Phase 2 Performance Measurement and Evaluation Support Plan (PMESP)

Heart of Iowa Regional Transit Agency ITS4US Deployment Project

www.its.dot.gov/index.htm

Final Report – June 18, 2024

FHWA-JPO-21-877

ITS4US

IT'S TRANSPORTATION FOR ALL OF US

U.S. Department of Transportation

Produced by Heart of Iowa Regional Transit Agency
U.S. Department of Transportation
Intelligent Transportation Systems Joint Program Office
Federal Highway Administration
Office of the Assistant Secretary for Research and Technology
Federal Transit Administration

Notice

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-JPO-21-877	N/A	N/A

4. Title and Subtitle	5. Report Date
Phase 2 Performance Measurement and Evaluation Support Plan (PMESP) Heart of Iowa Regional Transit Agency ITS4US Deployment Project	June 18, 2024
	6. Performing Organization Code N/A

7. Author(s)	8. Performing Organization Report No.
Shauna Hallmark, Josh Albertson, Brianna Jasset, Brooke Ramsey	N/A

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Heart of Iowa Regional Transit Agency (HIRTA) 2824 104th St Urbandale, IA 50322	N/A
	11. Contract or Grant No. 693JJ321C000006

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation ITS Joint Program Office 1200 New Jersey Avenue, SE Washington, DC 20590	Final, Phase 2 (6/2022-6/2024)
	14. Sponsoring Agency Code HOIT-1

15. Supplementary Notes

Michael Barry, AOR (FHWA)

16. Abstract

Heart of Iowa Regional Transit Agency (HIRTA) is one of four awardees for Phase 2 of the ITS4US program for its proposed concept ***"HIRTA Health Connector: Bridging the Gap Between Healthcare and Transportation"*** (Health Connector) by the United States Department of Transportation (USDOT). Per the goals of the program, Health Connector project is focused on improving transportation access to healthcare for all in Dallas County, Iowa. This Performance Management and Evaluation Support Plan (PMESP) provides an approach for measuring the outcomes of the Health Connector system. This document defines goals and objectives and identifies relevant performance measures and targets. The performance measures take into account the user scenarios developed as part of ConOps. Further the PMESP defines the approach for conducting analyses to calculate performance measures. PMESP also provides our approach for supporting the Independent Evaluation (IE) team identified by the USDOT.

This document has been updated from the PMESP submitted as part of Phase 1 to reflect the new expectations and understanding around data, data sources, and goals established as part of Phase 2. As part of Phase 2, updates to the design of each performance measure and updates to the data used to assess each performance measure were the most critical changes made.

Note that all performance measures require cross referencing of demographic data to evaluate impacts on each of the user groups. Therefore, all measures will also involve profile data on whether a Traveler is in one or more of those groups. The original numbering of performance measures was maintained for clarity and consistency purposes when referencing previous project documents.

17. Keywords	18. Distribution Statement
ITS4US; Complete trip; Deployment; ITS; Intelligent Transportation Systems; Performance Measurement, Independent Evaluation, Data Management	No restrictions

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	**95**	

Form DOT F 1700.7 (8-72) **Reproduction of completed page authorized**

Revision History

Name	Date	Version	Summary of Changes	Approver
Santosh Mishra, IBI Group	23 Aug 2021	1.0	Initial Draft	Brooke Ramsey
Santosh Mishra, IBI Group	11 Nov 2021	2.0	Revised to addressed USDOT Comments	Brooke Ramsey
Santosh Mishra, IBI Group Shauna Hallmark, ISU	20 January, 2022	3.0	Revised to addressed USDOT Comments	Brooke Ramsey
Brianna Jasset, IBI Group	4 February, 2022	4.0	Revised to comply with 508 requirements.	Brooke Ramsey
Shauna Hallmark, ISU Josh Albertson, Arcadis IBI Group	9 August 2023	5.0	• Updates to introductory sections to match other Phase 2 documents • Removing and combining specific performance measures in line with current system understanding and capabilities (see overview in section 1)	Brooke Ramsey
Shauna Hallmark, ISU Josh Albertson, Arcadis IBI Group, Brianna Jasset, Arcadis IBI Group	6 October 2023	6.0	• Revised to address USDOT comments	Brooke Ramsey
Shauna Hallmark, ISU Josh Albertson, Arcadis IBI Group, Brianna Jasset, Arcadis IBI Group	7 May 2024	7.0	• Revised to address remaining USDOT comments • Updates to performance measure methodology as needed to reflect phase 1 changes	Brooke Ramsey
Shauna Hallmark, ISU Brianna Jasset, Arcadis IBI Group	7 June 2024	8.0	• Updates and 508 compliance	Brooke Ramsey

Name	Date	Version	Summary of Changes	Approver
Josh Albertson, Arcadis IBI Group Brianna Jasset, Arcadis IBI Group	18 June 2024	9.0	• Final updates and 508 compliance	Brooke Ramsey

Table of Contents

List of Tables

List of Figures

Introduction

Heart of Iowa Regional Transit Agency (HIRTA) is one of four awardees for Phase 2 of the ITS4US program for its proposed concept ***"HIRTA Health Connector: Bridging the Gap Between Healthcare and Transportation"*** (Health Connector) by the United States Department of Transportation (USDOT). Per the goals of the program, the Health Connector project is focused on improving transportation access to healthcare for all in Dallas County, Iowa. This Performance Management and Evaluation Support Plan (PMESP) provides an approach for measuring the outcomes of the Health Connector system. This document defines goals and objectives and identifies relevant performance measures and targets. While 'customer' is commonly used by transit agencies and 'patient' or 'consumer' by healthcare facilities, for this project (and in this document), 'Traveler' will be used to identify individuals who may benefit from Health Connector.

The performance measures consider the user scenarios developed as part of ConOps [5]. Further, the PMESP defines the approach for conducting analyses to calculate performance measures. The PMESP also documents the approach for supporting the Independent Evaluation (IE) team identified by the USDOT.

1.1. Summary of Changes Since Phase 1

The HIRTA team has updated this document to reflect the new expectations and most current understanding around available data, data sources, and goals. The most critical changes relating to the performance measures themselves along with an explanation of why they are changing are outlined in this section.

In addition to providing updates to the design of each performance measure, we also highlight here the changes to data that will be used to evaluate each measure. Even in instances where the design has only been slightly modified, new data needs that map more directly to each performance measure were identified. The data needs category in that section has been updated for each performance measure, and those changes are also shown in Table 1 below.

Note that all performance measures require cross referencing of demographic data to evaluate impacts on each of the user groups. Therefore, all measures will also involve profile data on whether a Traveler is in one or more of those groups. For simplicity, that data is not repeated in each of the rows below.

Note that the original numbering of performance measures was maintained for clarity and consistency purposes when referencing previous documents.

Note as part of Phase 2, Via was selected as the MOD platform provider for the Health Connector project. HIRTA currently uses Via's technology to support their existing on-demand service. The term, "MOD Platform" will continue to be used throughout the report (as opposed to referring to Via's system) when appropriate to serve as a vendor neutral resource for peer agencies considering the adoption of a similar system.

Table 1. Phase 2 Changes to Performance Measures

PM#	Title	Design Changes since Phase 1	Updated Data Needs
1	**Ability to dynamically reassign vehicles to address service disruption**	Slight changes were made to clarify the language in metric description and target, but no significant modifications to design were made.	ID #5 - Date of service interruption ID #6 - Time of service interruption ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID # 9 - Trip cost ID #10 - Payment method (i.e., Traveler, third party) ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #13 - Transportation provider ID #15 - Original pick-up time offered (and accepted) ID #16 - Actual pick-up time ID #17 - Original estimated vehicle travel time ID #18 - Updated estimated vehicle travel time
2	**Availability of transportation alternatives**	This measure was updated to change targets to better align with definitions of advanced versus on-demand booking.	ID #7 - Trip request date (date when Traveler made request) ID #46 Slots offered
3	**Trips unfulfilled due to system unreliability**	This measure was updated to clarify data used for system reliability. Before/after experimental design was removed in favor of measuring against an established threshold, since before/after data would be similar in comparing Via's normal operations data with HIRTA to Via's Health Connector data.	ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #26 - Seat unavailable and 'other error' alerts without finding a ride within one session

PM#	Title	Design Changes since Phase 1	Updated Data Needs
4	**ETA prediction accuracy**	Slight changes were made to clarify the language in metric description and target.	ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #15 - Original pick-up time offered (and accepted) ID #16 - Actual pick-up time ID #19 – Original estimated drop-off time ID #20 – Actual drop-off time
5	**On-time performance**	Slight changes were made to clarify the language in metric description.	ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #15 - Original pick-up time offered (and accepted) ID #16 - Actual pick-up time ID #25 - Actual in-vehicle travel time
6	**On-board travel time prediction accuracy**	Slight changes were made to clarify that this is measuring in-vehicle travel time, distinct from PM-4. Target was updated as well.	ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #15 - Original pick-up time offered (and accepted) ID #25 - Actual in-vehicle travel time ID #17 - Original estimated vehicle travel time
7	**Spontaneity time**	PM-7 was removed, as spontaneity can be measured through PM-2 as availability of vehicles upon request.	N/A

PM#	Title	Design Changes since Phase 1	Updated Data Needs
8	**Reliability of the system in assisting with non-vehicle component of a complete trip**	Slight changes were made to clarify the language in metric description, but no significant modifications to the design were made.	ID #28 - Traveler rating of pre-vehicle wayfinding ID #29 - Traveler rating of post-vehicle wayfinding
9	**Traveler perception of privacy**	Clarified this data will come from traveler surveys and not in-app survey.	ID #30 - Traveler perceptions about privacy
10	**Traveler safety in healthcare transportation**	PM-10 was removed due to similarity to PM-21 and concerns about over-surveying Travelers.	N/A
11	**System ability to meet accessibility needs of Travelers**	Updated to reflect that specific accessibility questions will vary by underserved group. Potential questions were established.	ID #21 – Mobility needs identified ID #22 – Mobility needs accommodated ID #23 - Traveler perception of accessibility (language, mobility)
12	**Self-reliance**	Self-reliance was further defined, and metrics and targets were updated accordingly.	ID #31 - Traveler perception about self-reliance
13	**Reduced anxiety / stress**	PM-13 was deemed infeasible to measure without including confounding variables and therefore was removed.	N/A
14	**Complaints and customer satisfaction**	Slight changes were made to clarify the language in metric description and method of collection was clarified, but no significant modifications to the design were made.	ID #32 - Customer satisfaction ID #33 -Number of complaints

PM#	Title	Design Changes since Phase 1	Updated Data Needs
15	**System productivity**	The modification eliminates the need for a before/after evaluation because Via is both the MOD platform for normal HIRTA service and the Health Connector platform. This was a major change since Phase 1 and would reduce most of the changes that were expected in before/after design in Phase 1. Target was revised in consideration of HIRTA's current operating statistics post-pandemic.	ID #34 - Number of Health Connector Trips
16	**Added capacity from third-party providers**	This measure was updated to more directly align with measuring the trips provided by third-party vehicles as opposed to trips delivered by HIRTA vehicles.	ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #13 - Transportation provider ID #15 - Original pick-up time offered (and accepted) ID #16 - Actual pick-up time ID #17 - Original estimated vehicle travel time ID #18 - Updated estimated vehicle travel time ID #35 - Number of trips provided by a third party (after hours)
17	**Deadhead miles and hours**	The goals of PM17 are covered by PM15, so it was deleted here. Deadhead miles and hours were deemed too indirect of a way to measure system reliability in this context.	N/A
18	**WAV reliability**	PM18 was combined with PM11, and therefore PM18 has been removed. WAV reliability was determined to be a subset of accessibility more broadly.	N/A

PM#	Title	Design Changes since Phase 1	Updated Data Needs
19	**Increased cost efficiency**	Slight changes were made to clarify the language in metric description, but no significant modifications to the design were made.	ID #45 – HIRTA admin cost for Medicaid trips
20	**Improved coordination among HIRTA, healthcare providers, health navigators**	Slight changes were made to clarify the language in metric description and the targets.	ID #36 - Amount of time healthcare providers spend per trip helping Travelers ID #37 - Number of times healthcare providers help Traveler
21	**Delivery of safe healthcare transportation**	Slight changes were made to clarify the language in metric description and target to match HIRTA documentation. Target was updated to reflect measurement against a threshold rather than before/after analysis.	ID #43 - Number of safety events
22	**Reduction in medical appointment deferment due to lack of transportation**	Changes were made to clarify where we hope to get this data from and how we hope to measure this, both through quantitative analysis and survey.	ID #34 – Number of Health Connector Trips ID #40 - Number of missed medical appointment trips
23	**Savings due to reduction in the number of missed medical appointments**	Changes were made to clarify the language in metric description and target was revised down from 30% to 25% cost savings after team discussion. Methodology was further defined.	ID# 39 - Cost of a missed appointment ID #40 - Number of missed medical appointment trips
24	**Safe transportation access to healthcare facilities**	The goals of PM24 are covered by PM21, so it was deleted here. The team struggled to find reliable national level data to support PM24. In addition, rates of incidents and crashes were deemed an unreliable way to measure safety in this context.	N/A

Survey and experimental design categories have also been updated in Section 5 to better account for our current understanding of processes. Control vs. treatment group design was determined to be infeasible for performance metrics which relied on Health Connector app data, given that both groups rely on a booking platform that is provided by the same vendor or completing trips, which may lead to similar data. Performance metrics which are collected through surveys can include a treatment and control group. Before/after analysis was limited to instances where data is not coming from the MOD platform for the same reason control/treatment data cannot be collected for performance metrics which rely on Health Connector app data.

