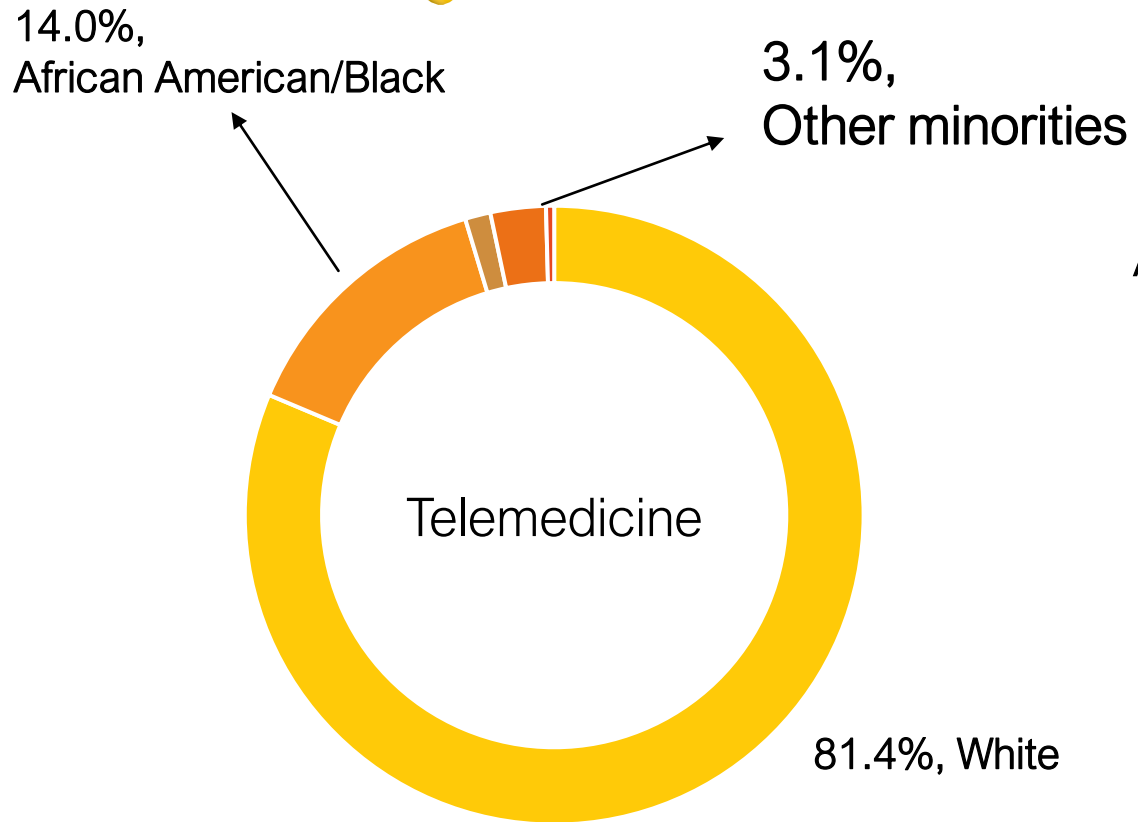
Phone or Message

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.

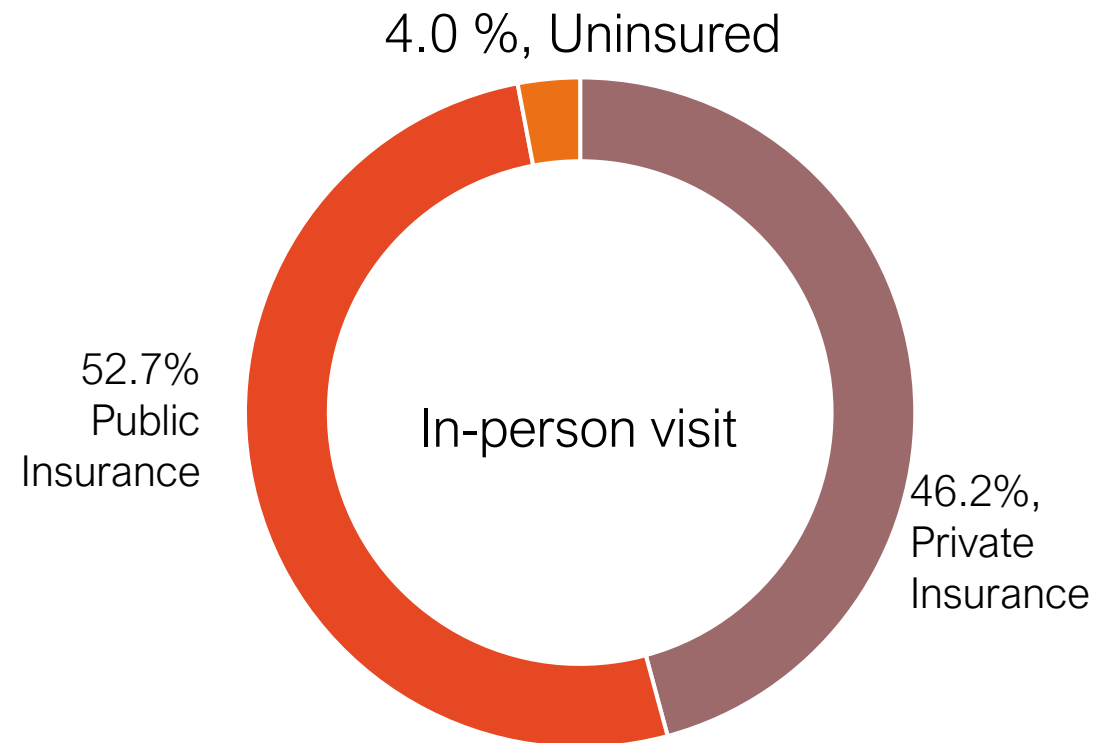
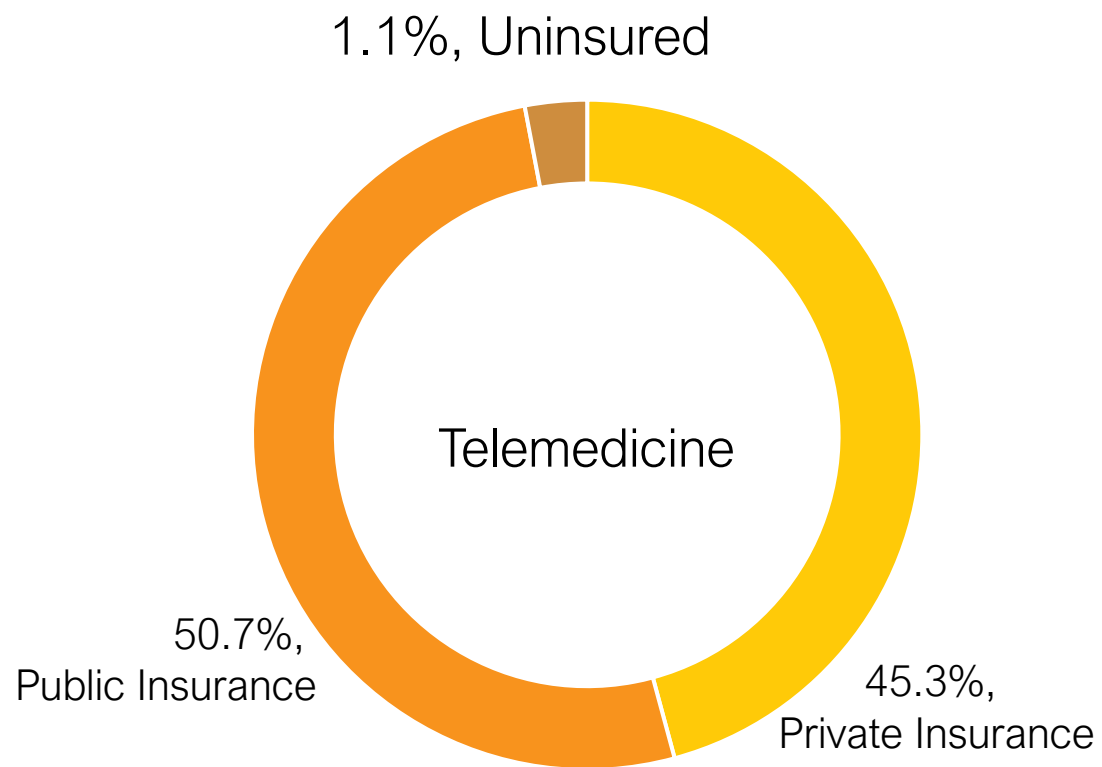
Age



