NATIONAL ACADEMIES Sciences Engineering Medicine

TRB TRANSPORTATION RESEARCH BOARD

TRB Webinar: Transformational Technologies and Mobility Inclusion

October 17, 2024

12:00 – 1:30 PM

PDH Certification Information

1.5 Professional Development Hours (PDH) – see follow-up email

You must attend the entire webinar.

Questions? Contact Andie Pitchford at TRBwebinar@nas.edu

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Purpose Statement

This webinar will will discuss the TCRP Research Report 244 & NCHRP Research Report 101: Transformational Technologies and Mobility Inclusion Playbook, setting the stage for inclusive transportation as an integral component of the evolving transformative transportation ecosystem.

Learning Objectives

At the end of this webinar, you will be able to:

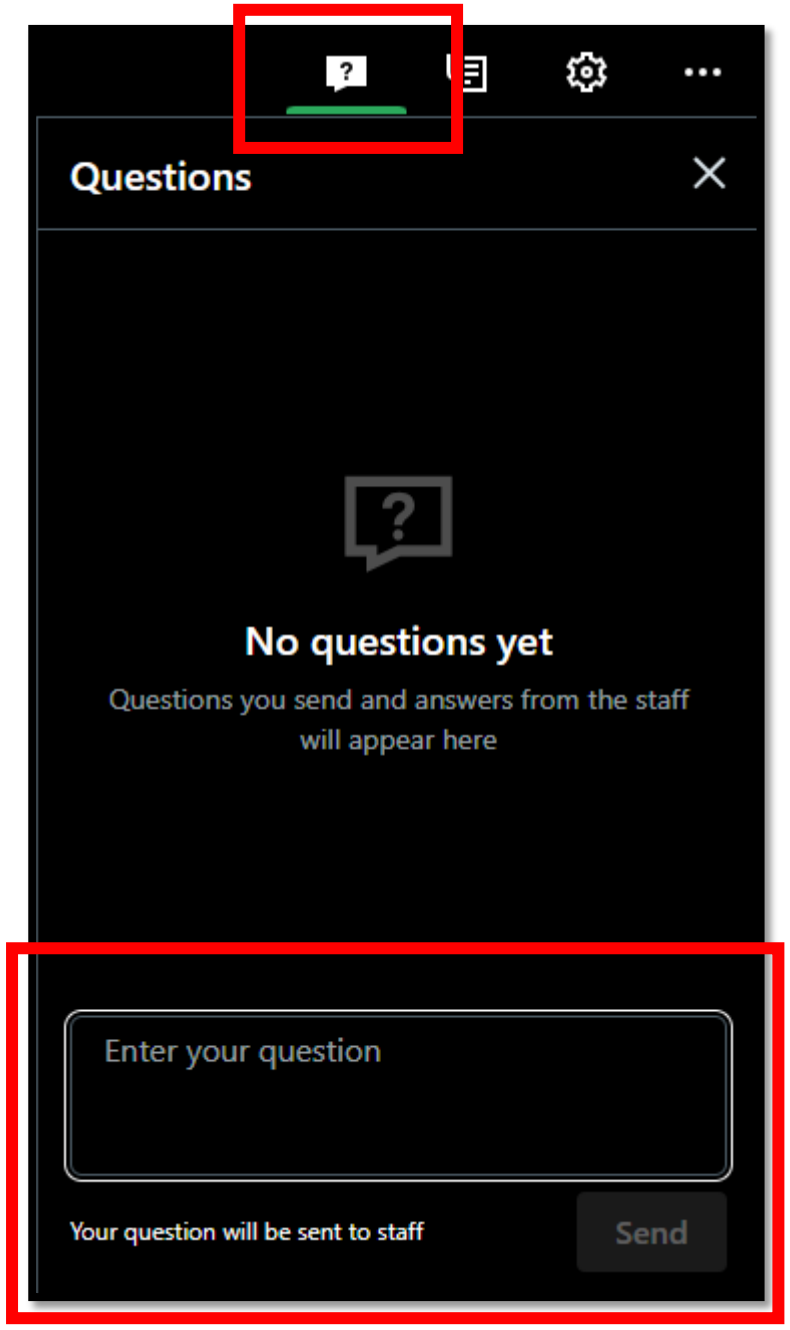
(1) Recognize current and anticipated barriers that pose challenges for underserved individuals to access and use new mobility services

(2) Develop actionable strategies to implement inclusive transportation solutions

(3) Utilize the Transformational Technologies and Mobility Inclusion Playbook to ensure inclusive transportation options tailored to the needs of underserved populations

Questions and Answers

- Please type your questions into your webinar control panel
- We will read your questions out loud, and answer as many as time allows



Today's presenters

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Transformational Technologies and Mobility Inclusion

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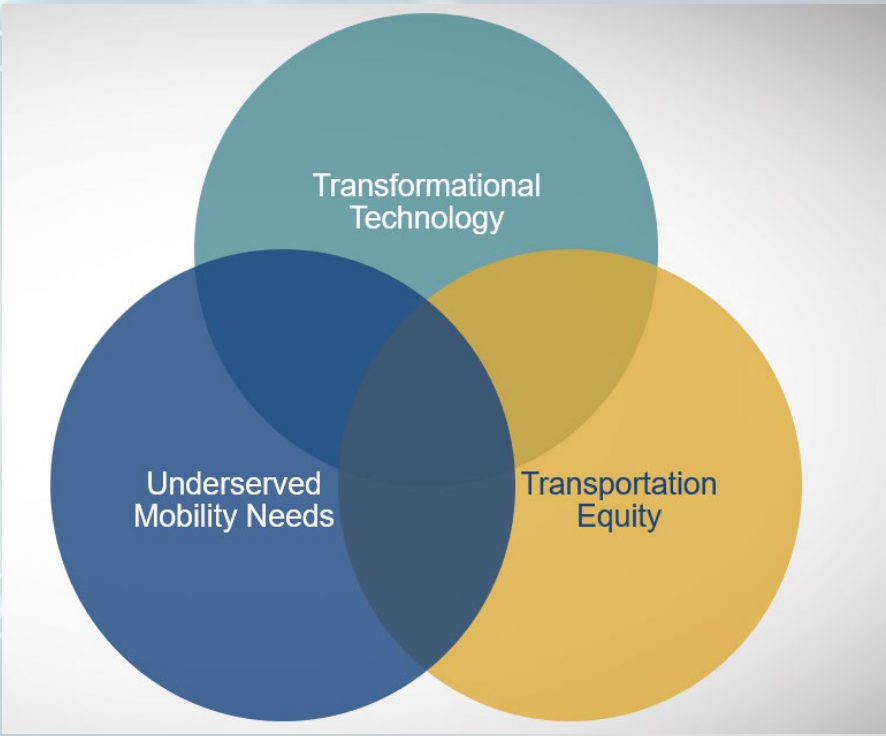
Research Objective

Provide guidance to achieve inclusive mobility, with a special focus on ensuring that underserved communities benefit from technology-enabled mobility services.