1.2. Intended Audience

The PMESP will be used by the following groups for an understanding of the performance measurements, related metrics, analysis approaches, and required data for calculating the measures:

- Members of the HIRTA ITS4US project team that are focused on the concept development (HIRTA, Arcadis IBI Group, CTAA), design and deployment (Via), and evaluation (ISU), along with other partners and HIRTA project stakeholders.
- The USDOT team managing and supporting the project.
- The Independent Evaluation (IE) team conducting an independent assessment of the success and outcomes of the project.
- Other entities implementing similar systems in the future.

1.3. Project Background

The Heart of Iowa Regional Transit Agency (HIRTA) provides 300,000 customer rides and operates 95,000 hours (2019 estimates; pre-pandemic) along with 1.3 million miles of service within the seven-county region encircling the Des Moines urban area. HIRTA provides demand response services to customers for all trips booked from 24 hours to up to 14 days in advance. If capacity is available, HIRTA also provides trips to meet same day requests. HIRTA also acts as a service provider for the State of Iowa Medicaid broker, Access2Care.

Health Connector is an innovative solution that will address various bottlenecks associated with transportation access to healthcare for HIRTA communities. Some of these challenges are key reasons behind missed appointments or the unacceptable level of preventive or as-needed healthcare in the HIRTA service area. For this deployment, the HIRTA team plans to implement a scalable and replicable solution that enables access to non-emergency medical transportation for all travelers by resolving transportation access barriers with the use of advanced technologies. This solution will allow Dallas County residents without access to transportation who may be seeking a medical appointment to explore their transportation alternatives and book both medical and transportation appointments at the same time through a smart device (e.g., smartphone) application or equally effective alternate method. Further, this solution will include information and wayfinding services to guide them at every step of their trip.

This deployment will provide enhanced transportation access to healthcare options for all Travelers in Dallas County with a specific focus on underserved communities, including rural travelers, older adults, and veterans. In addition to addressing mobility needs, the proposed deployment will recognize the net impact that access to healthcare services has on patient healthcare outcomes as well as both the financial and health outcomes from the perspective of the healthcare community/Dallas County Health Department (DCHD). Figure 1 provides an overview of the Health Connector concept.

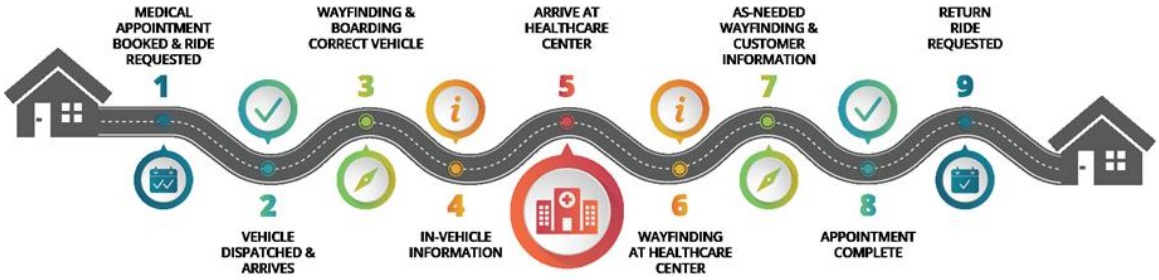

Figure 1. Overview of Health Connector System Concept (Source: HIRTA Team)

There are five main goals for the Health Connector Concept, which include:

- Improved health outcomes through increased access to medical transportation for Dallas County residents
- Self-reliance and spontaneity for all travelers including underserved groups
- Efficient transportation management capabilities for medical transportation services
- Financial sustainability of medical transportation programs
- Safe medical transportation services

The systems and interfaces involved in the context of Health Connector can be defined as follows:

- **Traveler-end Subsystem**: includes the tools and technologies (phone/interactive voice response (IVR), mobile/smart devices, web-based tools) to be used by Travelers seeking transportation services for their healthcare appointments as part of their pre-trip, during trip, on arrival, and return trip activities. This includes both a mobility-on-demand (MOD) application for planning, booking, and payment, as well as a wayfinding application for more detailed guidance within care facilities.

  This application, provided by Via, also provides real-time status of trips on demand and through push notification services and allows Travelers to discover options and plans trips. Mobile/smart devices will be used as part of the Traveler-end subsystem but are not a part of this procurement.

- **Transportation Management Subsystem (TMS):** TMS refers to any systems related to the operational backend functions involved in service delivery. Under this project, the following two transportation management subsystems are commonly referenced. Below provides a definition of each system.

  - **MOD TMS (also referred to as "VOC"):** Provided by Via and includes the technologies used to assist customer care and operations staff with Traveler

registration, eligibility management, reservations, scheduling, dispatching, billing, and administration activities.

- **HIRTA TMS:** The HIRTA TMS includes the MOD TMS and functions that support Health Connector from outside of the MOD platform such as the call center software. The HIRTA TMS will also host interfaces (middleware) being developed by the HIRTA team and made freely, publicly available on GitHub under a permissive license to support interfacing with State of Iowa Medicaid transportation broker(s) and the EHR system.

- **Vehicle Subsystem**: refers to the technologies deployed on vehicles to support driver-end functions for driver-dispatch communications, manifest management, support just-in-time dispatching, turn-by-turn navigation and outdoor wayfinding (e.g., to locate Travelers at the time of pickup), on-board information and fare payments. On all HIRTA-owned vehicles, drivers will use tablets running the driver app. On other vehicles, drivers may use the driver app on their tablet or their phone.

- **Wayfinding Subsystem:** refers to the technologies and infrastructure to be used for providing outdoor wayfinding, indoor positioning, orientation, and navigation on request to Travelers. It may also assist with translation functionality. One or more commercially available wayfinding system providers may be used. One of those providers will be NaviLens.

- **External Systems:** These systems, external to Health Connector, have been identified for close coordination among HIRTA and partners for providing efficient transportation services for medical trips or for collecting data for performance measurement needs.

  - **Medicaid Transportation Broker**: refers to the State of Iowa Medicaid broker. Currently, Access2Care's system is used for booking and managing Medicaid trips. HIRTA is one of the providers used by Access2Care. Medicaid trips will continue to be booked by Access2Care when requested by Travelers. Medicaid trips will be ingested in the HIRTA system when assigned to HIRTA. At that point, a Traveler using Medicaid benefits will be able to use Health Connector Traveler tools.

  - **Health Navigator- and Healthcare-end Subsystem**: refers to the limited access MOD platform that will be available to health navigators and healthcare customer care staff to request trips, modify trip requests, and check on trip status on behalf of Travelers. Additionally, health navigators and the health administrator at the Dallas County Health Department (DCHD) use a Microsoft Access-based information and referral (I&R) product to track the status of referral activities and for coordination with Dallas County residents' health navigation/social care services.

  - **EHR/Medical Record Subsystem**: refers to the systems used by partner hospitals and clinics for booking medical appointments and maintaining their appointments, including discharge and any subsequent referral activities. Participating Healthcare partners currently use different EHR services. The following bullet points outline participating healthcare partners and the EHR

systems they currently employ. Health Connector will develop a new interface with at least one healthcare partner's EHR system.

- MercyOne Hospital – Epic EHR, Epic EHR provides a publicly available API
- Dalla County Hospital – Transitioning to Epic EHR
- Other regional clinics – Veradigm EHR

- **Other**: Additional relevant details for the system to be deployed are as follows:
  - **Supporting systems**: These are existing systems and are not part of the Health Connector project. However, the TMS will exchange data with these systems or HIRTA staff may interact with these systems for certain operational functions, as needed. Specifically, this refers to the phone system, payroll, driver or vehicle information management, vehicle maintenance management, customer service management, safety event reporting, and other systems and processes for data collection and reporting.
  - operations and then processed and archived for reporting in a historical database.

Figure 2 provides a generic system context diagram for HIRTA Health Connector.

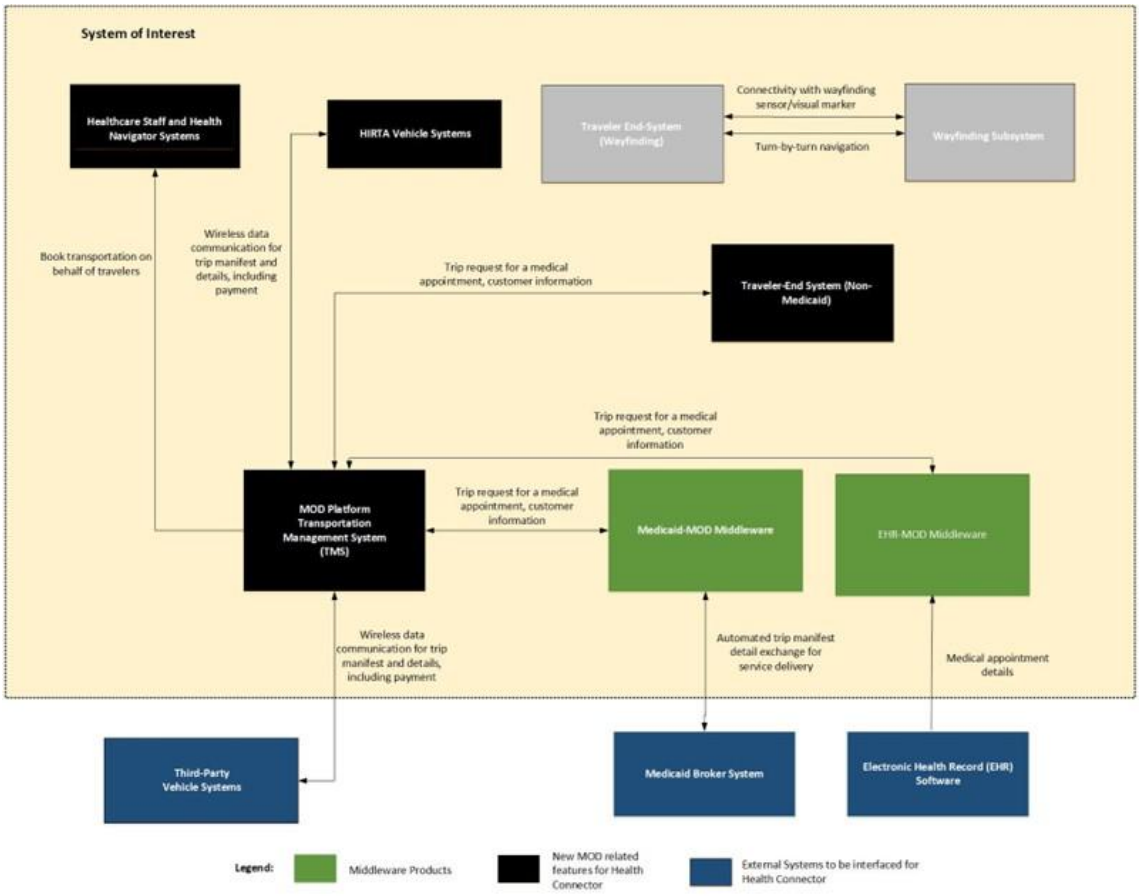

Figure 2. Generic System Concept Diagram (Source: HIRTA Team)

1.4. Scope

The PMESP build upon the needs, user scenarios, and initial performance measures described in the Concept of Operations (ConOps) document [5]. The PMESP also utilizes the data collection, storage, archival and sharing approach defined in the Data Management Plan (DMP) [6].

The PMESP uses the needs and broader ITS4US program goals as inputs to define the goals and objectives for the Health Connector system. The PMESP further defines the following:

- Definition of performance measures, metrics to be utilized, and targets for performance measures
- Confounding factors that may impact the analysis and interpretation of results
- Experiment design and analysis approach to be used for each performance measure
- Needs for data collection and sharing
- Process for supporting the IE team

The PMESP has been updated based on design discussions and changes to the data determined as part of Phase 2. This update also elaborates in more detail on analysis approaches and survey data.

1.5. Performance Measurement and Evaluation Support Plan Purpose

A key goal of the Health Connector project is to recognize the net impact that transportation access to healthcare services has on patient health outcomes as well as both the financial and health outcomes from the perspective of the healthcare community/Dallas County Health Department (DCHD). The PMESP defines measures and targets with respect to making transportation services accessible, available, efficient, productive, reliable, and safe for providing medical appointment-related services to underserved populations.

By conducting performance measurement and analysis activities, the project will be able to identify and quantify which deployed strategies, services, and/or components were of value in addressing the targeted complete trip challenges. Documenting the results with robust supporting data and analyses will enable others to understand and build upon the investments made in this project to progress toward complete trip goals more effectively in other deployments.

.

2. Goals and Objectives

As discussed in the ConOps, underserved populations in Dallas County often experience challenges accessing medical care due to a lack of transportation, including information and services. In fact, according to a 2014 National Leadership Academy for the Public's Health (NLAPH) survey of Dallas County residents (see Figure 3), approximately 39% of respondents (out of a total of 144 Dallas County respondents) cited missing at least one healthcare appointment due to lack of available transportation options. Further, it is noteworthy that approximately 70% of total respondents relied on either HIRTA or family/friends for their transportation needs.