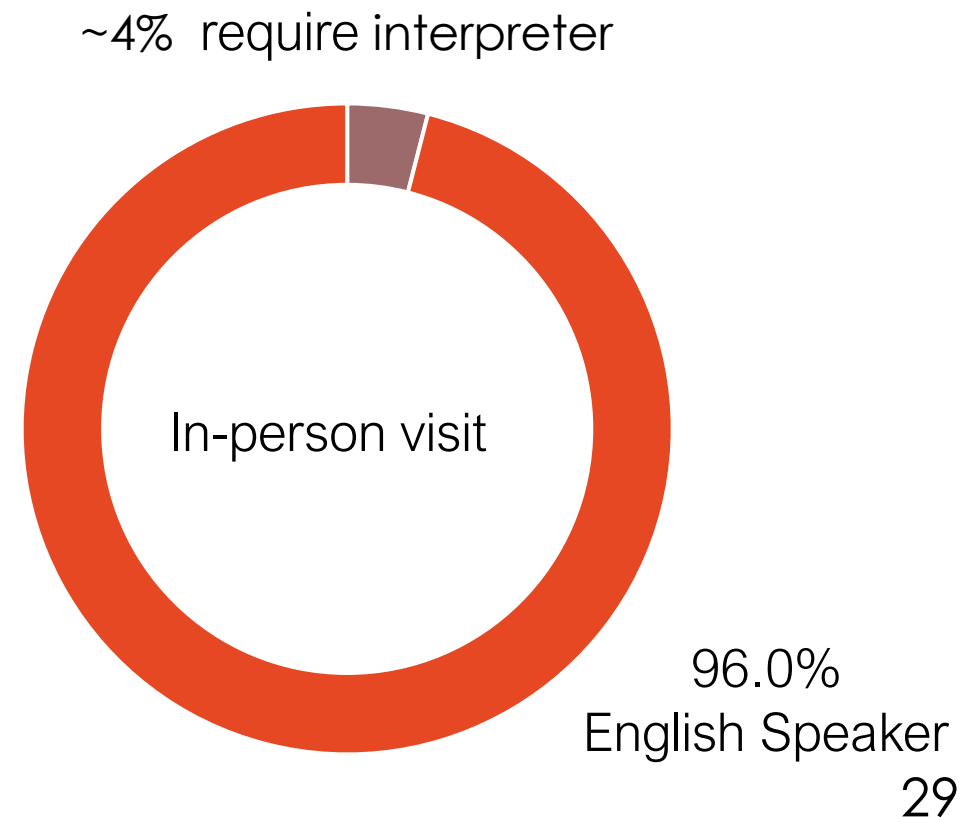
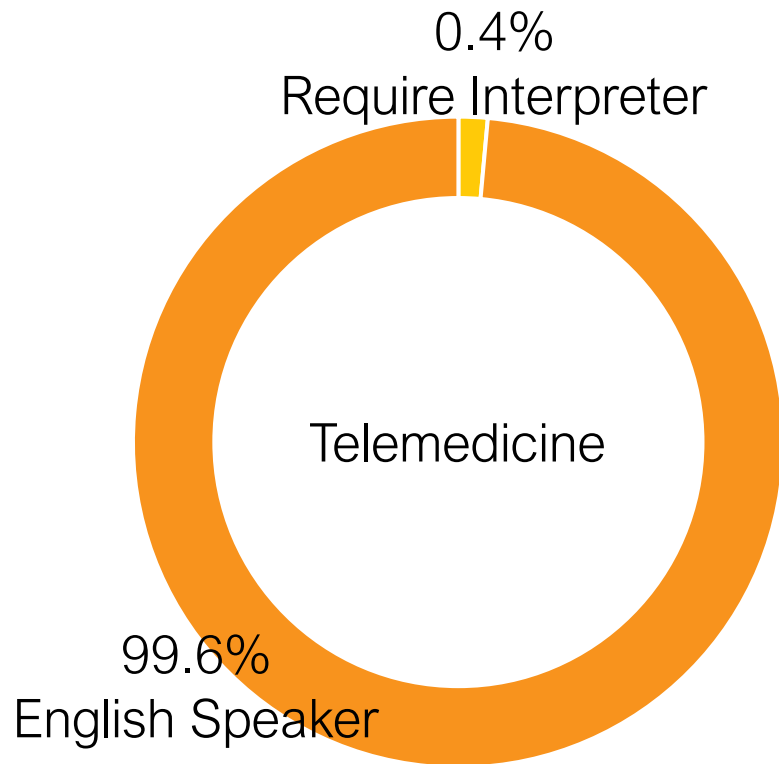
Race