Based on the two research projects:

- **TCRP B-47**—Impact of Transformational Technologies on Underserved Populations
- **NCHRP 20-102(30)**—Equity Impacts of Shared AVs on Transportation-Disadvantaged Communities



Principal Investigator: Ipek N. Sener, TTI

The Playbook

Transformational Technologies and Mobility Inclusion Playbook provides a practical guide for addressing barriers to accessing transformational transportation technologies and deploying these technologies in an inclusive manner.

It concentrates on what needs to be done and for whom.

https://nap.nationalacademies.org/catalog/27754/transformational-technologies-and-mobility-inclusion-playbook

Expanding Impact and Inclusivity

Adapting to future transportation landscapes

Scalable strategies for underserved communities

Primary Steps of the Research

1

Laying the foundation

2

Playbook development

3

Implementation considerations

Acknowledgments

AUTHOR ACKNOWLEDGMENTS

The research reported herein was performed under TCRP Project B-47 and NCHRP Project 20-102(30) by the Texas A&M Transportation Institute (TTI), a member of The Texas A&M University System; EBP US; and GO Systems Solutions.

In addition to the authors listed on the title page, we extend our heartfelt thanks to all those who have been part of this project at various times, offering support throughout its execution. Special acknowledgments go to TTI researchers and staff Johanna Zmud (formerly with TTI), Audrey Cabay (formerly with TTI), Dawn Herring, Justin Malnar, Tobey Lindsey, and Vicky Nelson; EBP US researchers Scott Middleton (formerly with EBP US) and Dilara Sisman; as well as Adrienne Pulido and Daniela Kayser of Primavera Strategy. We also express our gratitude to David Evans and Anne Del Vecchio for their assistance with ASL interpretation during focus groups.

We thank our project staff, in particular Stephan Parker (formerly with TCRP), Gwen Chisholm-Smith, and Stephanie L. Campbell, as well as our project panel for their support and valuable feedback during the execution of this project.

The study team would like to extend its appreciation to various transportation agencies, advocacy and social services organizations, technology providers, and other agencies and organizations that have deployed, are in the process of deploying, or are planning to deploy shared automated vehicles. We sincerely thank them for generously donating their time and sharing their experiences with our team members. A list of stakeholders interviewed is provided in Appendix B.

We are also deeply grateful to the focus group and survey participants for their support and involvement, which resulted in providing invaluable insights for the development of this playbook.

This playbook represents the culmination of a true collaboration with all our partners and is intended to support various agencies and organizations in making a meaningful impact through inclusive transportation systems that enhance mobility, equity, and access for all.

TRANSIT COOPERATIVE RESEARCH PROGRAM

TCRP RESEARCH REPORT 244

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP RESEARCH REPORT 1101

Transformational Technologies and Mobility Inclusion Playbook

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Subject Areas
Public Transportation • Planning and Forecasting

Research sponsored by the Federal Transit Administration in cooperation with the American Public Transportation Association and by the American Association of State Highway and Transportation Officials in cooperation with the Federal Highway Administration

NATIONAL ACADEMIES Sciences Engineering Medicine

TRB TRANSPORTATION RESEARCH BOARD

2024

Laying the foundation: Background research

Cecilia Viggiano

Vice President

EBP US

Research Methods

Literature Review

- Historical analysis
- Barrier identification
- Review of inclusion-focused policies and improvements
- Review of equity in AV and shared AV deployments

Stakeholder Interviews

Stakeholder interviews with:

- Transportation (transit) agencies
- Associations representing underserved populations (e.g. American Council of the Blind, AARP, Houston Area Urban League)
- Advocacy and Research Organizations (e.g. Shared-Use Mobility Center, Center for Neighborhood Technology)
- Technology providers (RouteMatch, Smart Columbus)
- Staff involved in 24 distinct AV deployment events with deployment dates ranging from 2017 to 2024

Research Methods

Focus Groups

Online focus groups discussing travel behaviors and preferences with:

- Older adults
- People with low incomes
- People residing in rural areas
- People who spoke little to no English
- People with disabilities

Also conducted 2 additional focus groups with people with disabilities that specifically focused on perceptions and potential barriers to shared AV use

Survey

Online survey to gather information from members of underserved populations about transformational technology use and barriers.

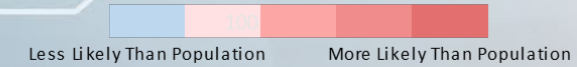
Collected 1,275 usable survey responses. Not a representative sample. Instead filled quotas of each of the underserved populations.

Gap Analysis

Characteristic	Total
Below Poverty	12%
Older Adult	17%
Person of Color	27%
Rural	17%
Indigenous	2%
Hearing Disability	4%
Vision Disability	3%
Ambulatory Disability	7%
Cognitive Disability	5%
Non-English Speaker	4%
No Internet	8%
No Cellular Data	25%
No Broadband	18%
No Smartphone	15%
No Laptop or Tablet	9%
No Credit Card	29%
Unbanked	5%
Underbanked	15%

Sources: US Census 2021, US Census PUMS 2014-2018, Pew 2021, FDIC 2021 National Survey