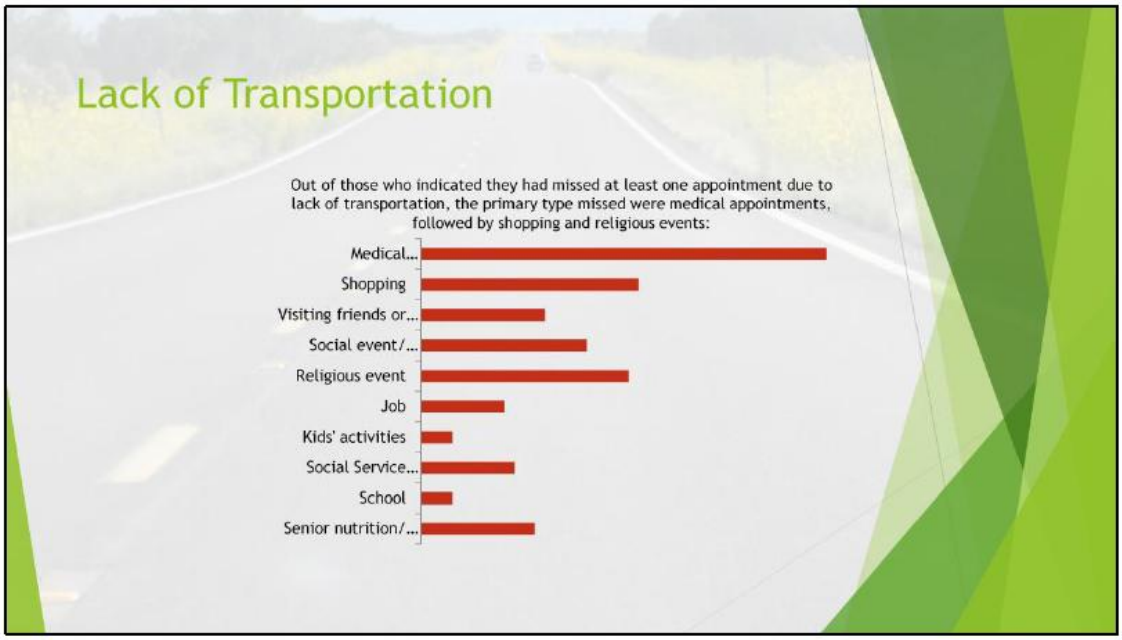

Figure 3. Excerpt of Survey Response from 2014 NLAPH Survey of Dallas County Residents (Source: DCHD)

Further challenges, as faced by the Dallas County residents, and identified during stakeholder discussions, are discussed in detail in the ConOps [5]. Health Connector is intended to utilize advanced technologies for planning, booking, payment of transportation, as well as information and wayfinding services.

A primary objective of the ITS4US Deployment Program is to demonstrate, quantify, and evaluate the impact of advanced technologies, strategies, and applications toward addressing Travelers' challenges to planning and executing a complete trip. Accordingly, the Health Connector project is focused on evaluating the measurable impact of increased access to medical transportation on the health of Dallas County residents.

After the successful design, development, testing, and acceptance in Phase 2, the Health Connector system will be placed in full operation and maintenance in Phase 3. The system will be: 1) closely monitored for its performance; and 2) evaluated to measure the outcome of the project.

2.1. Deployment Goals and Objectives

Overall, based on stakeholder discussions, the unmet needs can be summarized as follows:

- **Lack of awareness about available transportation options:** One of the major factors limiting access to transportation is Travelers having limited information about options beyond personal (or arranged via family/friends) transportation for medical trips. Health Connector will provide a platform that will allow customers to explore availability of HIRTA and its partner vehicles through a “trip planning/discovery” feature within Health Connector.
- **Lack of integrated booking and trip management experience**: The planned Health Connector deployment concept addresses a longstanding need to integrate transportation and healthcare scheduling, management, and day-of services monitoring functions for the ultimate “one stop” experience for all Travelers for their mobility needs, with a specific focus on underserved populations. This solution will help Dallas County residents who are not able to make their medical appointments due to lack of access to transportation; they will be able to explore their options and book and manage a ride at the schedule of their choice.
- **Challenges in meeting the needs of underserved groups:** The key challenges relevant to transportation access to healthcare services in the context of HIRTA services are as follows:
    - Return trip is a major issue for all groups, since the end time for appointments cannot be accurately determined ahead of time. HIRTA tries to accommodate customers’ requests for same day service, particularly for return trips, but due to limited driver/vehicle and financial resources, it is not possible to address the needs of all customers. Sometimes customers do not want to be on the same vehicle with others, which creates additional burden on resources and capacity to provide single ride transportation.
    - DCHD health navigators spend a lot of time and resources, often arranging multi-party calls, given the lack of access to consolidated information (funding eligibility, transportation availability, healthcare service availability) from a single tool. While most underserved groups are affected due to this limitation, persons with low English proficiency (LEP) need the most assistance and are severally impacted.
    - HIRTA currently offers services in limited hours, which does not meet the needs of many Travelers who may be interested in using HIRTA vehicles but are unable to use HIRTA to make their appointments. HIRTA has plans for providing services through third-party service providers for Travelers’ after-hours needs.
    - Some people are not aware of HIRTA, or they do not take it because of the fee (e.g., $5.00 one way).
    - Most of the customers that Iowa Health and Human Services (HHS) works with are on Medicaid or Medicare. Also, the elderly groups are on Supplementary Security Income (SSI) and getting Medicaid, which covers some part of the transportation. However, Medicaid has very strict requirements as to what qualifies, and if a trip does

not qualify for coverage, that could be a barrier that prevents the customer from making the trip. When customers are not eligible for Medicaid, HIRTA coordinates with funding partners and health navigators to determine if other funding sources are available for healthcare trips.

- Older adults have identified lack of comfort with the use of smart devices as a major issue and have expressed a preference for devices with larger font specifically designed for older adults (e.g., Grand Pad). However, those devices have limited functions. Applications to be used by older adults must have the ability to adjust user experience by utilizing accessibility functions either available in the operating system or supplemented by built-in advanced capabilities within the application. Also, extensive training will be required so older adults are self-reliant in using the capabilities offered by the Health Connector solution. To increase usability for populations that are not tech-savvy, it will be most helpful to make the system design as simple as possible and with larger fonts. In addition, the team will continue to take into account user feedback as the app is rolled out to ensure the design is user-friendly and addresses the needs of all users.
- Persons with disabilities have limited mobility options when booking transportation, due to lack of accessible vehicles or those that can accommodate mobility needs such as walkers, oxygen tank, service animals, and others. All HIRTA vehicles are accessible but commercial vehicles (e.g., taxis or TNCs) provide a limited fleet of accessible vehicles.
- Third-party drivers need to understand how to assist persons with disabilities should they need assistance when using Health Connector. HIRTA should work with third-party providers to ensure they receive proper training and understand the needs of these individuals.
- Even at smaller facilities, wayfinding is an issue. Customers may have their first appointment on one side of facility and a second on another side, but they may not remember to share this information when booking a trip. Drivers typically must coordinate with dispatchers to find out the exact pick-up location.
- Customer experience during initial trips is critical. If a customer has a long wait or services are not available when needed for an appointment, customers are likely to prefer other transportation options. Most trips are on time, but when there are delays, the experience may prevent customers from trying the service again.
- The customer's ability to pay for trips is a major barrier. While HIRTA services are offered at a fixed low fare for customers that are covered by external funding sources, many low-income customers may still not be eligible for those services, due to the income criteria established by those programs (e.g., Medicaid). Also, low-income populations may rely on cash if they do not use banking and financial institutions.
- Persons with LEP may prefer to have someone accompany them for medical appointments so they can be helped. They may not use the tools and services available (e.g., translation service) as they may not feel comfortable.
- Helping customers get where they need to create an additional cost to hospitals at times. While hospitals may have affiliated social workers and health navigators who

help customers find transportation services, the process of registering and booking trips creates an administrative burden, due to a largely manual process. Also, healthcare providers have only limited funds available to help customers who may not have funds to pay for services arranged. One healthcare provider mentioned that coordination for follow-up care, coordinating the time and availability for the patients and the provider, educating the patient on their options, and communicating with the provider ends up being a time-consuming process for healthcare professionals.

- Healthcare customer coordinators currently rely on manual methods (e.g., phone calls, emails, in-person coordination, spreadsheets) to assist customers who may be looking for transportation services. They would prefer electronic capabilities as conceived within Health Connector, particularly real-time information on transportation services.
- Many customers live in rural areas where broadband access is lacking, unreliable, or insufficient. Also, the expense of data plans may limit the ability of low-income populations to use applications that may require extensive data bandwidth (e.g., feature-rich map interface).

- **Limited capabilities with current transportation modes**: Apart from HIRTA vehicles, there are limited modes that can meet the needs of underserved groups related to visual, hearing and learning disabilities, language barriers, and other limitations. The proposed project deployment will be universally designed to meet the needs of all Dallas County's underserved population, including persons with disabilities, low income, rural, older adults, veterans, and persons with LEP. As needs vary by the individual, underserved citizens may qualify for one or more these subgroups (i.e., the person may be an older adult who lives in a rural area, is a veteran, and has a disability).
- **Limited wayfinding capabilities:** Another missing link in medical transportation has been wayfinding both for locating the vehicle on arrival or wayfinding/navigating to the correct destination inside a facility upon arrival. The Health Connector solution will provide a seamless outdoor and indoor wayfinding experience from the same application.
- **Same day reservation and service capacity issues:** HIRTA typically does not provide same day reservations. Uncertainty with return trips may often generate a need for same day booking or modifications, creating capacity challenges in meeting customer demand. Health Connector will augment capacity through a seamless integration with taxi, TNC, and other non-dedicated service providers (NDSPs). Please note that these services are expensive and will have to be subsidized so the Traveler share is comparable to the use of other HIRTA services. HIRTA will be invoiced by NDSPs on a monthly basis for trips successfully performed.
- **Limited coordination among different organizations:** The proposed deployment seeks to further integrate the operations and services provided by HIRTA, DCHD, and the Dallas County healthcare community by providing them access to the transportation booking and real-time service information tools to maximize outcomes for the community and reduce the level of manual coordination by phone calls and emails. Access to these tools will also allow tracking of any missed medical appointments caused by lack of access to transportation.
- **Data sharing and reporting:** Currently, healthcare providers, DCHD, and HIRTA do not have any ability to share data or report on booking and delivery of medical trips. HIRTA has those

trips captured within their transportation management system (TMS) provided by Via, but there is not enough data to analyze health outcomes of those trips. Health Connector will allow tracking of medical and transportation appointment related data (e.g., appointment date, time, and location by a customer identifier) by healthcare partners so DCHD, HIRTA, community partners, funding entities, and government partner agencies are able to monitor the impact of improved transportation access while protecting the privacy of individuals requesting trips. All data collection and sharing will be conducted per the approved process from the Institutional Review Board (IRB) at the Iowa State University (ISU) as documented in the Phase 1 and Phase 2 Data Management Plan [5] [7].

A detailed needs assessment Is also provided in the ConOps document.

Figure 4 provides a list of ITS4US program goals that primarily focus on identifying needs and challenges for populations so appropriate tools can be identified for enhanced mobility. Also, a key goal is to measure the outcomes of the deployed applications/systems. Further, a key goal of the program is to identify solutions which are scalable and replicable so similar solutions/systems can be deployed nationwide in other communities.

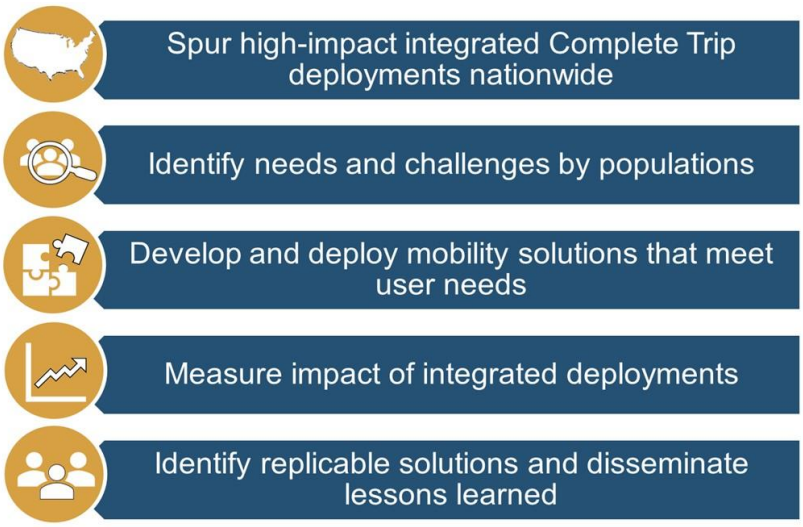

Figure 4. ITS4US Project Goals (Source: USDOT)

Health Connector goals and objectives based on user needs, and using the USDOT and ITS4US program goals as the context, are provided below:

1. **Goal G1. Improved health outcomes through increased access to medical transportation for Dallas County residents:** Reduction in the number of no-shows for medical appointments due to increased access to transportation will help Dallas County residents, particularly underserved populations, make their appointments in a timely manner. This increased access to medical services will result in measurable positive health outcomes. Relevant objectives are:
    a. G101. Reduced number of no-shows for medical appointments with availability of increased access to transportation options in Dallas County.
    b. G102. Increased access to follow-up care options through availability of transportation services.

   c. G103. Tracking of measurable positive impacts of transportation access on healthcare outcomes for Dallas County residents.

2. **Goal G2. Self-reliance and spontaneity for underserved groups:** Health Connector will provide tools to access safe, affordable, and reliable transportation services and relevant information/wayfinding as and when needed by underserved groups. Relevant objectives are:

   a. G201: Access to safe transportation services for underserved groups through the availability of secure and reliable tools and services for planning, booking, payment, and customer information.

   b. G202. Ability to safely assist underserved Travelers in locating vehicles and/or facilities at destinations through the availability of secure and reliable outdoor and indoor way-finding tools.

   c. G203. Availability of safe and reliable transportation services when needed by underserved groups for their medical appointments, return trip, and follow-up care.

3. **Goal G3. Efficient transportation management capabilities for medical transportation services:** HIRTA and its contractors, Access2Care, DCHD, healthcare providers, and funding agencies will have access to tools and services for coordinating booking, management, completion, billing, and payments for medical transportation in Dallas County requested by underserved Travelers. Relevant objectives are:

   a. G301. Ability to manage transportation services from multiple service providers from a centralized Health Connector system, along with enabling as-needed transportation capacity at all times.

   b. G302. Ability to provide reliable transportation for requested trips using tools and procedures as necessary.

   c. G303. Provision of affordable transportation through coordination with funding entities for subsidizing transportation for the underserved.

   d. G304. Reduction in time needed by involved staff and HIRTA partners in trip coordination through the implementation of automation.