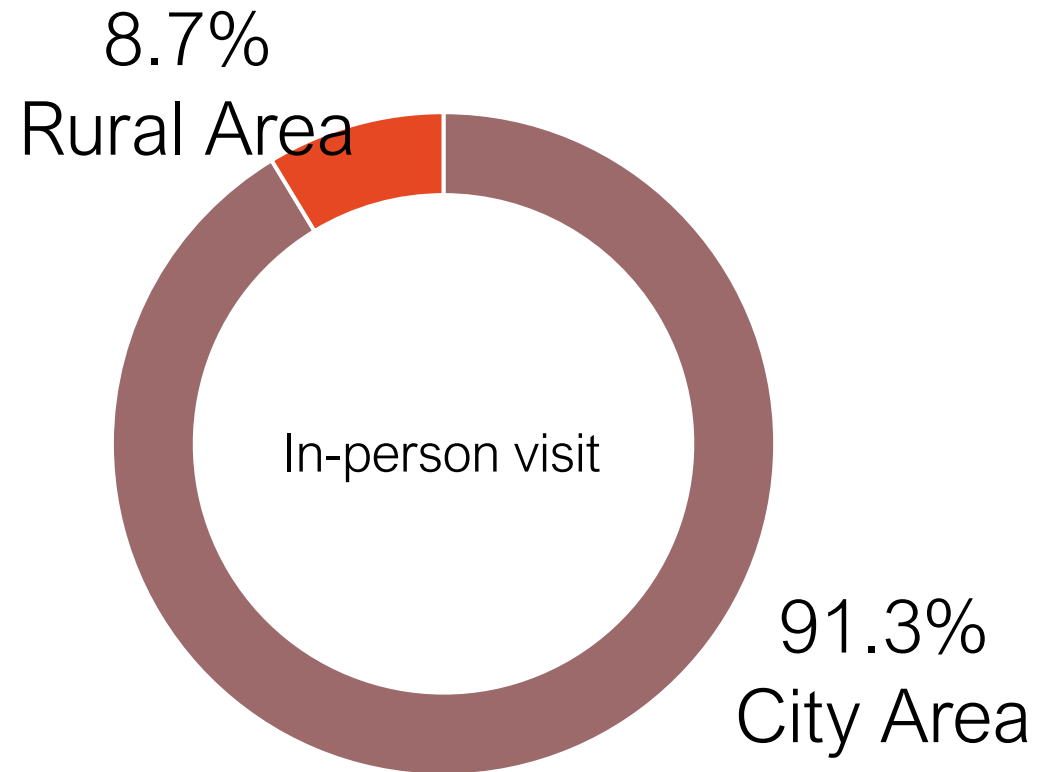
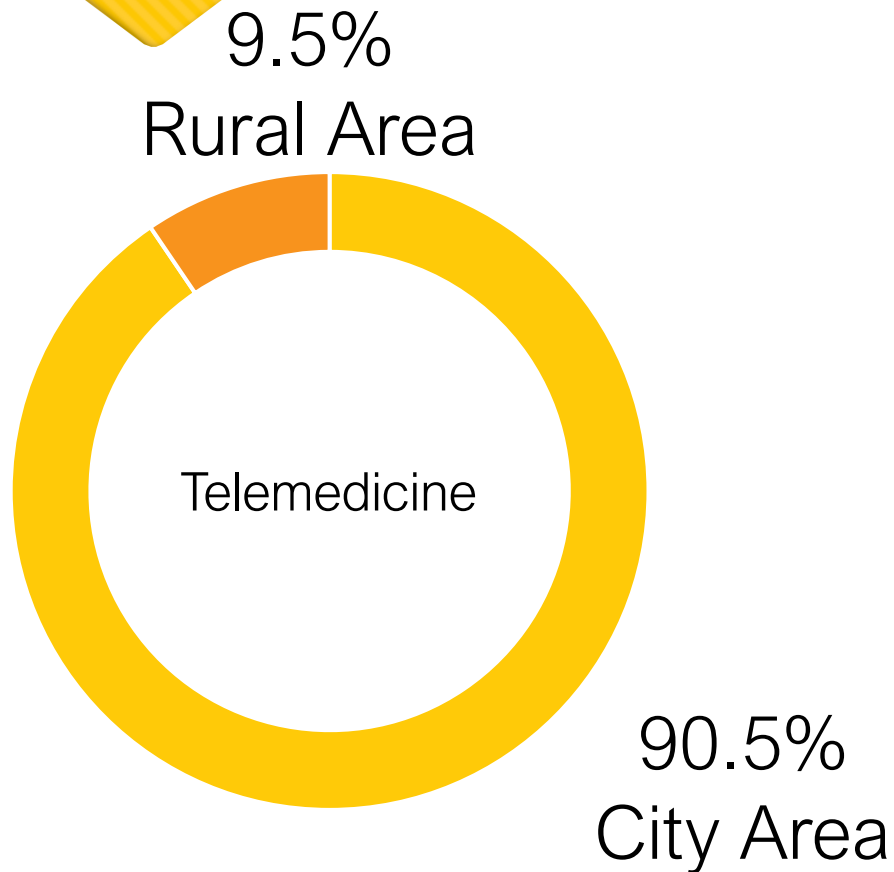
Insurance