Characteristic	Below Poverty	Older Adult	Person of Color	Rural	Tribal	Hearing Disability	Vision Disability	Ambulatory Disability	Cognitive Disability	NonEnglish Speaker	No Internet	No Cellular Data	No Broadband	No Smartphone	No Laptop or Tablet
Below Poverty	-	-34	45	14	57	0	59	46	81	84	120	37	74	57	124
Older Adult	-	-	-38	16	-36	306	178	245	97	34	109	53	47	145	95
Person of Color	-	-	-	-36	267	-40	3	-10	0	76	27	7	18	-2	34
Rural	-	-	-	-	107	41	31	27	23	-48	41	12	47	27	35
Tribal	-	-	-	-	-	32	62	42	71	-33	68	15	57	23	65
Hearing Disability	-	-	-	-	-	-	758	473	416	15	114	44	52	121	101
Vision Disability	-	-	-	-	-	-	-	572	582	64	125	39	57	100	117
Ambulatory Disability	-	-	-	-	-	-	-	-	543	41	133	47	59	125	124
Cognitive Disability	-	-	-	-	-	-	-	-	-	20	86	21	38	67	84
NonEnglish Speaker	-	-	-	-	-	-	-	-	-	-	118	37	70	48	131
No Internet	-	-	-	-	-	-	-	-	-	-	-	305	462	411	681
No Cellular Data	-	-	-	-	-	-	-	-	-	-	-	-	118	220	189
No Broadband	-	-	-	-	-	-	-	-	-	-	-	-	-	191	370
No Smartphone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	357
No Laptop or Tablet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Literature Review: Key Findings

Context

- Historical Transportation Inequities
  - Underserved populations are often under-represented among decision-makers, and their input to decisions may also be limited
- Typical users of mobility services are young, have high incomes, have high education levels, are tech-savvy, and have access to the full banking system

Barriers

- Include:
  - Spatial (e.g. density and land use)
  - Temporal (limited off-peak service)
  - Economic (costs, technology, and banking requirements)
  - Physiological (design is not accessible or inclusive to all)
  - Social (perception, including of safety)

Strategies

- Some cities have inclusive stated policy goals for shared mobility
- Some cities have regulations to improve equity
  - Ex: Denver and Washington D.C. require carshare vehicles be placed in low-income areas
- Some programs include discounted memberships and alternative payment options
  - Ex: Boston's SNAP Care to Ride (discounted bikeshare for SNAP participants); Philadelphia's PayNearMe (cash for bikeshare)

Stakeholder Interviews: Key Findings

Barriers:

- **Discrimination:** TNC drivers rejecting or canceling trips, Bikeshare systems with fewer docks in low-income areas
- **Affordability:** Ridesourcing in particular is cost-prohibitive for long trips for some populations
- **Upfront Costs:** Bikeshare programs with high annual membership
- **Access without Credit Cards:** Bikeshare, ridesourcing, carsharing programs often do not accept cash
- **Access to and Comfort with Cellphones and Smartphones:** Older people and people with low incomes may not have smartphones and rural and tribal communities may lack service coverage
- **Accessible Vehicles and Apps:** Frequently updated apps are not always accessible, diverse accessible vehicle needs are not always met
- **Fundamental Barriers in Rural Settings:** Lack of lighting, unpaved roads, lack of service
- **Safety Concerns:** Riding with strangers, safely using bikes, e-bikes, or e-scooters
- **Documentation and Other Requirements:** Carsharing requires driver's license and insurability

Stakeholder Interviews: Key Findings

Strategies for Inclusion

Information and Training

- Put information where people are going already
- Hands-on and interactive (buddy programs, call-in lines)

Planning for Inclusion

- Listen to underserved communities
- Use available data to evaluate access
- Consider innovative models for improving access (low-cost memberships, land-line-based TNC requests)

Addressing Silos

- Ensure that equity/inclusion focused staff/departments are integrated into planning process

Financing Adaptive Solutions

- Programs that redistribute payments to support less-profitable trips
- Employer and university-sponsored programs
- Pilots to demonstrate solutions at low cost

Stakeholder Interviews: SAV Deployment Findings

Questions

- How are/will identified population groups facing/face limitations in access from the current and future use of SAV mobility services?
- What barriers exist to exclude or deter these population groups?
- What can be done to reduce these barriers and encourage participation?

Challenges

Vary by urban, suburban, and rural setting but common themes include:

- Physical Operation (interactions with signals, other vehicles, people)
- Regulatory (permitting, lack of laws in place)
- Safety (contingency plans and safeguards)

Stakeholder Interviews: SAV Deployment Findings

Strategies for Equitable Deployment

- Seeking community input
- Prioritizing deployments in disadvantage communities, including rural areas, retirement communities, and transit deserts
- Education and awareness campaigns, including public demonstrations and free test rides
- Using SAVs to bridge access gaps, including first and last mile connectivity

Specific Equity Consider-ations

- Trip planning and payment at kiosks or by phone
- ADA-compliant vehicles
- Training for stewards in assisting people with ambulatory disabilities
- Designated drop off spots and ramps for people in wheelchairs
- Visual and auditory announcements in vehicles

Design, funding, and service provision challenges remain.

Focus Groups: Key Findings

Focus groups were used to inform the online survey development.

Overall, many participants had lack of awareness and experience with many of the modes, especially app-based carpooling and carsharing.

People were most likely to have experience with ridehailing (Uber/Lyft) and commonly listed it as the best mode for them. There was considerable interest in self-driving shuttles as a convenient option in the future.

The focus groups with people with disabilities on shared AV perceptions emphasized concerns including wheelchair accessibility, affordability, fare payment options, technology (smartphone) requirements, trust, vehicle design, and pick-up/drop-off proximity.

Online Survey: Respondent Characteristics

Own or Have Access to a Personal Vehicle by Underserved Population Groups

	Older Adults	Low Income	Rural	Disability	Little/No English
Yes	92%	69%	90%	82%	69%
No	8%	31%	10%	18%	31%
	100%	100%	100%	100%	100%

Daily Frequency of Driving by Underserved Population Groups

Daily Frequency	Older Adults	Low Income	Rural	Disability	Little/No English
Every day	15%	13%	17%	17%	36%
Almost every day	43%	25%	36%	33%	19%
Subtotal	58%	38%	53%	50%	55%
Sometimes	26%	25%	28%	22%	15%
Rarely	7%	12%	9%	12%	8%
Never	9%	24%	10%	16%	22%
	100%	100%	100%	100%	100%

Online Survey: Experience with Technologies

As suggested by the focus groups, many members of these groups have limited experience with the modes studied:

- Ridehailing is the mode participants have the most experience with. Still, with the exception of the Little/No English group, the majority of participants have never used ridehailing services.
- These responses highlight the fact that significant barriers exist for these populations.