4. **Goal G4. Financial sustainability of medical transportation programs:** Availability of tools to efficiently coordinate booking and manage delivery of transportation services through optimal use of resources will help in cost reduction of medical transportation and will help with maintaining long term sustainability of funding programs. Relevant objectives are:

   a. G401. Ability to analyze the total cost of delivering medical transportation services for HIRTA and partners through the availability of tools to track cost and revenue measures along with applicable subsidies.

   b. G402. Reduction in resources spent in delivering and administering trips funded by various programs through implementation of processes.

5. **Goal G5. Safe medical transportation services:** Availability of advanced tools to provide trip information and wayfinding services, customized per the needs of

underserved groups, will help provide safe transportation options to Travelers who may lack those. Relevant objectives are:

a. G501.Enhanced perceived safety through timely and reliable delivery of required information on vehicle and trip status.

b. G502. The mitigation of risks related to accidents, incidents, injuries, and severe consequences associated with trips to medical facilities, outdoor/indoor wayfinding, and return trips through the implementation of required safety measures.

2.2. Use Cases/Scenarios

As explained in the ConOps document, Health Connector will interact with at least four distinct operational environments: HIRTA, third-party service providers, healthcare providers, and health navigation/social care providers. Therefore, the HIRTA project team has developed scenarios considering situations faced by specific user groups pertaining to those operational environments.

For Travelers, scenarios play out differently if their healthcare is paid through Iowa's Medicaid program. For Medicaid participants, whether enrolled in traditional (fee-for-service) or managed care, transportation is centralized through the state's broker, Access2Care, but there are specific practices and procedures that will need to be followed, and there can be issues around the need to ensure that an eligible person is receiving allowable care or services from an approved provider, and challenges around what to do if proper procedures are not followed, even if the transportation would otherwise be eligible. For persons not covered by Medicaid, the scenarios are varied and more complex, and include the risk that needed medical transportation might not be available, accessible, affordable, or appropriate.

The most applicable scenarios that the Health Connector solution will address are as follows. Please note that scenario numbers are the same as in ConOps document for easy reference regarding details.

1. **ConOps Scenario 3- Traveler looking for Transportation for a Recurring Medical Appointment (referred in this document as U1)**: A Traveler is looking for transportation for a recurring medical appointment (e.g., dialysis) scheduled with a hospital/clinic.

2. **ConOps Scenario 4- Traveler looking for Transportation for a Recurring Medical Appointment on Irregular Schedule (referred in this document as U2)**: A Traveler is looking for a prenatal appointment and will need transportation. It is recurring but not on a fixed schedule.

3. **ConOps Scenario 5- Traveler Looking for a Preventive Care Appointment (referred in this document as U3):** A Traveler is looking for a preventive care appointment.

4. **ConOps Scenario 7- Traveler looking for more than one Person as Accompaniment for a Medicaid-funded Trip (referred in this document as U4):** A Traveler is approved to take a Medicaid-eligible trip, but they would like family to accompany them to provide assistance. The outbound trip is 45 mins long, so they may be looking to be dropped off at a friend's house so they can rest and arrange their own transportation later for ride home. Medicaid will pay for only eligible portion of the trip.

5. **ConOps Scenario 11- HIRTA to be Aware of Medical Appointment Status to Arrange the Return Trip (referred in this document as U5)**: HIRTA is not able to find out if a Traveler who was dropped off for a medical appointment has already been discharged. The Traveler had booked the return trip, and the driver is waiting at the medical facility to pick up the Traveler. The Traveler does not use the Health Connector app and is relying on HIRTA service for coordination.
6. **ConOps Scenario 12-HIRTA to Coordinate regarding Return Trip since Outbound Trip to Healthcare Facility a No-Show (referred in this document as U6)**: A Traveler was a no-show for their outbound trip to a medical appointment (or cancelled without providing a reason), but the Traveler had also booked a return trip, and HIRTA has to follow up with both customer and the hospital to find out if the Traveler needs the return trip before their trip back to home can be cancelled.
7. **ConOps Scenario 13- HIRTA to Contract with a Non-dedicated Service Provider (taxi, TNC, Volunteer driver) to Provide Trips During After Hours (TBD) (referred in this document as U7):** A third-party service provider (taxi/volunteer or another agency in the region such as DART) would like to be part of this solution, particularly when trips are outside of the HIRTA service area. The third-party service provider would like to be integrated so their services are available to Travelers per terms and conditions agreeable to HIRTA.

These 7 scenarios have been selected for performance measurement out of the total of 13 scenarios as they cover most of the operational complexities and Traveler needs as follows:

- **Needs for Underserved Groups**: Needs for all underserved groups, as applicable to Health Connector (e.g., persons with disabilities, older adults, persons in rural areas, veterans, persons with low income, persons with limited LEP).
- **Schedule type:** Recurring on fixed schedule, recurring on irregular schedule, ad-hoc.
- **Timing:** Trips may be scheduled in advance or same day/on-demand, including during after-hours.
- **Types of vehicles/drivers**: HIRTA-owned, taxi/TNC or other NDSP.
- **Service anomalies**: no-shows, incidents.
- **Types of funding sources**: Medicaid and Non-Medicaid.

3. Performance Measurements and Targets

This section identifies performance measures, relevant metrics and targets, as applicable to identified goals and objectives. A mapping of performance measures and user scenarios is also provided.

Further, this section provides a description of a high-level description of any constraints related to obtaining, processing, and analyzing necessary data, including resolution and granularity necessary for the performance measure to be functionalized.

3.1. Identification of Potential Performance Measures and Targets

Performance measures are based on the goals and objectives identified according to the needs identified in ConOps. Further, goals are built using the preliminary measures that were identified in ConOps.

The performance measures are also mapped to mobility performance metrics (MPM), and the measures are identified under the following high-level categories, also illustrated in Figure 5:

- **Core Measures**: This category includes Traveler-centric measures and those related to the following key aspects associated with a trip: availability of services, reliability of available services, budget needed/affordability, travel time, and safety.

- **Tier 1 Measures**: This category represents the system's ability to deliver on the required goals and objectives and refers to system capacity, utilization, safety, reliability, and system efficiency, effectiveness, and cost.

- **Tier 2 Measures**: This category refers to the system's availability to deliver on the broader goals of the local community. The measures are related to overall mobility and safety/health of the members of the community and financial performance of the systems and organizations involved.

- **Tier 3 Measures**: This category refers to the system's ability to contribute to trends nationally and identifies measures related to financial performance of organizations delivering services and safety/health of communities.

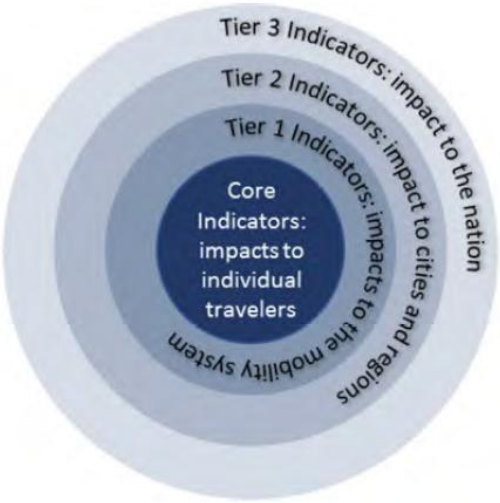

Figure 5. Tiered Framework for Metrics in MPM Report (Source: FTA)

For each of these categories, the HIRTA team has defined measures for the three stages of a complete trip that include pre-trip, trip (en route), and post-trip.

Initially, the HIRTA project team identified 57 measures in total and prioritized those as follows:

- **High**: These measures are highly critical to monitor to evaluate the success of the program.
- **Medium**: These measures are significant, but regular monitoring is not required.
- **Low**: These measures are not necessary for evaluating the success of the program.

A detailed discussion in this document is provided for only “high” priority measures. Table 2 provides a list of performance measures by goals and objectives and provides a mapping of measures by use cases as listed in Section 2.2. Additional measures, not included in the analysis, are provided in Table 26.

Table 2. Performance Measures by Goals and Objectives and Relevance to Use Cases

MPM Tier	Goal	Objective	PM#	Performance Measure Type	U1	U2	U3	U4	U5	U6	U7
Core	G3	G301, G302	**1**	**Ability to dynamically reassign vehicles to address service disruption**	X	X	X	X	X	X	X
Core	G2	G201, G102	**2**	**Availability of transportation alternatives**	X	X	X	X	X	X	X
Core	G3	G302	**3**	**Trips unfulfilled due to system unreliability**	X	X	X	X	X	X	X
Core	G3	G302	**4**	**Estimated time of arrival (ETA) prediction accuracy**	X	X	X	X	X	X	X
Core	G3	G302	**5**	**On-time performance**	X	X	X	X	X	X	X
Core	G3	G302	**6**	**Travel-time prediction accuracy**	X	X	X	X	X	X	X
Core	G2	G202	**8**	**Reliability of the system in assisting with non-vehicle component of the complete trip**	X	X	X	X	X	X	X
Core	G2	G201	**9**	**Traveler perception of privacy**	X	X	X	X	X	X	X
Core	G2	G201	**11**	**System's ability to meet accessibility needs of Travelers**	X	X	X				
Core	G2	G201, G202	**12**	**Self-reliance**	X	X	X	X	X	X	X

MPM Tier	Goal	Objective	PM#	Performance Measure Type	U1	U2	U3	U4	U5	U6	U7
Core	G2, G5	G201, G202, G203, G501	**14**	**Complaints and customer satisfaction**	X	X	X	X	X	X	X
Tier 1	G3	G301	**15**	**System productivity**	X	X	X	X	X	X	X
Tier 2	G3	G301, G302	**16**	**Added capacity from third-party providers**	X	X	X	X	X	X	X
Tier 2	G4	G401, G402	**19**	**Increased cost efficiency**	X	X	X	X	X	X	X
Tier 2	G3	G301	**20**	**Improved coordination among HIRTA, healthcare providers, health navigators**		X			X	X	
Tier 2	G5	G501, G502	**21**	**Delivery of safe healthcare transportation**	X	X	X	X	X	X	X
Tier 2	G1	G101	**22**	**Reduction in medical appointment deferment due to lack of transportation**	X	X	X	X	X	X	X
Tier 3	G1, G4	G101, G401	**23**	**Savings due to reduction in the number of missed medical appointments**	X	X	X	X	X	X	X

Further discussion on each of the measures in Table 2 is provided in the following subsections.

PM-1: Ability to dynamically reassign vehicles to address service disruption

Details of the measures are as follows:

- **Evaluation Question:** Will Health Connector enhance service reliability by reassigning disrupted healthcare trips in an efficient manner?

- **Metric Description**: Refers to the capability of the system to dynamically reassign a healthcare trip to an alternative vehicle in the event the originally scheduled trip was disrupted due to vehicle/driver issue so a Traveler is not left stranded or is not delayed for an appointment. It is measured as:

    - Percentage of instances a Traveler was picked up within a targeted threshold (includes Traveler wait time and boarding time in number of minutes) in the event of a service disruption.

- **Target:**

    - Traveler is picked up by a replacement vehicle within 10 minutes of delay 95% of time when trip is reassigned.

- **MPM Categories:** Core (impact stage), trip (trip stage), reliability (category).

PM-2: Availability of transportation alternatives

Details of the measures are as follows:

- **Evaluation Question**: Will Health Connector promote self-reliance for underserved groups by providing reliable access to preferred alternatives for healthcare transportation?

- **Metric Description**: Refers to the capability of the system to provide availability of travel alternatives for a given origin and destination and given pick-up and drop-off time when requested by Travelers. It is measured as:

    - Percentage of time when at least one travel alternative (e.g., vehicle x and vehicle y available within pickup time window) is available for each underserved group when trip request is submitted per their preferences.

- **Target:**

    - 95% of survey respondents had more than one options presented when trip is requested previous day

- 95% of survey respondents were satisfied with the number of time slots offered. These targets are being used since HIRTA guarantees pick-up within +/- 10 minutes of requested time with at least one vehicle.

  It is likely that the availability of additional capacity through third parties may impact the calculation of this measure. We will track any trip fulfillment that requires external capacity separately so that can be indicated as part of this analysis.

  The metrics will be calculated for each of the six underserved groups.

  MPM Categories: Core (impact stage), pre-trip (trip stage), reliability (category).

PM-3: Trips unfulfilled due to system unreliability

Details of the measures are as follows:

- **Evaluation Question**: Will Health Connector fulfill most trips and maintain system reliability through improved transportation management capabilities?

- **Metric Description**: Refers to the system's ability to monitor capacity and reliability to ensure that the requested trips are not denied, and if trips were booked, then the number of missed trips are minimized by providing a reliable service. A missed trip event occurs when a driver arrives after the pick-up window has passed. The metrics include the following:

  - Number of trips returning a 'seat unavailable' or other error as a percentage of all trips requested.

- **Target:**

  - Less than 10% of requests returned as "seat unavailable" or "other error" within one session.

- **MPM Categories:** Core (Impact stage), trip (trip stage), reliability (category).

PM-4: ETA prediction accuracy

Details of the measures are as follows:

- **Evaluation Question:** Will Health Connector help in delivering reliable services by calculating ETA predictions accurately and reliably?

- **Metric Description**: Refers to the capability of the system to calculate ETA accurately and reliably for all trips. It is measured as:

  - Accuracy in number of minutes/seconds for the delta between the estimated and actual arrival time for pickups or drop-offs depending on a Traveler's indicated preference.

- **Target:**
    - ETA accuracy target measured for Traveler pickups as whether the actual time of arrival or drop off is within +/-1 min error, 95% of time when a ride is 0-5 minutes away (calculated as aggregation across all pickups, average will be measured).
- **MPM Categories:** Core (impact stage), trip (trip stage), reliability (category).