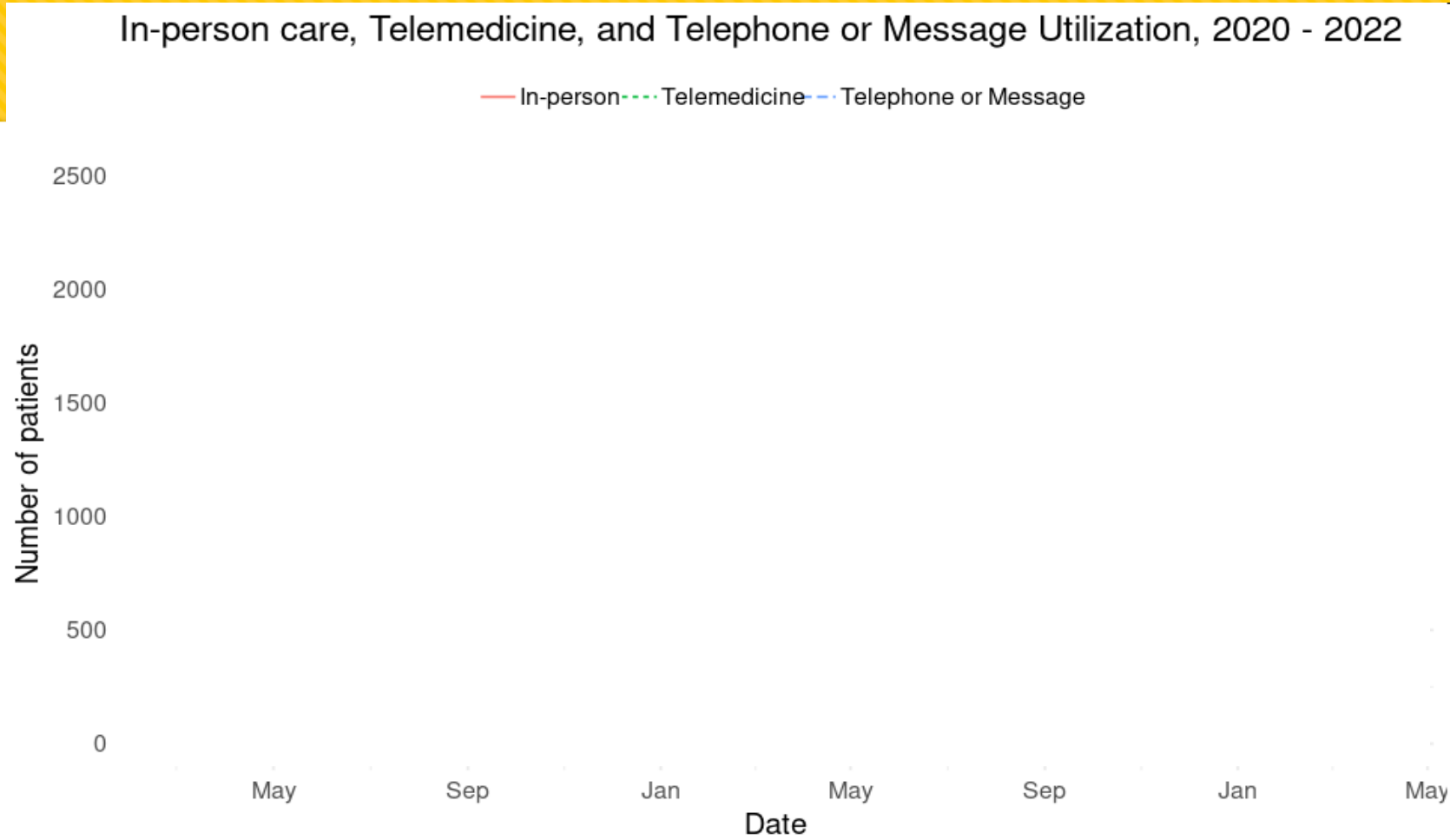
Language



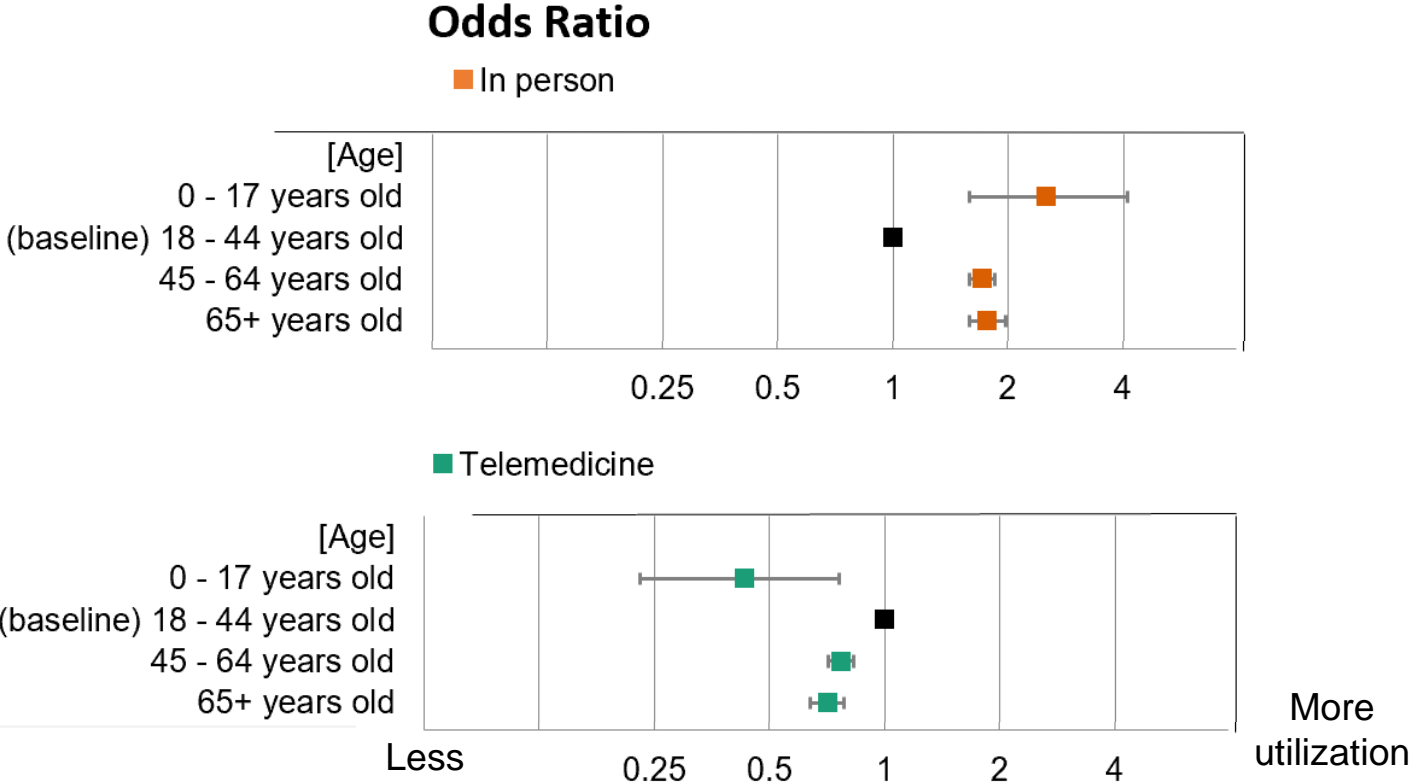
Rural/Urban gaps



Weekly Utilization