Percent of respondents that have **never** used this technology

	Older Adults	Low Income	Rural	Disability	Little/No English
Ridehailing	87%	71%	84%	72%	35%
Bikesharing	98%	89%	94%	88%	70%
E-Scooter	99%	91%	95%	89%	76%
Carsharing	98%	90%	95%	87%	80%
App-Based Carpooling	99%	90%	95%	89%	75%

Online Survey: Barriers

Top Barriers	Ridehailing Services	Bikesharing Services	E-scooter Sharing Services	Carsharing Services	Carpooling Services	Self-Driving Vehicles
Lack of Service Availability	✓	✓	✓	✓	✓	
Driver or Operational Safety Concerns	✓		✓		✓	
Affordability	✓			✓		✓
Facility Limitations (lack of bike lanes, sidewalks)		✓	✓			
Age/Impairment-Based Limitations (cannot use vehicles safely)		✓	✓			
Lack of Operational Knowledge or Information			✓	✓		
Burden of Responsibility				✓		✓
Lack of Trust in Technology						✓

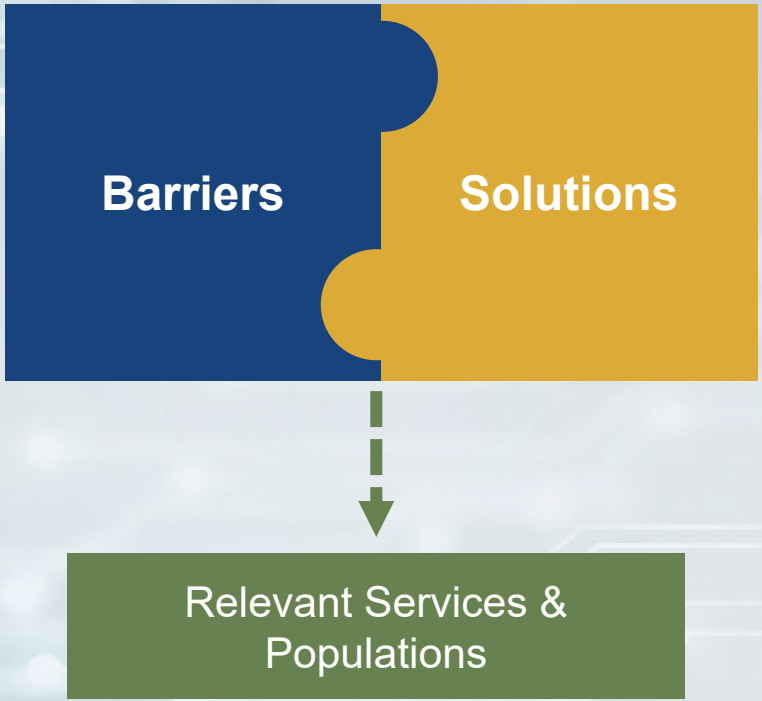
Online Survey: Additional Findings

Respondents identified many positive attributes of the technologies

In most cases, the top positive trait was “Don’t need to drive my own car.”

Exceptions were bikesharing, viewed as “Good exercise” and e-scooter, viewed as “Fun”.

Synthesis of Research Findings



APPENDIX A

Literature Review

Available as part of the Playbook.

TCRP Project B-47 and NCHRP Project 20-102(30)

Transformational Technologies and Mobility Inclusion Playbook

Appendices B–D are supplemental to *TCRP Research Report 244/NCHRP Research Report 1101: Transformational Technologies and Mobility Inclusion Playbook* (TCRP Project B-47 and NCHRP Project 20-102(30). The full report can be found by searching for the report title on the National Academies Press website (nap.nationalacademdies.org).

Appendix B: Stakeholder Interviews
Appendix C: Underserved Population Focus Groups
Appendix D: Underserved Population Survey

Available as supplemental reports.

Playbook development: Structure and use of case scenarios

Polly Okunieff

President

GO Systems and Solutions

Playbook Vision and Objective

Playbook defines

- Strategies and actions (“plays”) needed to achieve a goal

Playbook Objective

- Organizations needing a resource to address the diverse needs of a broader range of populations and foster more inclusive and equitable mobility services and support systems.

Audience

Organizations that want to provide safe, fair, and accessible (public) transportation tailored to the needs of underserved populations.

- Transit agencies,
- Transportation planning organizations,
- Mobility providers,
- State departments of transportation (DOTs), and
- Other social service organizations

Playbook Dimensions

Goals

Index Icon	Goal	Description
	Availability	Enhance the availability of the technology, infrastructure, and assistive services needed to operate the service
	Access to technology	Enhance access to technology and remove barriers for people who lack skills or abilities to use new technologies
	Awareness	Raise awareness of the service and its features, such as safety features

Goals

Index Icon	Goal	Description
	Accessibility	Build for universal inclusion and remove barriers that prevent interaction with or use of the service, including for people with disabilities or other special needs
	Safety and Security	Improve safety and security measures to mitigate concerns
	Affordability	Boost affordability of the service

Target Services

app-based carpool

- A concurrently shared commercial ride service in a motor vehicle where the traveler is matched with other riders traveling along a similar or identical route using a digitally enabled application or platform (e.g., smartphone apps).

bikesharing

- A service that provides travelers on-demand, short term access to a shared fleet of bicycles, usually for a fee. Bikesharing service providers may own, maintain, and provide charging or the bicycle fleet. Bikesharing includes pedal-only and powered bicycles such as e-bikes.

carsharing

- A service that provides travelers on-demand, short term access to a shared fleet of motor vehicles typically through a membership, and the traveler pays a fee for use.

Target Services

e-scooter sharing

- A service that provides travelers on-demand, short term access to a shared fleet of scooters for a fee. E-scooter-sharing service providers typically own, maintain, and provide fuel/charging (if applicable) for the scooter fleet. Service providers may also provide insurance. Scooter sharing includes standing and seated scooters that are solely human-powered and those that are partially or fully powered by a motor or engine. Scooter sharing is a form of shared micromobility.

ridehailing

- A service that provides travelers with prearranged and/or on-demand access to a ride for a fee using a digitally enabled application or platform to connect travelers with drivers using their personal, rented, or leased motor vehicles. Digitally enabled applications are typically used for booking, electronic payment, and ratings. Ridehailing service, also known as ridesourcing or transportation network company (TNC), refers to a type of for-hire ride service.

fully automated vehicle

- A service that includes sustained and unconditional performance by an automated driving system of the entire dynamic driving task and fallback.
- This technology could be applied to other services…ridehailing or microtransit services.