PM-5: On-time performance

Details of the measures are as follows:

- **Evaluation Question:** Will Health Connector help in delivering services on time in a reliable manner?
- **Metric Description**: Refers to the capability of the system to be on time for pick-up events. It is measured as:
    - Percentage of times pick-up events occur within +/- 10-minute window.
- **Target:**
    - 95% on-time performance on average across all trips (+/- 10 minutes).
- **MPM Categories:** Core (impact stage), trip (trip stage), reliability (category).

PM-6: On-board travel time prediction accuracy

Details of the measures are as follows:

- **Evaluation Question:** Will Health Connector help in calculating on-board (in-vehicle) travel time for a trip accurately and reliably at the time of scheduling?
- **Metric Description**: Refers to the capability of the system to accurately predict the on-board travel time at the time of scheduling. It is measured as:
    - On-board travel time accuracy in number of minutes and seconds.
- **Target:**
    - +/-10 minutes error 90% of time, assuming the trips cannot be delayed by the promised window of +/10 minutes.
- **MPM Categories:** Core (impact stage), post-trip (trip stage), time (category).

PM-8: Reliability of the system in assisting with non-vehicle component of a complete trip

Details of the measures are as follows:

- **Evaluation Question:** Will Health Connector provide wayfinding tools to increase Traveler ability to self-navigate to/from a pick-up or a drop-off location?

- **Metric Description**: Measures if Travelers are requesting wayfinding direction and following it to successfully reach their destination before and after their vehicle component of the complete trip. Measured as:

    - Average Traveler ratings received for the wayfinding directions provided prior to pick up upon request.

    - Average Traveler ratings received for the wayfinding directions after drop-off and upon wayfinding request.

- **Target:**

    - 10% or less of Traveler ratings noted pick-up location was very difficult to find

    - 10% or less of Traveler ratings noted destination was very difficult to find.

- **MPM Categories:** Core (impact stage), trip (trip stage), time (category).

PM-9: Traveler perception of privacy

Details of the measures are as follows:

- **Evaluation Question:** Do Travelers feel confident that their information is protected when using Health Connector?

- **Description**: Refers to Traveler's opinion on how their location-specific data are handled by the system in terms of privacy. This is a qualitative measure and will be calculated based on survey input. The measure will be calculated on a five-point Likert scale, with 5 indicating the highest rating. The following (or similar) questions may be asked of Travelers:

    - Do you have any concerns with any of the information you were asked to provide? If so, what information was a concern?
    - For Travelers who indicated they had opted not to use the system, a question about privacy concerns will be included. For example, for the survey item, "Select all the reasons you chose not to use the system" – responses could include 1) Traveler feels confident navigating on their own; 2) Traveler has options other than public transit; 3) Traveler has concerns about sharing personal information.

- **Target:** It will be critical to ensure that the Travelers have high confidence in the system. Target will be 95% of survey respondents indicate "not or somewhat not concerned" about Health Connector using their location data.

- **MPM Categories:** Core (impact stage), post-trip (trip stage), safety (category).

PM-11: System ability to meet accessibility needs of Travelers

Details of the measures are as follows:

- **Evaluation Question**: Do Travelers feel confident that the system and services are accessible?

- **Metric Description**: Refers to Traveler input on the system's ability to accommodate their personal needs and preferences (e.g., LEP, disabilities, access to transportation in rural areas) with capabilities provided. This is a qualitative measure and will be calculated based on survey input. The measure will be calculated on a five-point Likert scale, 5 indicating that the system meets most of the Traveler's needs. Specifically, this targets the availability of older adults, veterans, people who live in rural areas, LEP individuals, and individuals with low incomes or with disabilities. Questions that may be asked of Travelers are:

    - Have you had difficulty or intentionally not used the Health Connector? Due to:
        - Language barriers
        - Accessibility needs
        - Availability of the service in your area
        - Affordability of the service
    - Were you ever denied trip or could not take use Health Connector transportation for a medical appointment due to one of the following needs:
        - Accessible vehicle was not available.
        - Needed personal assistance to access transportation, and the assistance was not available.
        - Inability to pay required fare.
        - Transportation was not available due to living in a rural area.

- **Target:**

    - 95% of survey respondents had no difficulty using the Health Connector and 95% of survey respondents have not been denied a trip due to accessibility barriers (identified in the survey).

- **MPM Categories:** Core (impact stage), trip (trip stage), customer satisfaction (category).

PM-12: Self-reliance

Details of the measures are as follows:

- **Evaluation Question**: Will Health Connector provide Travelers freedom of movement while accommodating their needs and preferences, so they are able to complete trips on their own?

- **Metric Description**: Refers to a Traveler's overall experience of how their personal preferences were accommodated, if they perceived bias in making their own travel arrangements, and if transportation access made it possible to access the care on their own or with limited assistance from another person.

  For a basic measurement, this will be considered a qualitative measure and will be calculated based on the survey input. Questions determine how the Health Connector has assisted Travelers in getting to medical appointments. Travelers will be asked about

their experience in booking and how Health Connector has impacted their ability to get to medical trips.

- What has been your experience with booking a trip through the Health Connector app?
- How has Health Connector impacted your ability to get to medical trips on your own?

While we explored defining a metric to calculate a comprehensive measurement of perceived quality of life as related to freedom of movement, there is a limited research literature basis for measuring self-reliance in form of “dignity” for transportation. Therefore, the measurement is limited to availability of tools that make Travelers able to manage transportation on their own.

- **Target:** An average of 90% or more indicated they have never been denied a trip or were not able to use Health Connector; 90% found it easy to book or needed some experience to book
- **MPM Categories:** Core (impact stage), post- trip (trip stage), customer satisfaction (category).

PM-14: Complaints and customer satisfaction

Details of the measures are as follows:

- **Evaluation Question**: Will the system help in reducing complaints related to a medical trip and increase Traveler satisfaction with delivery of service for healthcare trips?
- **Metric Description**:
  - Refers to the reduction in the number of valid complaints recorded by HIRTA and satisfaction with driver/HIRTA related to medical transportation needs. It is measured as follows:
    - Reduction in the number of complaints from the baseline measure or achieve a target number of complaints per month.
    - Ratings received by HIRTA for each delivered trip.
  - Also, refers to customer satisfaction with Health Connector as reported by Traveler during a survey. The measure will be calculated on a five-point Likert scale, with 5 referring to highest level of satisfaction. The following questions may be asked:
    - How do you rate HIRTA services for healthcare transportation?
    - How likely are you to pick HIRTA services over other alternatives for healthcare transportation?

- **Target:**
    - Up to 25% reduction in the number of valid complaints during evaluation period or achieve a target of no more than 5 valid complaints per month.
    - At least an average of 3 (out of a maximum of 5) rating for customer satisfaction recorded across all trips delivered per month and during evaluation period.
    - Average rating of 4 or above from 95% of survey respondents would choose HIRTA over another alternative.
- **MPM Categories:** Core (impact stage), trip (trip stage), customer satisfaction (category).

PM-15: System productivity

Details of the measures are as follows:

- **Evaluation Question**: Will the system enhance productivity as evidenced by increasing number of medical trips per hour each month?
- **Description**: Refers to the number of healthcare trips delivered by the service/system per hour. Measured as total Health Connector trips served per month divided by monthly hours of operation. Productivity can vary 2-4 trips/hour in the industry depending on various factors.
- **Target:** Achieve a target of 3 trips/hour
- **MPM Categories:** Tier 1 (impact stage), trip (trip stage), customer satisfaction (category).

PM-16: Added capacity from third-party providers

Details of the measures are as follows:

- **Evaluation Question:** Will Health Connector demonstrate efficient transportation management capabilities to provide as-needed capacity by assigning trips to third-party providers when needed?
- **Metric Description**: Refers to the capability of the system to automatically assign trips to a third-party service provider when HIRTA does not have the capacity to provide those trips. While most impact will be seen for same-day service, third-party providers will also help better provide trips booked in advance for rural areas where HIRTA has limited service available. It is measured as:
    - Increase in the number of trips provided after normal HIRTA service hours.
- **Target:** Targets to be considered as:
    - At least 10 Health Connector trips provided by third-party vehicles per month.
- **MPM Categories:** Tier 1 (impact stage), trip (trip stage), capacity (category).

PM-19: Increased cost efficiency

Details of the measures are as follows:

- **Evaluation Question**: Will the system demonstrate efficient transportation management by reducing the cost of medical transportation on HIRTA?
- **Metric Description**: Evaluates the cost of delivering a healthcare trip and measured by reductions in administrative and staff cost for taking calls, making reservations, performing scheduling, dispatching and other administrative functions related to medical transportation.
- **Target:** Reduced administrative costs of medical trip coordination by 10% for HIRTA
- **MPM Categories:** Tier 1 (impact stage), post-trip (trip stage), effectiveness/ efficiency/ cost (category).

PM-20: Improved coordination among HIRTA, healthcare providers, health navigators

Details of the measures are as follows:

- **Evaluation Question:** Will the system demonstrate efficiency by coordinating trips among HIRTA and its partners in a short period of time?
- **Metric Description**: Refers to the ability of the system to automate tasks so the number of person-minutes spent in coordinating a trip by HIRTA and partners are minimized. Healthcare partners and health navigators will have access to the same trip booking and dispatching software as HIRTA dispatchers and will be able to register Travelers and book or modify trips, as authorized. Data will be collected through a survey of healthcare partners and will include questions such as:
    - How many patients on average do you assist in a month with transportation?
    - How long on average do you spend assisting a patient, who is not using Health Connector, obtain a ride?
    - How long on average do you spend assisting a patient using Health Connector to obtain a ride?
- **Target:**
    - 20% reduction in the amount of time staff spend assisting patients with transportation using Health Connector.
- **MPM Categories:** Tier 1 (impact stage), post-trip (trip stage), effectiveness/ efficiency/ cost (category).

PM-21: Delivery of safe healthcare transportation

Details of the measures are as follows:

- **Evaluation Question:** Will Health Connector help provide safe transportation?
- **Metric Description**: Refers to the number of safety events recorded by the system. Measured as:
    - Number of incidents recorded per month.
- **Target:** Fewer than 10 incidents per month.
- **MPM Categories:** Tier 1 (impact stage), post-trip (trip stage), safety (category).

PM-22: Reduction in medical appointment deferment due to lack of transportation

Details of the measures are as follows:

- **Evaluation Question**: Will capabilities available through Health Connector reduce medical appointments missed (meaning the patient did not arrive or did not timely reschedule) due to lack of access to transportation services for Dallas County Residents?
- **Description**: Refers to the ability of the system to help reduce the number of missed medical appointments caused due to lack of access to transportation. This may be tracked by healthcare providers via social determinant of health billing codes and would be recorded in the system when an appointment is canceled or rescheduled due to patients not having access to a reliable transportation service. It will be measured as:
    - Reduction in the number of medical appointments missed by healthcare customers that can be linked to transportation. This will be calculated per underserved group so needs for one group do not skew the results. The HIRTA team is working with care facilities to see if this can be tracked using a new insurance code used to track social determinants of health (Z59.82). If this is not available, this would be tracked using regional data available through the CHA CHIP regional health survey. As feasible this information will be disaggregated for specific underserved groups. The number of disaggregated underserved groups that can be included will depend on the number of participants ultimately included in each group (i.e., low-income rural participants).
        - In addition, Dallas County residents will be asked this question in the survey to determine if transportation was a barrier in making the medical appointment. Residents may be asked the following question: How has Health Connector impacted your ability to get to medical trips on your own? (easier, not much difference, harder)
- **Target:**
    - At least 30% reduction in the number of missed medical appointments that are related to transportation access during the 18-month evaluation period.

  - At least 80% of residents indicating that transportation did not present a barrier to healthcare access 6 months after Health Connector launch.

  - At least 90% of residents indicating that transportation did not present a barrier to healthcare access 12 months after Health Connector launch.

- **MPM Categories:** Tier 2 (impact stage), pre-trip (trip stage), mobility (category).

PM-23: Savings due to reduction in the number of missed medical appointments

Details of the measures are as follows:

- **Evaluation Question**: Will the system result in financial savings for healthcare partners with the reduction in the number of missed medical appointments?

- **Metric Description**: Refers to the financial savings due to reduced number of missed medical appointments. This will be extrapolated from the national trend. The metric will be calculated in amount of dollars and cents.

  The HIRTA team has reviewed the TCRP report on *"Cost-Benefit Analysis of Providing Non-Emergency Medical Transportation"* [7] and plans to follow the guidance described in the report as the starting point for calculating net savings delivered by transportation for the healthcare community.

- **Target:**

  - 10% increase in total cost savings by reducing the number of missed medical appointments.

- **MPM Categories:** Tier 3 (impact stage), post-trip (trip stage), financial (category).

3.2. Relationship between Performance Measures and Technologies/Services/Components

Table 3 illustrates how the performance measures relate to Health Connector's core subsystem components (as described in Section 1.3) and help to ensure that the set of performance measures adequately cover the planned technologies, services, and/or components.

Table 3. Mapping of Performance Measures and Systems/Services

PM#	Performance Measures	Traveler-end Subsystem	TMS Subsystem	Wayfinding Subsystem	Vehicle Subsystem	Health Navigator and Healthcare - End Subsystem
1	**Ability to dynamically reassign vehicles to address service disruption**		X			
2	**Availability of transportation alternatives**	X	X			X
3	**Trips unfulfilled due to system unreliability**	X	X		X	
4	**ETA prediction accuracy**	X	X		X	
5	**On-time performance**	X	X		X	
6	**Travel-time prediction accuracy**	X	X		X	
8	**Reliability of the system in assisting with non-vehicle component of the complete trip**	X		X		
9	**Privacy protection**	X	X	X	X	X
11	**System ability to meet accessibility needs of Travelers**	X	X	X	X	X

PM#	Performance Measures	Traveler-end Subsystem	TMS Subsystem	Wayfinding Subsystem	Vehicle Subsystem	Health Navigator and Healthcare - End Subsystem
12	**Self-reliance/ dignity index**	X	X	X		
14	**Complaints and customer satisfaction**	X	X	X		X
15	**System productivity**	X	X		X	
16	**Ability to assign trips to third party providers**		X		X	
19	**Increased cost efficiency**		X		X	
20	**Improved coordination among HIRTA, healthcare providers, health navigators**		X		X	X
21	**Delivery of safe healthcare transportation**	X	X	X	X	
22	**Reduction in medical appointment deferment due to lack of transportation**					X
23	**Savings due to reduction in the number of missed medical appointments**		X			X

3.3. Potential Constraints

This section identifies potential constraints in obtaining, processing, and analyzing necessary data, including resolution and granularity necessary for the performance measure to be functionalized.