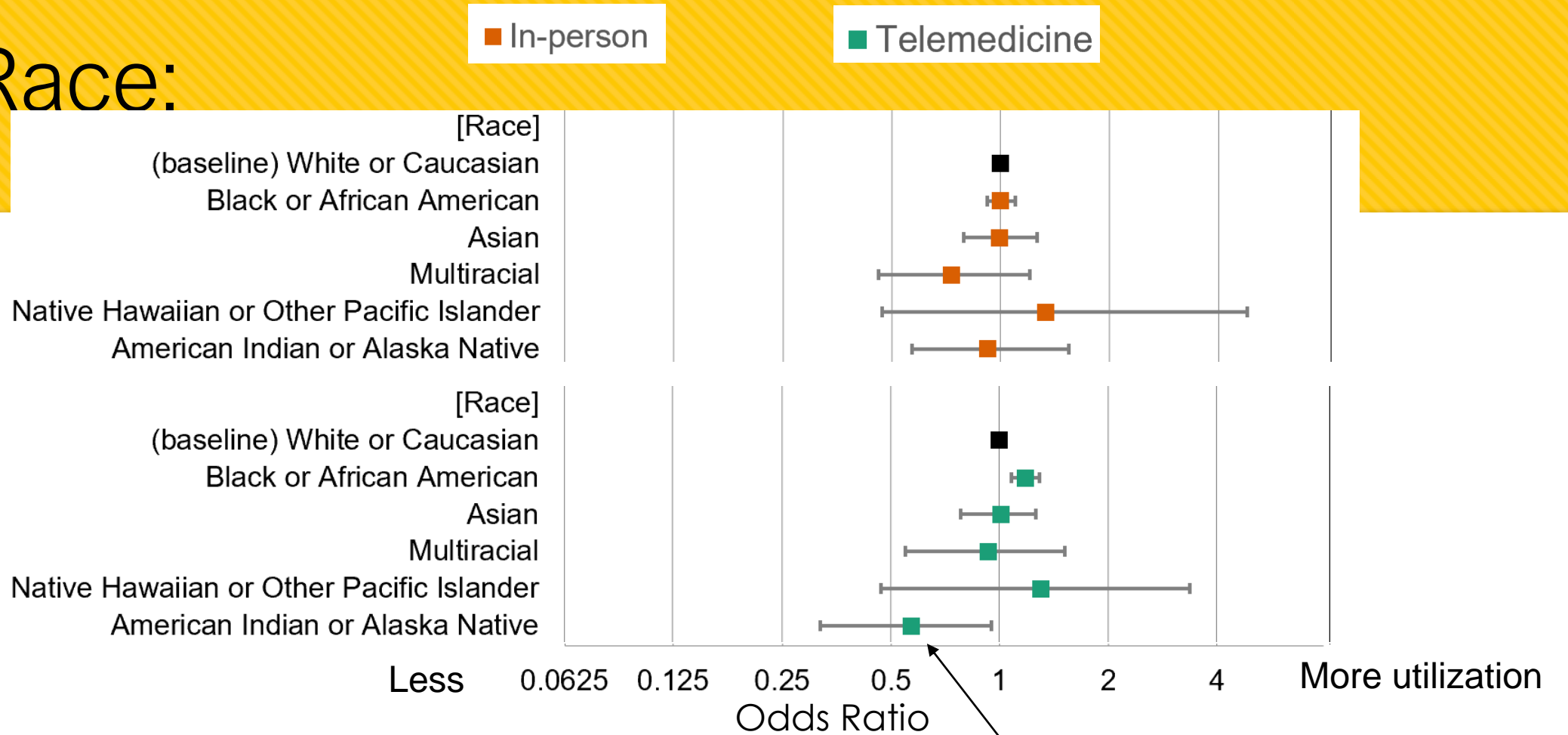


By Age, utilization



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:

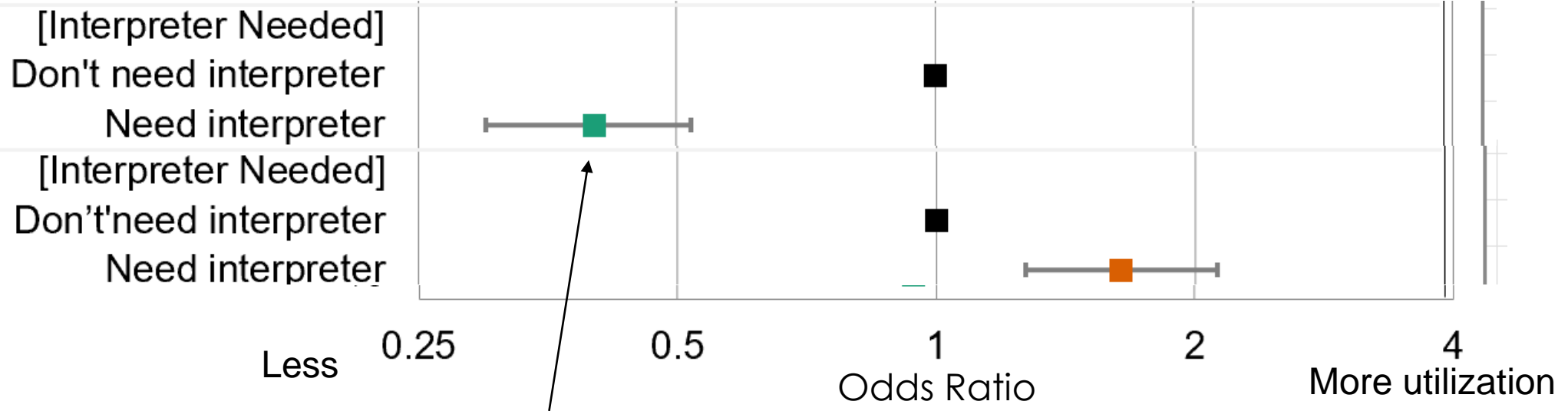


American Indian and Alaska Native are Underserved populations

By Language

■ Telemedicine

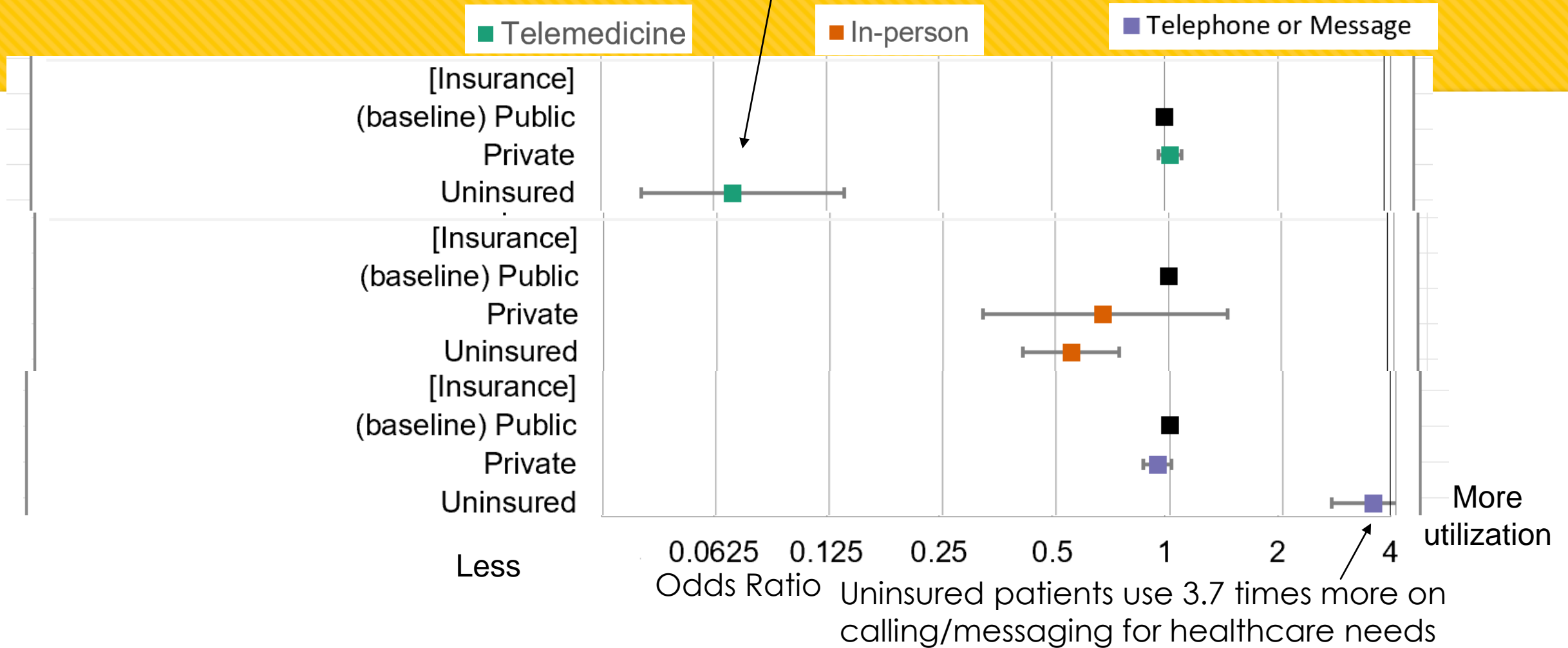
■ In-person



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)