Target Populations

People who aged 65 years or older

People who speak little or no English

People with disabilities

People with low incomes

People residing in rural areas and tribal reservations

Playbook Plays

- Play TT-1: Build Trust through Enhanced Security and Communication
- Play TT-2: Create Discount and Ease-of-Payment Programs
- Play TT-3: Expand Adaptive and Motor-Assisted Micromobility Fleets
- Play TT-4: Boost Knowledge and Awareness of New Mobility Services
- Play TT-5: Create Safe Infrastructure for Micromobility Services
- Play TT-6: Facilitate Smartphone-, Data-, and Broadband-Free Ride Booking
- Play TT-7: Expand New Mobility Services in Rural and Tribal Areas
- Play TT-8: Implement Assistive Service Technologies in Vehicles
- Play TT-9: Improve Safety and Comfort for Shared Ride Services
- Play TT-10: Promote Equitable Implementation of Shared AV Services

Anatomy of a Play

TT-1: Build Trust through Enhanced Security and Communication

GOAL	Accessibility Safety and Security
SERVICE	App-based carpooling services Ridehailing services Fully automated vehicle services
POPULATION	People aged 65 years or older People who speak little or no English People with disabilities

- Overview
- Major Barriers
- Potential Strategies

Playbook Goal Icons

TT-1: Build Trust through Enhanced Security and Communication

GOAL	Accessibility Safety and Security
SERVICE	App-based carpooling services Ridehailing services Fully automated vehicle services
POPULATION	People aged 65 years or older People who speak little or no English People with disabilities

Playbook Overview

Overview

Ridehailing and app-based carpooling services have the potential to improve mobility outcomes for underserved populations. However, concerns regarding their safety and security can hinder individuals from fully embracing these services. Publicizing and enumerating the safe driving standards for ridehailing and app-based carpooling services is one viable solution to help foster trust in drivers by underserved populations, particularly older adults and people with disabilities. Additional measures such as providing increased education efforts, assistive drivers or attendants, safe rider checks, and additional app-related accessibility features would also help improve trust and increase service use if implemented in conjunction with the safety standards.

Playbook Major Barriers

Major Barriers

Even though ridehailing and app-based carpooling companies require driver background checks, common worries for new riders include uncertainty about the experience and concerns about safety that stem from getting into a car with an unknown driver or sharing a ridehailing trip with strangers.

In a self-driving vehicle without a human driver, the concerns can be further amplified when there is no immediate human presence to mediate or address any conflicts or safety issues that may arise between passengers during the ride. The lack of a driver as a neutral authority figure may heighten feelings of vulnerability and discomfort.

According to this project's transformational technologies survey, concerns about unknown drivers and riding with strangers exist across all population groups but are most pronounced for older adults and people with disabilities. The following were among the top barriers:

- **Riding with unknown ridehailing drivers perceived as unsafe.**
- **Having safety concerns about carpooling with strangers.**
- **Needing to know a driver's background and driving record.**
- **Not feeling safe or comfortable when riding with other people without a driver.**