- **Traveler Details and Trip History Data**: HIRTA will have access to Traveler details and trip history at the individual level for all Travelers, and this data can be used to export data at aggregated levels. Data to be made publicly available for analysis will not include any personally identifiable information (PII) for privacy protection. PII in this context includes Traveler name, address, origin/destination locations, and Traveler mobility needs.

  Metrics on no-shows, cancellations, on-time performance, reassignments, and other trip performance measures will be calculated by aggregating data at trip level and anonymizing any PII. To calculate any metric by underserved group, as planned, appropriate aggregation will have to be made when exporting trip performance history. The following types of aggregations are planned: 1) trip-level (e.g., trip performance); 2) geographic, such as, traffic analysis zone (TAZ) or census tract (CT)-level (e.g., travel time); and 3) temporal (e.g., daily, weekly, or monthly); and 4) by underserved group.

  Impacted Measures: PM-2, PM-3, PM-4, PM-6, PM-7, PM-10, PM-14

- **Survey Design and Recruitment:** Several qualitative measures have been identified that will require 1) well designed survey instruments; 2) a representative sample, of active Health Connector participants, of sufficient size to determine statistical significance; and 3) a control group that may not use Health Connector and will continue with the tools they currently use (for performance metrics that are collected from Health Connector). Performance metrics that rely on user surveys will include both a treatment and control group. A representative sample size depends on having sufficient number of characteristics for each for response of interest so that statistical significance can be determined. For instance, if the metrics present information for a sub-group (i.e., veterans or individuals with LEP), a minimum sample size for each sub-population needs to be determined. A cross-section of responses for each question is also needed. For instance, if the survey intends to measure satisfaction with transportation alternatives, survey responses would need to include Travelers who attempted trips at times when alternatives were likely to be lower. Sample size is typically determined by expected population size, standard deviation, margin of error, and a confidence level.

  Impacted Measures: PM-10, PM-11, PM-12, PM-13, PM-14, PM-22

- **Extrapolation for Tier 2 and Tier 3 Metrics:** Most of the data that will be collected will be at Traveler-level through their trip requests. For extrapolation, methods will have to be developed to calculate planned measures related to transportation safety, health and health outcomes, and financial savings due to reduced number of missed medical appointments at the community level (beyond Dallas County) and subsequently across the state of Iowa and nationally. Direct extrapolation using geographic and demographic factors alone may not be sufficient, since local factors may also play a role (e.g., capabilities and capacities of healthcare systems, level of transportation services

available, connectivity to healthcare services, levels of current baseline metrics, and socio-economic conditions).

Impacted Measures: PM-21, PM-22, PM-23

Confounding Factors and Mitigation Approaches

Confounding factors or externalities will impact how metrics can be successfully calculated and interpreted. While some confounding factors can be identified at this time either based on knowledge or anticipation, others may still not be known. HIRTA team will continue to update this list with any additional factors as they become known so operations and maintenance staff, the ISU team conducting the evaluation, independent evaluators, and researchers are able to interpret the results appropriately when evaluating system impacts.

Table 4. Confounding Factors and Mitigation Approaches

Confounding Factor	Description	Mitigation Approaches
Travelers may be offered capacities similar to Health Connector by healthcare providers or funding entities.	Unity Point Health works with Kaizen Health (https://kaizenhealth.org/), which provides an application that has some similarities to Health Connector. Given this, it may be difficult to measure Tier 1 and Tier 2 metrics associated with efficiency gains resulting only by the deployment of Health Connector. Further, Access2Care provides app-based booking for medical appointments that Medicaid members are required to use. VA also provides their own solution for managing healthcare appointments for veterans. Traveler perception of medical transportation may be confounded unless benefits from Traveler's use of Health Connector is fully isolated.	When recruiting Travelers, their level of use of and dependency on other similar systems will be documented. For situations where Travelers use multiple apps, survey questions will be designed to get input related to functions specifically provided by Health Connector (e.g., wayfinding, vehicle dispatching, on-board experience).

Confounding Factor	Description	Mitigation Approaches
Traffic delays may be caused by factors that are beyond HIRTA's control.	The following measures may be impacted: • ETA and travel time prediction may be impacted due to construction activities. • ETA and travel time prediction may be impacted due to a severe weather event and its aftermath. • ETA and travel time prediction may be impacted due to uncertainty related to an accident/incident.	Historical travel time variability by time of day and day of week for a given origin/destination pair will be analyzed so anomalies can be detected and isolated. Outlier data that falls outside the 95th percentile will not be used in the calculation of metrics for ETA and travel time measures. HIRTA's own record of past trip performance through the Via platform is considered the primary source. Also, data from private providers such as INRIX can be utilized, if necessary.
Traveler's choices and perception may be impacted by weather.	Travelers may no-show or cancel for a trip as they may rely on family/friend in the event of an adverse weather condition for better level of comfort. Similarly, Travelers may make other decisions that may depend on weather.	Given any anomalies in the number of no-shows or cancelations, we will examine the historical weather record for potential impacts.
Capacity may be limited due to low participation of service providers in rural areas.	Availability and operation of TNCs and taxi providers are limited in rural areas. Availability may change in the future; additional capacities may become available or availability may be further reduced. The status of this factor is important when evaluating agency productivity and capacity.	Before the launch of Health Connector, HIRTA will contract with third-party service providers (e.g., TNCs, taxis, volunteer drivers) that are available to provide service in rural areas under contract to HIRTA. The system will have information on their service hours, service area, and any other restrictions and will assign trips accordingly. The system will also document available capacity through all providers at a given time and will utilize that in calculating metrics related to productivity and cost efficiency.

Confounding Factor	Description	Mitigation Approaches
Injuries may be caused due to activities beyond the control of HIRTA and its partners.	Some injuries caused during the complete trip that relate to infrastructure (e.g., poor sidewalk conditions) may not be under the control of HIRTA or other partners.	Safety events and incidents will be tracked in accordance with what is defined in the Safety Management Plan (SMP).
Other factors causing improvements in health outcomes due to increased spontaneity of travel and reduction in the number of missed medical appointment.	There are plans for construction of additional healthcare facilities in the study area. There may be other similar changes in the geographic area. While there may be no direct relationship with Health Connector solution, added capacity and similar changes may impact how some underserved groups may perceive spontaneity.	Mitigating this particular factor will require multiple steps: 1) Complete documentation of known and anticipated changes. 2) Interpretation of other qualitative and quantitative measures/metrics alluding to customer satisfaction and other Traveler metrics. 3) Historical record of customer satisfaction, if available.
Reasons for no-shows and cancellations may not be fully known.	Travelers are typically not required to provide reasons for no-shows and cancellations.	Traveler surveys will be used to better understand no-show and cancellation reasons to the extent possible. These surveys will extend beyond Health Connector riders.
A temporary outage or degraded performance of the system may impact customer perception.	System may sometimes be non-responsive due to outage with one or more components or performance may be degraded due to technical issues, leading to inaccurate results.	Any system outage log will be documented and will be made available to evaluators to be factored in the analysis and interpretation.
Customer complaints may not be valid.	It is likely, in some cases, customer complaints are received but are not valid, as there may be valid reasons for why a particular event may have occurred.	A detailed analysis of relevant events is needed before a complaint is closed in the system.

4. System Deployment Impact Analysis Design

This section provides an approach for measuring the outcomes of Health Connector deployment using the performance measures as defined in Section 3. The section includes the following details:

1. Analysis approaches to be used for calculating the measures. This includes before/after analysis, system impact study, behavioral analysis, and financial modeling.

2. Detailed information on how performance will be evaluated for each performance measure. Discussion in this section is provided by performance measure, and applicable user scenarios are identified for each measure. Most of the performance measures apply to all scenarios.

4.1. Experimental Design

The HIRTA team will use the following approaches for calculating identified measures:

- **Before and after analysis**: Baseline measures will be collected when necessary and compared to post-deployment data. This analysis will be primarily conducted with qualitative methods, comparing before and after survey/interview evaluations for specific metrics. It may also be used in quantitative analysis by comparing operational costs before and after deployment (PM-19), complaints (PM-14), staff efficiency (PM-20) and missed appointments (PM-22).

  Data collection for before/after analysis will be at specific points in time as identified in the PMESS.

- **Measurement against a standard**: Most performance measures are designed to evaluate how Health Connector is performing relative to an industry-established or project-established standard. This will help inform whether Health Connector is performing as the team expects it to and will be critical in evaluating the success of the service. This includes measures such as “fewer than 10 safety events/month” and “less than 10% seat unavailable error”, as well as many others.

- **Financial Modeling:** A separate methodology will be used to understand financial implications of the savings Health Connector could provide at a national scale, primarily considering:

  - Financial benefits observed by healthcare providers due to reduced number of missed appointments.

- Financial benefits observed by healthcare providers due to timely primary/preventive care resulting in reduced urgent care or emergency room (ER) visits.

The HIRTA team is planning to deploy the methodology described in the TCRP Report on *"Cost-Benefit Analysis of Providing Non-Emergency Medical Transportation."* This will incorporate missed appointment data and cost data.

4.2. Survey Design

Success in obtaining respondent feedback depends on well-designed questions that can be answered or asked in a reasonable time frame. As a result, an electronic survey will initially be the primary survey instrument. All questions used in any survey format will be drafted and then reviewed by several people not involved with the project to ensure the questions are understandable and can be answered in a reasonable time frame. Updates will be made as needed. Additionally, the survey will be tailored so that questions for specific groups (i.e., persons with disabilities) can be included for those groups but not others in order to avoid lengthy surveys which will impact response rates.

The following methods will be critical for collecting performance measure data that is not available quantitatively through HIRTA, Via, or other sources:

- **In-app surveys:** To assess Traveler perceptions of accessibility, evaluations of wayfinding technology, and opinions about self-reliance, the HIRTA team will leverage surveying capabilities offered through the Via Traveler app. This will allow Travelers to answer questions related to their trip at the conclusion of their ride and is best for trip-level evaluations.

- **Traveler surveys:** To assess perceptions about Traveler privacy, general satisfaction about the program, and other assessments about the accessibility of Health Connector, the HIRTA team will distribute traveler surveys. These will be sent to Travelers who have used the system or have familiarity with the system and have declined to use it, to evaluate system performance on a higher level. These surveys will not relate to specific trip evaluations.

- **HIRTA surveys**: Surveys and potentially in-person interviews will be utilized to understand Health Connector impacts to HIRTA staff. These will be primarily used for evaluations of staff time used on Health Connector, perceptions of Traveler experience and number of complaints received.

- **Healthcare surveys**: Evaluations of healthcare provider experience will need to come directly from surveys and potentially in-person interviews with healthcare staff and health navigators. This will primarily be used to collect data on the number of healthcare providers assisting Travelers, and number of complaints about Health Connector that the healthcare providers have received. These are critical variables in assessing system productivity and quality of life.

- **Third-party surveys**: Some information may need to be collected from volunteer drivers or other third-party operators to get feedback on Traveler complaints and Traveler experience if this is not conveyed through the VOC.

Each different survey tool will be submitted and approved by the Institutional Review Board (IRB) process at the Iowa State University (ISU). Typical information required includes survey methods, survey questions, descriptions of how data will be collected and utilized, what personally identifying information (PII) will be collected, how PII will be protected.

Although several different techniques will be used to ensure an adequate sample size, several constraints are present which may impact the number and types of responses ultimately gathered. First, the effort will need to be conducted within the time and resource constraints of the project. For instance, a majority of the needed respondents will need to come from initial surveys through the Health Connector app or other electronic means. Additional samples will be sought through other means such as telephone calls or in-person surveys. However, these methods are much more time and cost intensive. As a result, the number of additional samples that can be gathered may be limited if sufficient initial responses are not received. Additionally, it may be difficult to ensure an adequate sample size of some groups since their representation in the available population of respondents is low and they may be harder to contact through electronic means and may be less likely to answer surveys.

4.3. Evaluation Methodology

The following subsections describe the methodology for analyzing each performance measure. Categories include:

Description: Provides information on what the evaluation intends to measure and why

Data Needs: Discusses the individual data that will be used in the analysis. All data referenced in this category falls under Data ID 32. Please refer to Table 24 for a detailed breakdown of all anonymized and/or aggregated data required to support performance evaluation.

Experimental Design: Describes how data will be evaluated (see Section 5.1)

Modeling/Tools: Describes what will be used to complete the analysis

Hypothesis: What the HIRTA team expects to see when analyzing the results

Targets: Specific metrics that will constitute success when evaluating each measure

Risks: Issues that could arise in the evaluation process related to each measure

Confounding factors: Externalities that could impact how metrics can be interpreted

Applicable use cases: See Table 2.