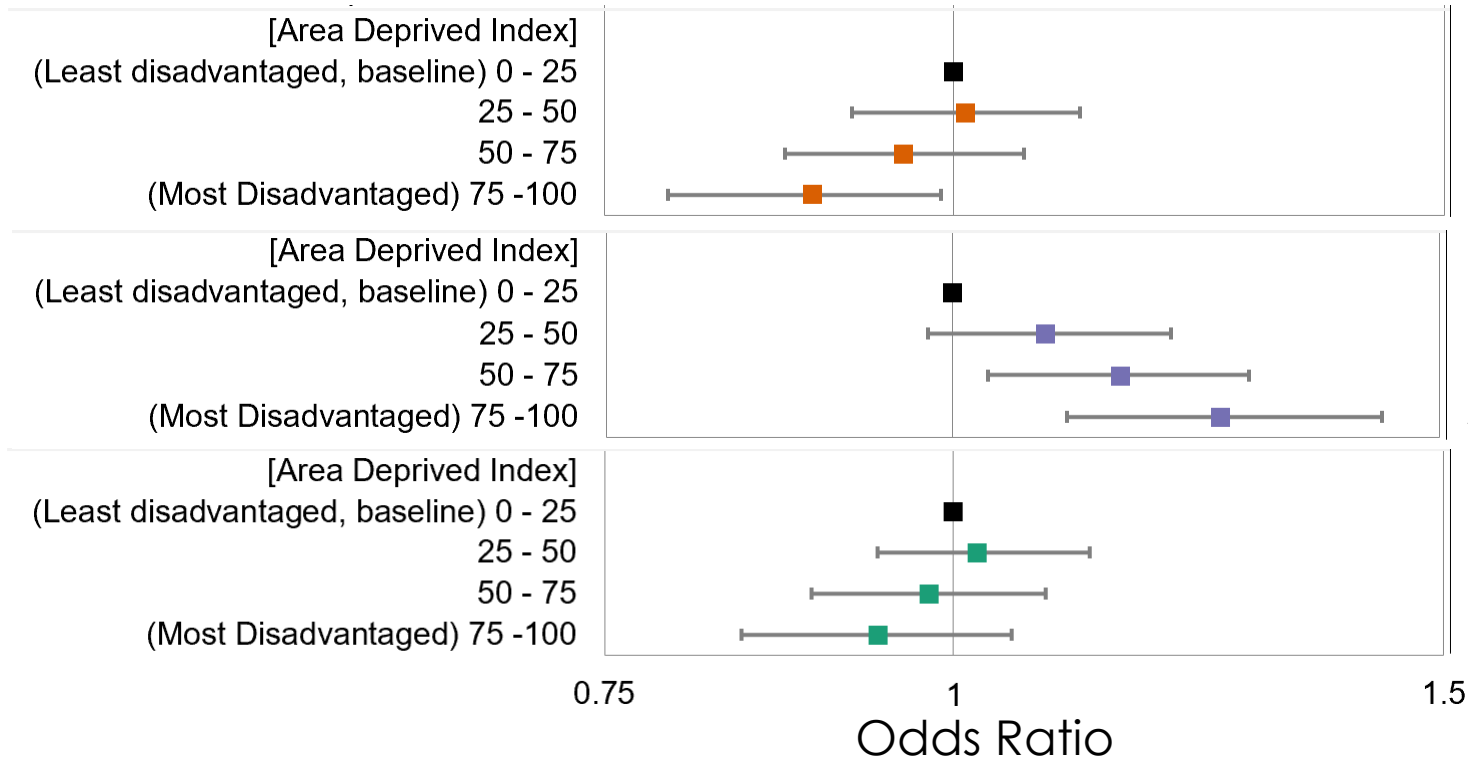


By Area Deprived Index

■ In-person

■ Telephone or Message

■ Telemedicine

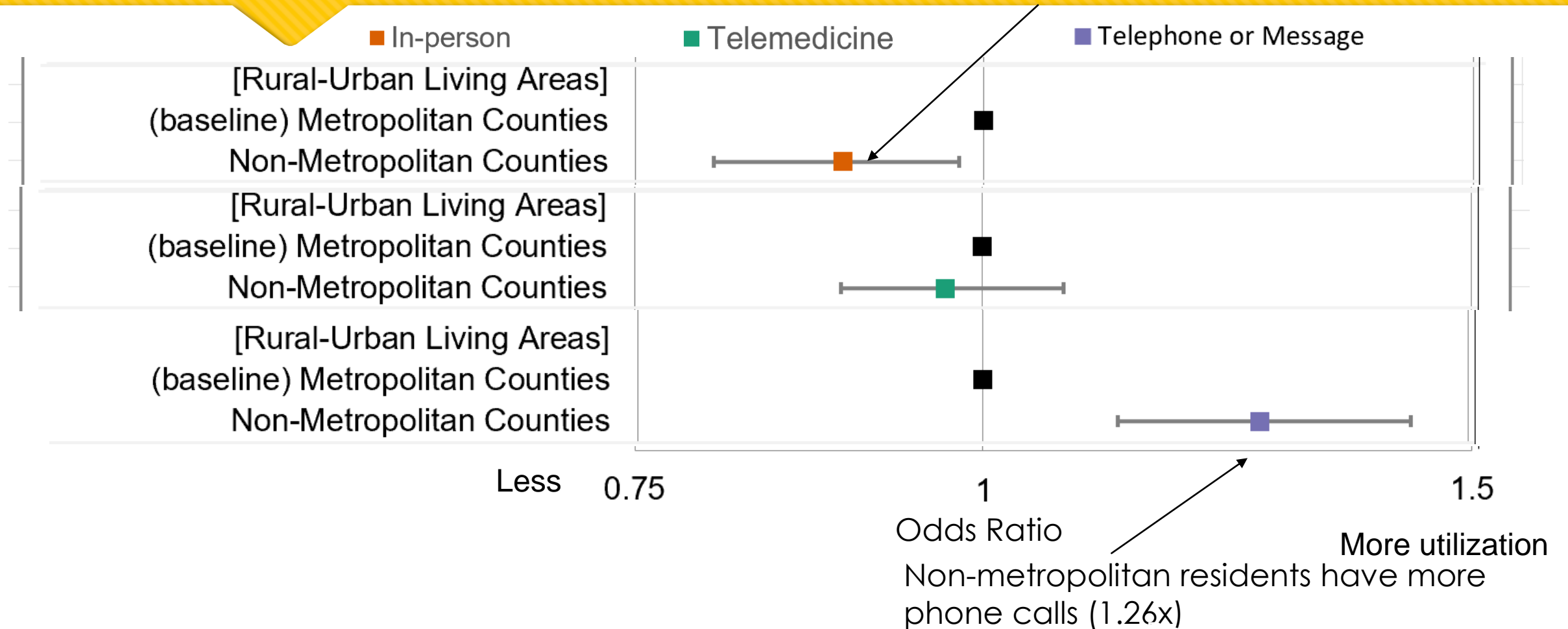


Summary:

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)



Discussion

Study review: measurement of healthcare disparity

Telemedicine Utilization:

- Coverage remains low (~21%)
- Phone and in-person care are major forms (60-70%)
- Telemedicine only work in basic e-meetings and consultants, etc