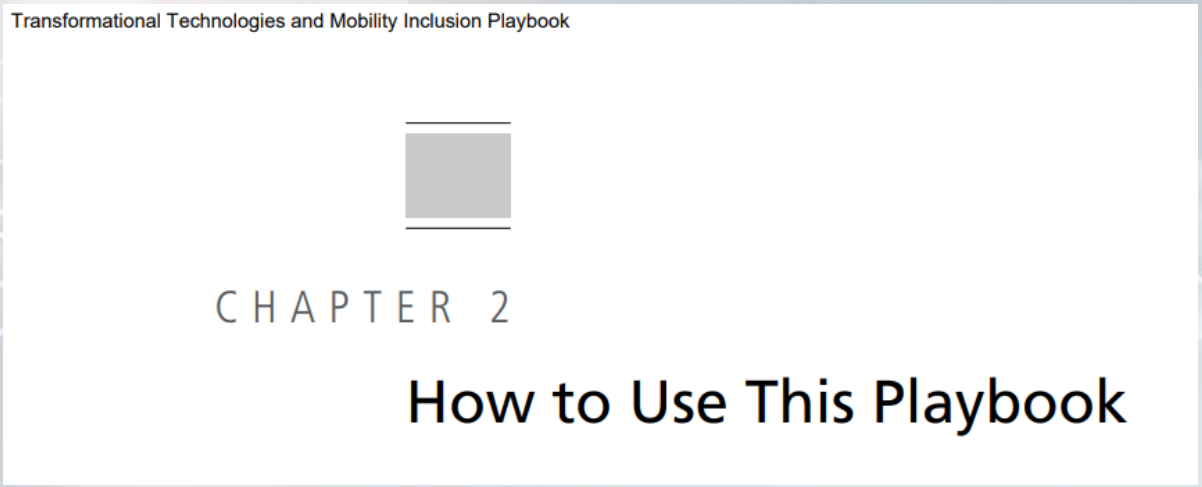
Playbook Potential Strategies

TT-2: Create Discount and Ease-of-Payment Programs

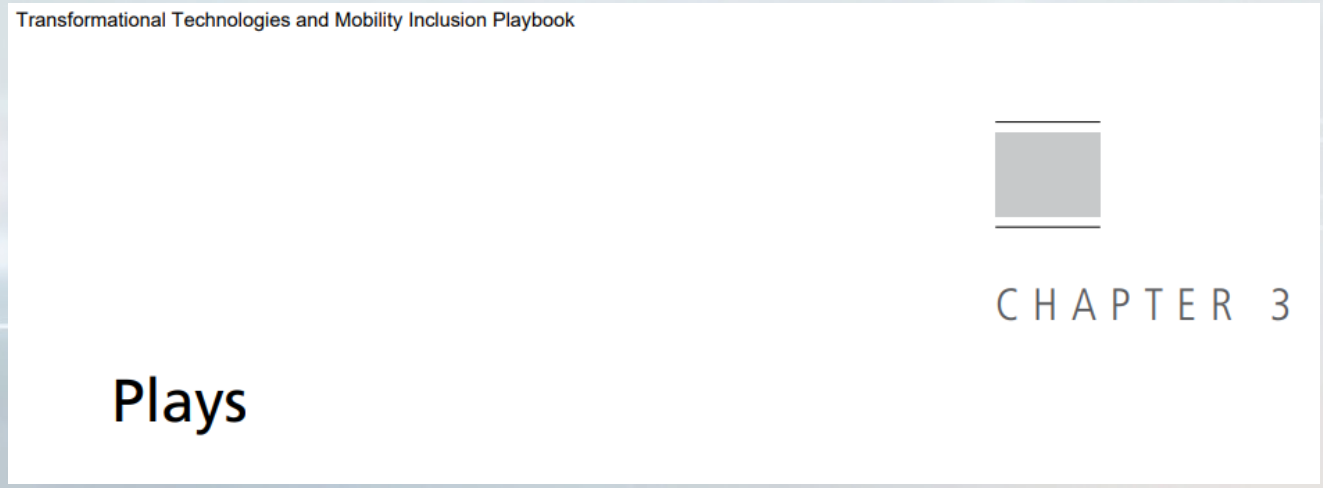
GOAL	Affordability
SERVICE	Carsharing services Ridehailing services Fully automated vehicle services
POPULATION	People with low incomes People residing in rural areas or on tribal reservations

Potential Strategies

- **Implement free or discount programs** for mobility services for riders under a certain income threshold (e.g., below the poverty line) to improve access to these services for low-income populations. Funding from local, regional, or statewide sources could be considered, but funding is often a challenge, so this strategy may not be feasible in some communities.
  - State or regional policymakers could consider requiring subsidies or discount programs in rural and tribal areas as well as low-income neighborhoods for operators looking to obtain an operating permit.



Available as part of the Playbook.



From theory to practice: Implementation considerations

Jim Cline, P.E.

Program Manager / Senior Research Engineer

Texas A&M Transportation Institute

Why is this important to your project?

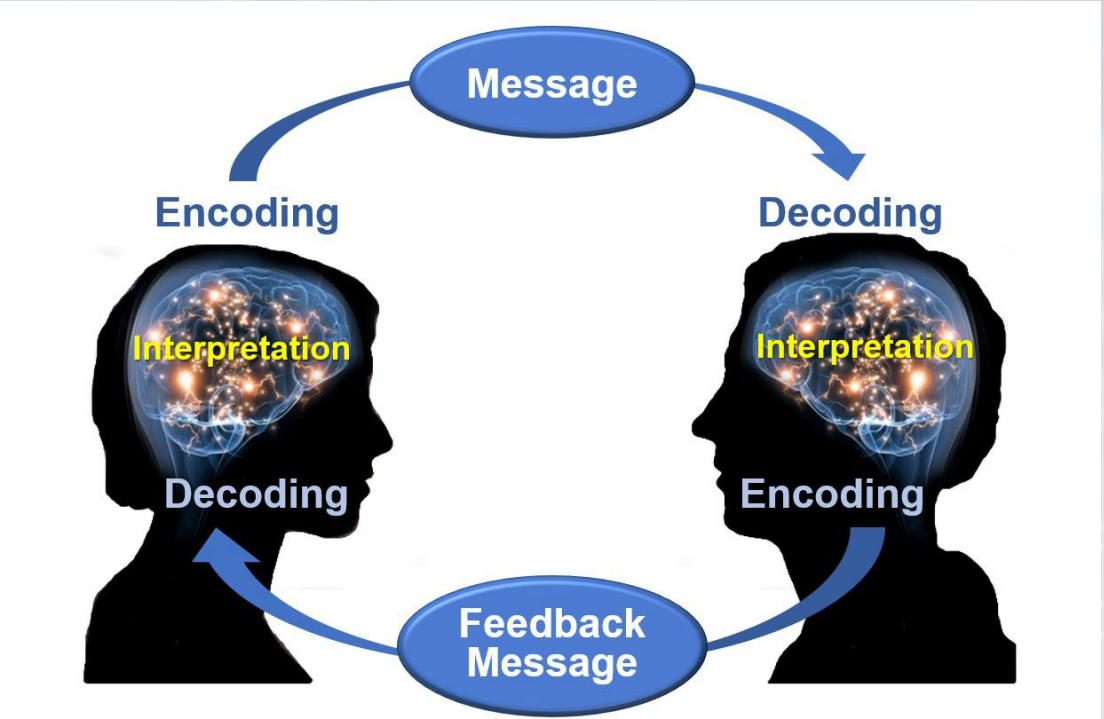
1. Meet the needs of those we serve - as they see it.
2. Be ready for the unexpected
3. Stay out of trouble with the process

Overall Program Needs

Developing an Overall Program

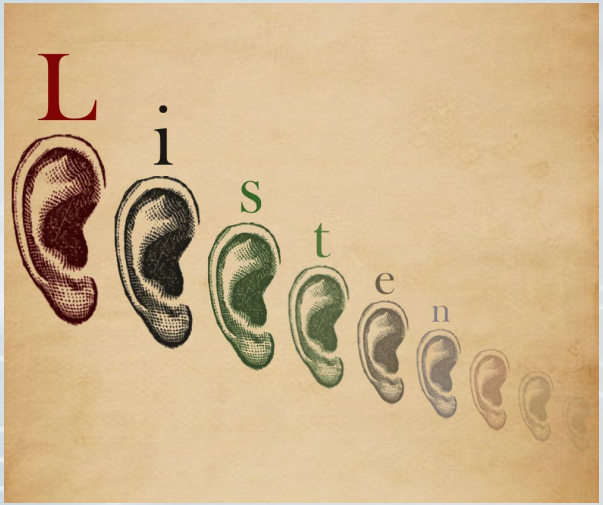
- Have a plan – if the pilot is successful (or not)
- Consider the complete trip – may be outside underserved area
- Who is best to be in the lead the program?
- Measure your success.
- Be flexible!
- Deployment duration.