PM-1: Ability to dynamically reassign vehicles to address service disruption

Table 5. Details for PM-1: Ability to dynamically reassign vehicles to address service disruption

CATEGORY	DETAILS
Description	Refers to the capability of the system to dynamically reassign a healthcare trip to an alternative vehicle in the event the originally scheduled trip was disrupted due to vehicle/driver issue so a Traveler is not left stranded or is not delayed for an appointment. It is measured as the percentage of instances a Traveler was picked up within a targeted threshold (includes Traveler wait time and boarding time in number of minutes) in the event of a service disruption.
Data Needs	ID #5 - Date of service interruption ID #6 - Time of service interruption ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID # 9 - Trip cost ID #10 - Payment method (i.e., Traveler, third party) ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #13 - Transportation provider ID #15 - Original pick-up time offered (and accepted) ID #16 - Actual pick-up time ID #17 - Original estimated vehicle travel time ID #18 - Updated estimated vehicle travel time
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of point in time data, likely methods include graphical comparison, chi-squared test
Hypothesis	Travelers will not be stranded or delayed during a trip due to an unforeseen service disruption.
Targets	Traveler is picked up by a replacement vehicle within 10 minutes of delay 95% of the time, when the trip is reassigned.
Risks	While such events are likely, occurrences may be low in number. A lower threshold of wait time may be needed for a larger sample size.
Confounding factor	None
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-2: Availability of transportation alternatives

Table 6. Details for PM-2: Availability of transportation alternatives

CATEGORY	DETAILS
Description	Refers to the capability of the system to provide availability of travel alternatives for a given origin and destination and given pick-up and drop-off time when requested by Travelers. It is measured as: • Percentage of time when at least one travel alternative (e.g., vehicle x and vehicle y available within pickup time window) is available for each underserved group when searched per their preferences.
Data Needs	ID# 46
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of point in time data, likely methods include graphical comparison, ANOVA
Hypothesis	The system will provide appropriate/suitable travel alternatives for a given origin and destination and given pick-up and drop-off time when requested by Travelers.
Targets	• 95% of survey respondents had more than one options presented when trip is requested previous day • 95% of survey respondents were satisfied with the number of time slots offered
Risks	None
Confounding factor	• Limited ability of third parties to accommodate the needs of Travelers that require mobility devices • Limited availability of third-party service providers in rural areas
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-3: Trips unfulfilled due to system unreliability

Table 7. Details for PM-3: Trips unfulfilled due to system unreliability

CATEGORY	DETAILS
Description	Refers to the system's ability to monitor capacity and reliability to ensure that the requested trips are not denied, and if trips were booked, then the number of missed trips are minimized by providing a reliable service. A missed trip event occurs when a driver arrives after the pick-up window has passed. The metrics include the following: Number of trips returning a 'seat unavailable' or other error as a percentage of all trips requested.
AnnData Needs	ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #26 - Seat unavailable and 'other error' alerts without finding a ride within one session
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of point in time data, likely methods include graphical comparison, chi-squared test
Hypothesis	The system will help HIRTA reduce the number of trips unfulfilled by providing reliable service.
Targets	Less than 10% of requests returned as "seat unavailable" or "other error" within one session
Risks	Further investigation into the reason of errors will be needed in some cases, which could be done through a combination of surveys, additional data from Via, or external data sources
Confounding factor	None
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-4: ETA prediction accuracy

Table 8. Details for PM-4: ETA prediction accuracy

CATEGORY	DETAILS
Description	Refers to the capability of the system to calculate ETA accurately and reliably for all trips. It is measured as: • Accuracy in number of minutes/seconds for the delta between the estimated and actual arrival time for pickups or drop-offs depending on a Traveler's indicated preference.
Data Needs	ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #15 - Original pick-up time offered (and accepted) ID #16 - Actual pick-up time ID #19 – Original estimated drop-off timeID #20 – Actual drop-off time
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of point in time data, likely methods include graphical comparison, chi-squared test
Hypothesis	The system will reliably predict estimated arrival time for vehicles.
Targets	ETA accuracy target measured for Traveler pickups as whether the actual time of arrival or drop off is within +/-1 min error, 95% of time when a driver is 0-5 minutes away (calculated as aggregation across all pickups, average will be measured).
Risks	None
Confounding factor	• ETA accuracy may be impacted due to construction activities. • ETA accuracy may be impacted due to a severe weather event and its aftermath. • ETA accuracy may be impacted due to uncertainty related to an accident/incident.
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-5: On-time performance

Table 9. Details for PM-5: On-time performance

CATEGORY	DETAILS
Description	Refers to the capability of the system to be on time for pick-up events. It is measured as: • Percentage of times pick-up events occur within +/- 10-minute window.
Data Needs	ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #15 - Original pick-up time offered (and accepted) ID #16 - Actual pick-up time ID #25 - Actual in-vehicle travel time Ride duration Direct trip duration
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of point in time data, likely methods include graphical comparison, chi-squared test
Hypothesis	During normal operations, services will be on time most of the time.
Targets	95% on-time performance on average across all trips (+/-10 minutes)
Risks	On-time performance may be high due to the +/-10 minutes window. Customer perception of on-time performance may be different and will be measured through survey.
Confounding factor	• On-time performance may be impacted due to construction activities. • On-time performance may be impacted due to a severe weather event and its aftermath. • On-time performance may be impacted due to uncertainty related to an accident/incident.
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-6: On-board travel time prediction accuracy

Table 10. Details for PM-6: On-board travel time prediction accuracy

CATEGORY	DETAILS
Description	Refers to the capability of the system to accurately predict the on-board travel time at the time of scheduling. It is measured as: • On-board travel time accuracy in number of minutes and seconds.
Data Needs	ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #15 - Original pick-up time offered (and accepted) ID #25 - Actual in-vehicle travel time ID #17 - Original estimated vehicle travel time
Experimental Design	Measurement against a standard
Modeling/Tools	Time series analysis of the dataset for the evaluation time period, graphical comparison, chi-squared test
Hypothesis	On-board travel time provided to the Traveler at the time of pick-up will be accurate most of the time. That is, the ETA that Travelers are provided at the start of their trip upon boarding is accurate to the actual arrival times experienced.
Targets	+/-10 minutes error 90% of time
Risks	None
Confounding factor	• Travel time prediction may be impacted due to construction activities. • Travel time prediction may be impacted due to a severe weather event and its aftermath. • Travel time prediction may be impacted due to uncertainty related to an accident/incident.
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-8: Reliability of the system in assisting with non-vehicle component of a complete trip

Table 11. Details for PM-8: Reliability of the system in assisting with non-vehicle component off a complete trip

CATEGORY	DETAILS
Description	Measures if Travelers are requesting wayfinding direction and following it to successfully reach their destination before and after their vehicle component of the complete trip. Measured as: • Average Traveler ratings of the wayfinding directions received prior to pick-up upon wayfinding request. • Average Traveler ratings of the wayfinding directions received after drop-off upon wayfinding request.
Data Needs	ID #28 - Traveler rating of pre-vehicle wayfinding ID #29 - Traveler rating of post-vehicle wayfinding
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of survey results, likely methods include graphical comparison, chi-squared test
Hypothesis	Pick-up and drop-off locations will be such that any inconvenience is not caused during the access leg (walk to/from pick-up/drop-off locations) of the complete trip.
Targets	• 10% or less of Traveler ratings noted pick-up location was very difficult to find • Average 10% or less of Traveler ratings noted destination was very difficult to find
Risks	None
Confounding factor	None
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-9: Traveler perception of privacy

Table 12. Details for PM-9: Traveler perception of privacy

CATEGORY	DETAILS
Description	Refers to Traveler's opinion on how their location-specific data are handled by the system in terms of privacy. This is a qualitative measure and will be calculated based on survey input. The measure will be calculated on a five-point Likert scale, with 5 indicating the highest rating. The following (or similar) questions may be asked of Travelers: • Do you have any concerns with any of the information you were asked to provide? If so, what information was a concern? • For Travelers who indicated they had opted not to use the system, a question about privacy concerns will be included. For example, for the survey item, "Select all the reasons you chose not to use the system" – responses could include 1) Traveler feels confident navigating on their own; 2) Traveler has options other than public transit; 3) Traveler has concerns about sharing personal information.
Data Needs	ID #30 - Traveler perception about privacy
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of survey results, likely methods include graphical comparison, chi-squared test
Hypothesis	Travelers will feel that Health Connector protects their privacy
Targets	95% of survey respondents indicate "not or somewhat concerned" about Health Connector using their location data.
Risks	None
Confounding factor	None
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-11: System ability to meet accessibility needs of Travelers

Table 13. Details for PM-11: System ability to meet accessibility needs of Travelers

CATEGORY	DETAILS
Description	Refers to Traveler input on system's ability to accommodate their personal needs and preferences (e.g., LEP, disabilities, access to transportation in rural areas) with capabilities provided. This is a qualitative measure and will be calculated based on survey input. The measure will be calculated on a five-point Likert scale, 5 indicating that the system meets most of Traveler needs. Specifically, this should measure accessibility for of older adults, veterans, people who live in rural areas, LEP individuals, and individuals with low incomes or with disabilities. Questions that may be asked of Travelers are: Have you had difficulty or intentionally not used the Health Connector due to: • Language barriers • Accessibility • Availability of the service in your area • Affordability of the service • Other Were you ever denied a trip or could not take a transportation for medical appointment due to one of the following: • Accessible vehicle was not available. • Needed personal assistance to access transportation and the assistance was not available. • Inability to pay required fare. • Transportation was not available due to living in a rural area. • Other
Data Needs	ID #21 – Mobility needs identified ID #22 – Mobility needs accommodated ID #23 - Traveler perception of accessibility (language, mobility)
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of survey results, likely methods include graphical comparison, chi-squared test, generalized linear models to test relationships between responses and other variables
Hypothesis	Health Connector will meet the accessibility needs of Travelers.
Targets	95% of survey respondents had no difficulty using the Health Connector and 95% of survey respondents have not been denied a trip due to accessibility barriers (identified in the survey).
Risks	A Traveler's accessibility needs may change without them updating their profile
Confounding factor	Limited ability of third parties to accommodate the needs of Travelers that require mobility devices
Applicable use cases	U1, U2, U3

PM-12: Self-reliance

Table 14. Details for PM-12: Self-reliance

CATEGORY	DETAILS
Description	Refers to a Traveler's overall experience of how their personal preferences were accommodated, if they perceived bias in making their own travel arrangements, and if transportation access made it possible to access the care needed on their own or with limited assistance. • For a basic measurement, this will be considered a qualitative measure and will be calculated based on the survey input. Questions determine how the Health Connector has assisted travelers in getting to medical appointments. Travelers will be asked about their experience in booking and how Health Connector has impacted their ability to get to medical trips. What has been your experience with booking a trip through the Health Connector app? • How has Health Connector impacted your ability to get to medical trips on your own? While we explored definition of a metric to calculate a comprehensive measurement of perceived quality of life as related to freedom of movement, literature reviewed thus far on measuring self-reliance in form of "dignity" for transportation purpose is limited. Therefore, the measurement is limited to availability of tools that make Travelers able to manage transportation on their own.
Data Needs	ID #31 - Traveler perception about self-reliance
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of survey results, likely methods include graphical comparison, chi-squared test, generalized linear models to test relationships between responses and other variables
Hypothesis	Health Connector will enhance the ability of Travelers to book medical appointments and travel to/from those appointments, or other care facilities, on their own.
Targets	An average of 90% or more indicated they have never been denied a trip or were not able to use Health Connector; 90% found it easy to book or needed some experience to book
Risks	None
Confounding factor	None
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-14: Complaints and customer satisfaction

Table 15. Details for PM-14: Complaints and customer satisfaction

CATEGORY	DETAILS
Description	Refers to the reduction in the number of valid complaints recorded by HIRTA and satisfaction with driver/HIRTA related to medical transportation needs. It is measured as follows: • Reduction in the number of complaints from the baseline measure or achieve a target number of complaints per month. • Ratings received by HIRTA for each delivered trip. Also, refers to customer satisfaction with the Health Connector service as reported by Traveler during a survey. The measure will be calculated on a five-point Likert scale, with 5 referring to highest level of satisfaction. The following questions may be asked: • How will you rate HIRTA services for healthcare transportation? • How likely are you to pick HIRTA services over other alternatives for healthcare transportation?
Data Needs	ID #32 - Customer satisfaction ID #33 - Number of complaints
Experimental Design	Before and after analysis will be conducted to analyze the change in the number of customer complaints and customer satisfaction.
Modeling/Tools	Likely methods include graphical comparison, chi-squared test, generalized linear models to test relationships between responses and other variables
Hypothesis	Health Connector will assist in improving customer satisfaction.
Targets	• Up to 25% reduction in the number of valid complaints during evaluation period or achieve a target of no more than 5 valid complaint per month • At least 3 (out of a maximum of 5) rating for customer satisfaction recorded across all trips delivered per month and during evaluation period • Average rating of 4 or above from 95% of survey respondents would choose HIRTA over another alternative. Rating of 4 or above from 95% of survey respondents • 95% of respondent indicate they are satisfied with the Health Connector
Risks	None
Confounding factor	Customer complaints may not be valid, and a detailed analysis may be required for calculating this measure to ensure validity of complaints. System may sometimes be non-responsive due to outage with one or more components or performance may be degraded due to technical issues leading to inaccurate results
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-15: System productivity

Table 16. Details for PM-15: System productivity

CATEGORY	DETAILS
Description	Refers to the number of healthcare trips delivered by the service/system per hour. Measured as total Health Connector trips served per month divided by monthly hours of operation. Productivity can vary 2-4 trips/hour in the industry depending on various factors.
Data Needs	ID #34 - Number of Health Connector Trips
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of point in time data, likely methods include graphical comparison, chi-squared test, generalized linear models to test relationships between responses and other variables
Hypothesis	Health Connector will HIRTA enhance productivity.
Targets	3 trips/hour
Risks	None
Confounding factor	None
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-16: Added Capacity from third-party providers