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

Internet 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](#)

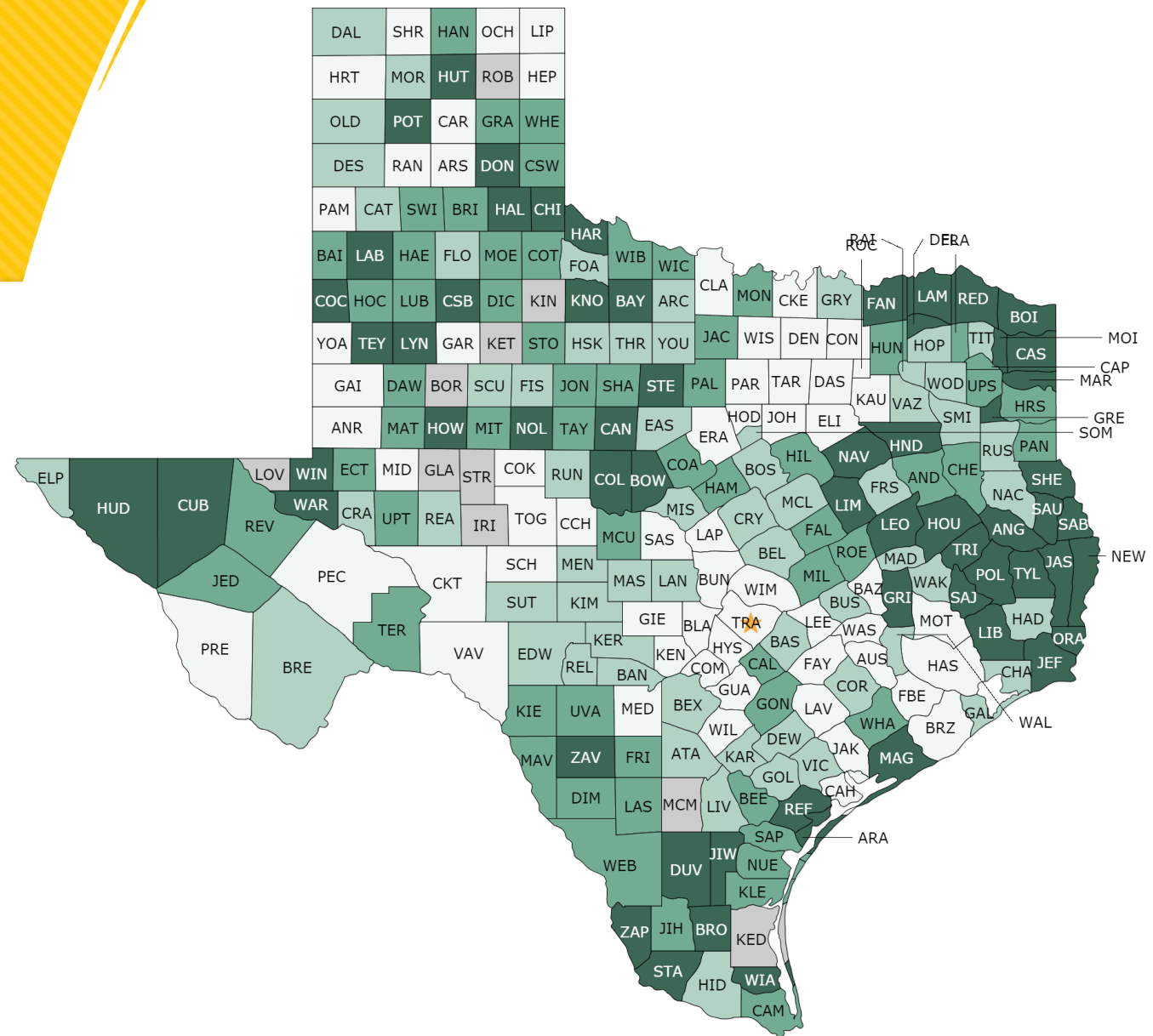
Conclusion

- 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.

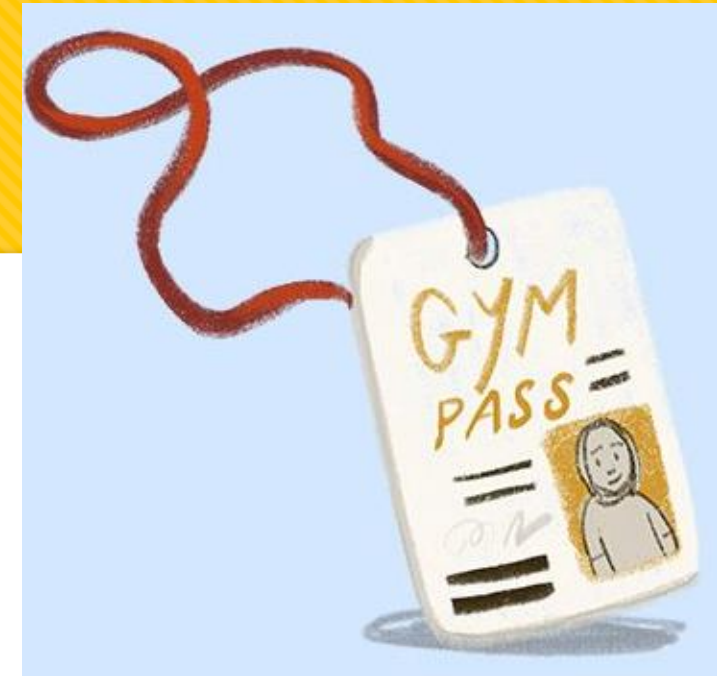


Rank 1-61 Rank 62-122 Rank 123-183 Rank 184-244 Not Ranked

2. Including social and cultural factors

Social, cultural factors for different populations:

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



4/17/2023

3. Using technology to addressing the health literacy



Deploying technology to reduce the gap

- E.g. Online, Clinical Decision support 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

Thank You!



Download the paper

[Telemedicine Adoption during the COVID-19 Pandemic: Gaps and Inequalities](#)



Visit Ling's website



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