Communication



Listening, then Telling the Story

- Understand where they want to go and when they want to get there – Include the perspective of caregivers and chained trips, not just work trips.
- Place/Setting is critical
  a) Place
  b) Language
  c) Time
  d) Access



- Be prepared for a significant negative event – and who will talk to the media.

Funding Approaches

Paying for the service

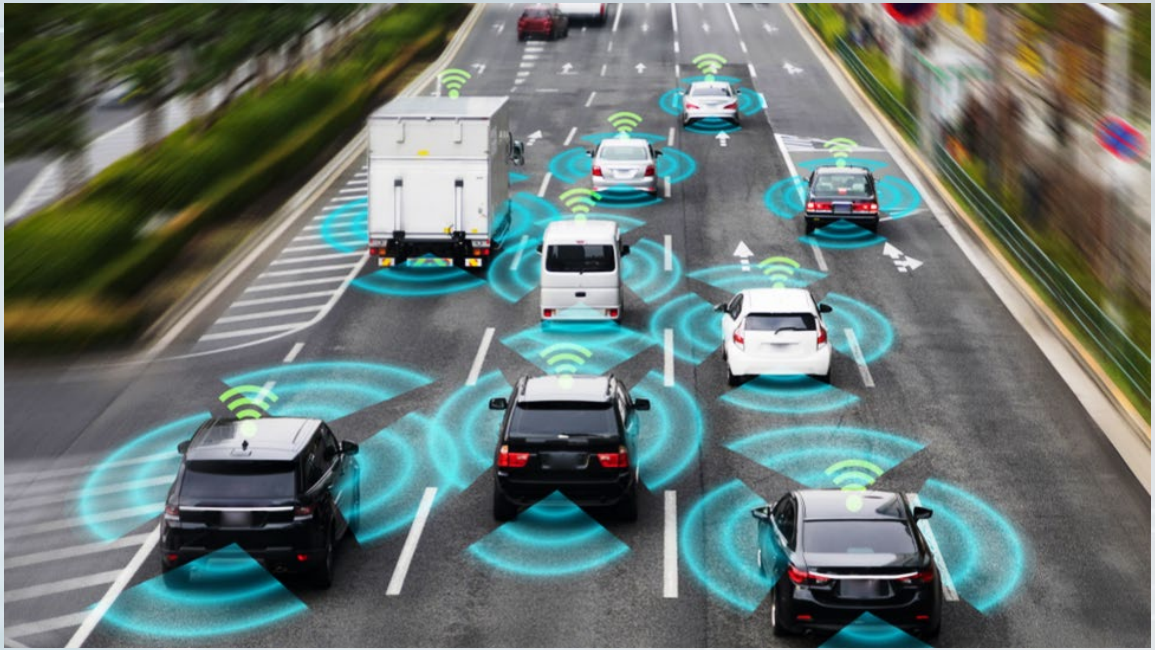
- Building and sustaining the program after the “pilot”
- Establish the level of control before entering a partnership
- Watch the “color” of money
- Understand the requirements related to the funding
- Look for multiple sources

Compliance

Following the Rules/Compliance

- Property/fiscal accountability.
- Federal reviews and procurement regulations.
- Drug/alcohol testing.
- Accounting.
- Accessing detailed operational data.
- Recordkeeping and privacy.
- Insurance and liability considerations.
- Requirement of an attendant to be present in a vehicle (if applicable) or capability/option.

Autonomy



Implementing Autonomy

- Understand current gaps and barriers for underserved populations and design shared AV solutions to improve them, not ignore them.
- Supporting infrastructure in rural and tribal areas
- Use industry standards.
- Understand the operational design domain and
- Availability of accessible vehicles.
- Lease/Purchase decision

Private Sector Implications

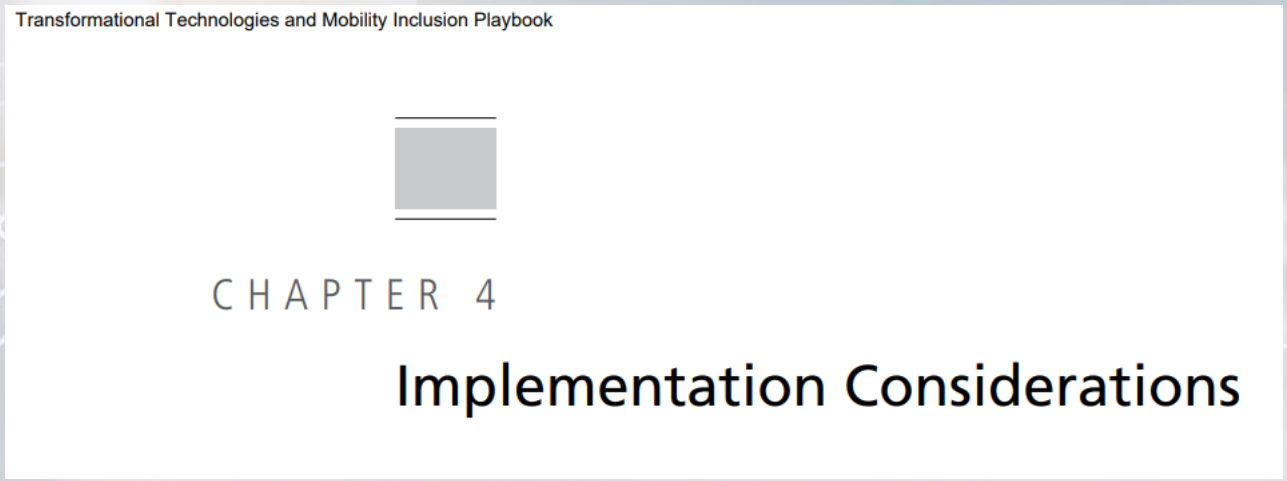
Partnering with the Private Sector

- Profitability challenge of expansive service areas and accessible vehicle offerings.
- Leverage existing services to better utilize existing transportation capacity – what already is in place.
- Adapt existing policies and governance to provide solutions to barriers.
- Forced or incentivized compliance?
- Focus on closing gaps vs. one-size-fits-all.
- VC perspective.

Other Specific Factors

“Did We Think About That…?”

Crossing agency boundaries
Car seats
Grocery carts
Service animals
Linked/chained trips
Companion/Caregiver access
Developing trust/overcoming fear
First responder perspective
Public infrastructure limitations
…



Available as part of the Playbook.

A complementary tool to the plays and should be used alongside them.

Thank you!

Ipek N. Sener, TTI

Cecilia Viggiano, EBP

Polly Okunieff, Go Systems and Solutions

Jim Cline, TTI

Texas A&M Transportation Institute | EBP | GO Systems and Solution LLC

https://nap.nationalacademies.org/catalog/27754/transformational-technologies-and-mobility-inclusion-playbook

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November 8, 2024

TRB Webinar: Behavioral Science and Nudge Applications in Transportation

November 19, 2024

TRB Webinar: Rural Accessibility to Economic Opportunities and Education

https://www.nationalacademies.org/trb/events

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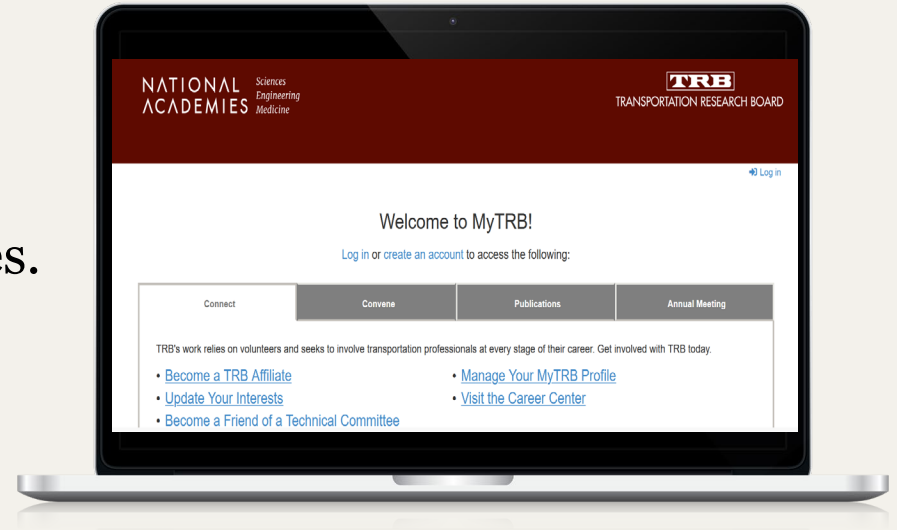

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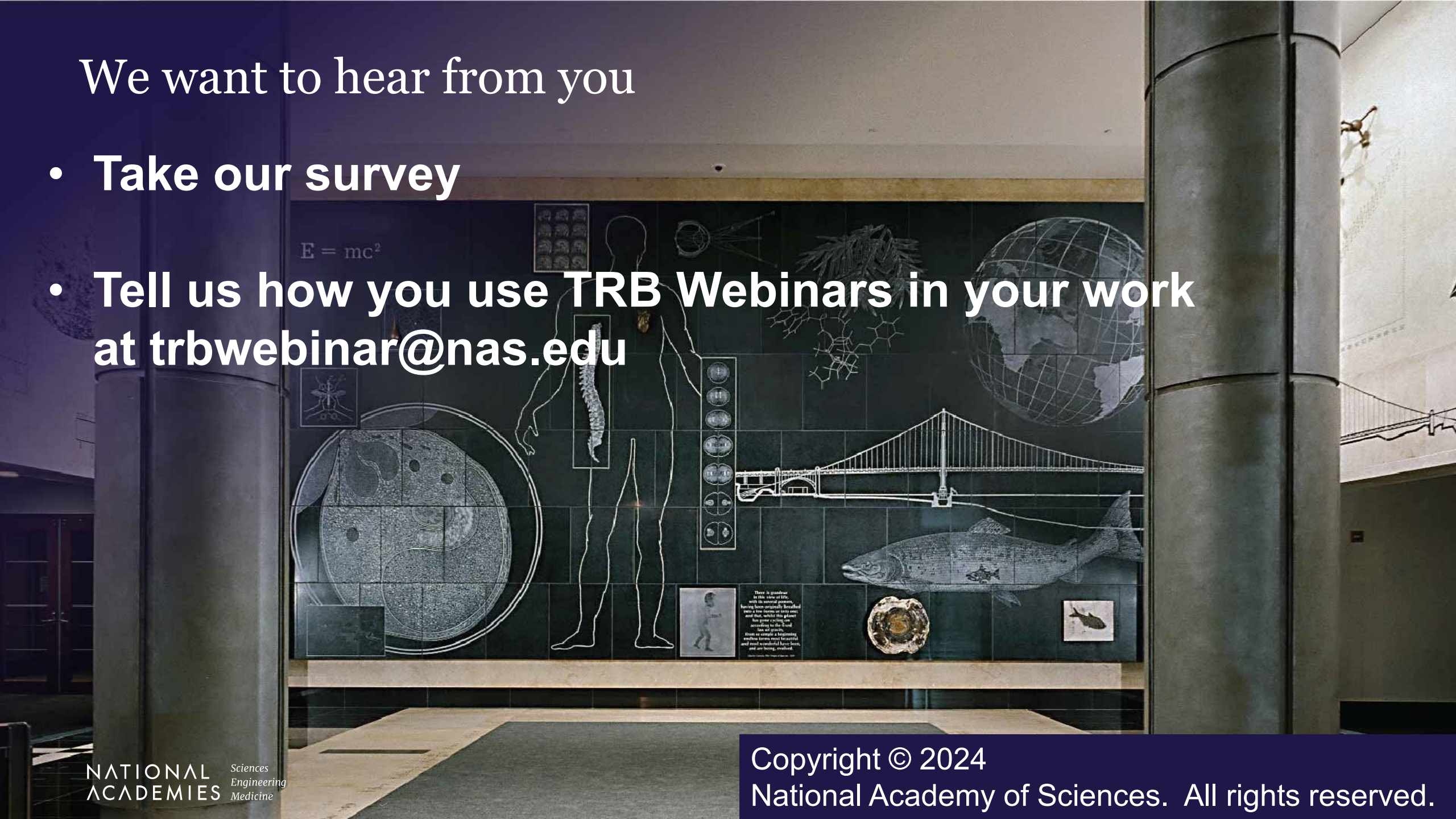

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