Table 17. Details for PM-16: Added capacity from third-party providers

CATEGORY	DETAILS
Description	Refers to the capability of the system to dynamically assign trips to a third-party service provider when HIRTA does not have the capacity to provide those trips. While most impact will be seen for same-day service, third-party providers will also help better provide trips booked in advance for rural areas where HIRTA has limited service available. It is measured as: • Increase in the number of trips provided after normal HIRTA service hours successfully delivered that are booked with at least 24 hours' notice. • Increase in the number of trips successfully delivered that are booked same day with at least 20 minutes' notice.
Data Needs	ID #7 - Trip request date (date when Traveler made request) ID #8 - Trip date ID #11 - Trip request time (time when Traveler made request) ID #12 - Pick-up time requested ID #13 - Transportation provider ID #15 - Original pick-up time offered (and accepted) ID #16 - Actual pick-up time ID #17 - Original estimated vehicle travel time ID #18 - Updated estimated vehicle travel time ID #35 - Number of trips provided by a third party (after hours)
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of point in time data, likely methods include graphical comparison, chi-squared test
Hypothesis	Health Connector will enhance HIRTA's productivity.
Targets	At least 10 Health Connector trips provided by third-party vehicles per month AND 95% success rate or higher when assigning trips to third-party vehicles.
Risks	None
Confounding factor	Limitation in capacity due to participation of service providers in rural areas
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-19: Increased cost efficiency

Table 18. Details for PM-19: Increased cost efficiency

CATEGORY	DETAILS
Description	Evaluates the cost of delivering a healthcare trip and measured by reductions in administrative and staff cost for taking calls, making reservations, performing scheduling, dispatching and other administrative functions related to medical transportation. **Error! Reference source not found.**
Data Needs	ID #45 – HIRTA admin cost for Medicaid trips
Experimental Design	Before/after analysis
Modeling/Tools	Likely methods include graphical comparison, chi-squared test, generalized linear models to test relationships between responses and other variables
Hypothesis	Health Connector will help in reduction of cost/trip.
Targets	Reduction in administrative and staff costs for healthcare trips by 10% for HIRTA
Risks	None
Confounding factor	None
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-20: Improved coordination among HIRTA, healthcare providers, health navigators

Table 19. Details for PM-20: Improved coordination among HIRTA, healthcare providers, health navigators

CATEGORY	DETAILS
Description	Refers to the ability of the system to automate tasks so the number of person-minutes spent in coordinating a trip by HIRTA and partners are minimized. Healthcare partners and health navigators will have access to the same trip booking and dispatching software as HIRTA dispatchers and will be able to register Travelers and book or modify trips, as authorized. Will be collected through a survey of healthcare partners and will include questions such as: • How many patients on average do you assist in a month with transportation? • How long on average do you spend assisting a patient, who is not using Health Connector, obtain a ride? • How long on average do you spend assisting a patient using Health Connector to obtain a ride?
Data Needs	ID #36 - Amount of time healthcare providers spend per trip helping Travelers ID #37 - Number of times healthcare providers help Travelers
Experimental Design	Before/after analysis
Modeling/Tools	Likely methods include graphical comparison, chi-squared test, generalized linear models to test relationships between responses and other variables
Hypothesis	Health Connector will reduce the time spent in coordination per trip.
Targets	20% reduction in the amount of time staff spend assisting patients with transportation using Health Connector.
Risks	None
Confounding factor	None
Applicable use cases	U2, U5, U6

PM-21: Delivery of safe healthcare transportation

Table 20. Details for PM-21: Delivery of safe healthcare transportation

CATEGORY	DETAILS
Description	Refers to the number of incidents recorded by the system. Measured as: • Number of incidents recorded per month
Data Needs	ID #43 - Number of safety events
Experimental Design	Measurement against a standard
Modeling/Tools	Analysis of time series data, likely methods include graphical comparison, chi-squared test
Hypothesis	Health Connector will deliver safe healthcare transportation
Targets	Fewer than 10 incidents per month
Risks	None
Confounding factor	None
Applicable use cases	U1, U2, U3, U4, U5, U6, U7

PM-22: Reduction in medical appointment deferment due to lack of transportation

Table 21. Details for PM-22: Reduction in medical appointment deferment due to lack of transportation

CATEGORY	DETAILS
Description	Refers to the ability of the system to help reduce the number of missed medical appointments caused due to lack of access to transportation. This will be tracked by healthcare providers and will be recorded in the system when an appointment is cancelled or rescheduled due to patients not having access to a reliable transportation service. It may be measured as: • Reduction in the number of medical appointments missed by healthcare customers (patient did not arrive or did not timely reschedule) that can be linked to transportation. This will be calculated for each underserved group so needs for one group do not skew the results. The HIRTA team is working with care facilities to see if this can be tracked using a new insurance code used to track social determinants of health (Z59.82). If this is not available, this would be tracked using regional data available through the CHA CHIP regional health survey. As feasible this information will be disaggregated for specific underserved groups. The number of disaggregated underserved groups that can be included will depend on the number of participants ultimately included in each group (i.e., low-income rural participants). In addition, Dallas County residents will be asked this question in the survey to determine if transportation was a barrier in making the medical appointment. Residents may be asked the following question: • How has Health Connector impacted your ability to get to medical trips on your own? (easier, not much difference, harder)
Data Needs	ID #34 - Number of Health Connector trips ID #40 - Number of missed medical appointment trips
Experimental Design	Before and after analysis
Modeling/Tools	Likely methods include graphical comparison, chi-squared test, generalized linear models to test relationships between responses and other variables
Hypothesis	Health connector will provide safe and reliable transportation at all times for medical appointment reducing no-shows or deferments.
Targets	• At least 30% reduction in the number of missed medical appointment that are related to transportation access during the 18-month evaluation period • At least 80% residents responding by indicating that transportation did not present a barrier to healthcare access 6 months after the Health Connector launch • At least 90% residents responding by indicating that transportation did not present a barrier to healthcare access 12 months after the Health Connector launch

CATEGORY	DETAILS
Risks	None
Confounding factor	None
Use cases	U1, U2, U3, U4, U5, U6, U7

PM-23: Savings due to reduction in the number of missed medical appointments

Table 22. Details for PM-23: Savings due to reduction in the number of missed medical appointments

CATEGORY	DETAILS
Description	Refers to the financial savings due to reduced number of missed appointments or no-shows for medical appointments. It is measured in amount of dollars and cents. The HIRTA team has reviewed the TCRP report on "Cost-Benefit Analysis of Providing Non-Emergency Medical Transportation" and planning to follow the guidance described in the report as the starting point for calculating net savings delivered by transportation for the healthcare community.
Data Needs	ID #39 - Cost of a missed appointment ID #40 - Number of missed medical appointments trips
Experimental Design	Financial Modeling
Modeling/Tools	NEMT Modeling Tool available through TCRP report, other methods include graphical comparison, chi-squared test, generalized linear models to test relationships between responses and other variables. Measured by: Net Cost Effectiveness at time (1) - Net Cost Effectiveness at time (2) = total savings realized by improved NEMT service.
Hypothesis	Health Connector will help reduce the financial burden on healthcare partners.
Targets	10% increase in total cost savings by reducing the number of missed medical appointments.
Risks	None
Confounding factor	Similar capabilities offered to Travelers by healthcare providers or funding entities
Use cases	U1, U2, U3, U4, U5, U6, U7

5. Support to Independent Evaluation Effort

HIRTA team will support the needs of the IE team as required as follows:

- **Documentation Review and Input**: The HIRTA team understands that the IE team is required to review ConOps, DMP, PMESP, and any other document produced for understanding of the project. The HIRTA team will support with the review and welcome any feedback on the documents from the IE team and address any questions or concerns as part of the regular process of addressing comments from the USDOT team. The HIRTA team will also be available to answer any questions outside of the regular review cycle.

- **Data Sharing:** The HIRTA team will coordinate with the IE team on any needs related to data for analysis, data sources, and the baseline data for the performance measures or key performance indicators as set by the IE team. HIRTA will define the approach for sharing data in both the DMP and the PMESP. Where data will be made available via a public portal, access levels for data will be defined in the DMP. As discussed in the DMP, in most cases, data can be made available for analyses in a comma separated value (CSV) file format on request.

- **Interviews:** HIRTA will also support any staff interview requests from the IE team. The core group of HIRTA team members that include the Project Management Lead (PML), Concept Development Lead (CDL), System Development Lead (SDL), Technology Deployment Lead (TDL) and Stakeholder Engagement Lead (SEL) have been involved with every step of the project and will be available to answer any questions, as submitted by the IE team through an interview questionnaire.

Additionally, the HIRTA team will address any questions received from the IE team as they arise. It is anticipated that the IE team will ask any questions or make any data requests via the COR. The HIRTA PML will then coordinate with the internal team to develop an appropriate response.

Error! Reference source not found. Table 23 provides the current plan for interactions between the HIRTA team and the IE team.

Table 23. Interaction between HIRTA Project Team and IE Team

Participant Role	Pre- Deployment Interviews	Post- Deployment Interviews	Questionnaire(s) - TBD
Federal Program Managers (ITS JPO, FTA, FHWA staff members)	X	X	
Deployment Managers (e.g., HIRTA)	X	X	
Deployment Partners (HIRTA staff, Arcadis IBI Group, Via, Navi Lens, ISU, DCHD)	X	X	
Project Stakeholders (Dallas County Hospital, Access2Care, and other stakeholders identified in the stakeholder registry)			X
Government Entities (FTA Region 7 office, FHWA Resources Center, FHWA Iowa Division Offices, Iowa DOT, and government partners listed in the stakeholder registry)			X

Going forward, the HIRTA team will update this section for any further discussions related to IE team requests, any coordination needs, and documentation of any agreements.

6. Data Collection Plan

This section provides details on the data to be collected for performing the analyses described in Section 4. This data will be collected before and during the deployment. The pre-deployment data will be collected to set the baseline. Further information is provided in the subsections below as follows:

- Section 6.1 provides a summary of all data required for performance evaluation as identified in this document. The data in Table 24 can also be found when reading the individual performance measure data needs in Section **Error! Reference source not found.**.
- Section 6.2 provides an overview of the types of data privacy categories for all types of data. More information can be found about this in the DPP.
- Section 6.3 provides an overview of the types of data that will be collected outside of the Health Connector TMS during deployment.
- Section 6.4 provides an overview of the approach that will be used for data quality checks.
- Section 6.5 provides an overview of the data sharing framework, fully described in the DMP.

6.1. Data Needed

Table 24 provides detailed breakdown of Data ID 32 by identifying the anonymized and/or aggregated data required to support performance evaluation.

- **Variable:** Refers to distinct category of data exchanged between two systems. Distinction is provided by type of appointment (e.g., medical appointment or trip request), provider (e.g., in-house or contracted), and type of trip (e.g., Medicaid and non-Medicaid), since the level of aggregation or anonymization needed will be different.
- **Resolution:** The level of detail or granularity in which the data is collected
- **Source:** Origin of data collection
- **Format:** Format to be used for data sharing

Table 24. Detailed Breakdown of Data ID 32: Anonymized and/or Aggregated data for Performance Evaluation

ID#	Variable	Resolution	Source	Format
1	Age	Trip	Registration Form (optional)	CSV
2	Gender	Trip	Registration Form (optional)	CSV
3	Income	Trip	Registration Form (optional)	CSV
4	Veteran	Trip	Registration Form (optional)	CSV
5	Date of service interruption	Trip	VOC	CSV
6	Time of service interruption	Trip	VOC	CSV
7	Trip request date (date when Traveler made request)	Trip	VOC	CSV
8	Trip date	Trip	VOC	CSV
9	Trip cost	Trip	VOC	CSV
10	Payment method (i.e., Traveler, third party)	Trip	VOC	CSV
11	Trip request time (time when Traveler made request)	Trip	VOC	CSV
12	Pick-up time requested	Trip	VOC	CSV
13	Transportation provider	Trip	VOC	CSV
14	Trip distance	Trip	VOC	CSV
15	Original pick-up time offered (and accepted)	Trip	VOC	CSV
16	Actual pick-up time	Trip	VOC	CSV
17	Original estimated vehicle travel time	Trip	VOC	CSV

ID#	Variable	Resolution	Source	Format
18	Updated estimated vehicle travel time	Trip	VOC	CSV
19	Original estimated drop-off time	Trip	VOC	CSV
20	Actual drop-off time	Trip	VOC	CSV
21	Mobility needs identified	Trip	VOC	CSV
22	Mobility needs accommodated	Trip	VOC	CSV
23	Traveler perception of accessibility (language, mobility)	General	In-app survey, traveler survey	CSV
24	Number of vehicles offered		VOC	CSV
25	Actual in-vehicle travel time	Trip	VOC	CSV
26	Seat unavailable and 'other error' alerts without finding a ride within one session	Daily, weekly, monthly	HIRTA, vendors	CSV
27	Travel time for each option offered	Trip	VOC	CSV
28	Traveler rating of pre-vehicle wayfinding	Trip	In-app survey	CSV
29	Traveler rating of post-vehicle wayfinding	Trip	In-app survey	CSV
30	Traveler perception about privacy	General	Traveler group survey	CSV
31	Traveler perception about self-reliance	General	In-app survey, Traveler group survey	CSV
32	Customer satisfaction	General	VOC, focus group survey, info from HIRTA survey	CSV
33	Number of complaints	General	VOC, HIRTA surveys, 3rd party surveys	CSV
34	Number of Health Connector trips	Hourly	HIRTA, 3rd party partners, VOC	CSV
35	Number of trips provided by a third party (after hours)	Daily, weekly, monthly	VOC	CSV

ID#	Variable	Resolution	Source	Format
36	Amount of time healthcare providers spend per trip helping Travelers	Daily, weekly, monthly	HIRTA surveys, healthcare provider surveys	CSV
37	Number of times healthcare providers help Travelers	Daily, weekly, monthly	HIRTA surveys, healthcare provider surveys	CSV
38	Reduction in cost due to missed appointments	Daily, weekly, monthly	NEMT cost tool.	CSV
39	Cost of a missed appointment	General	NEMT cost tool.	CSV
40	Number of missed medical appointments trips	Daily, weekly, monthly	Care facilities, CHA CHIP	CSV
41	Number of medical trips	Daily, weekly, monthly	Care facilities, CHA CHIP	CSV
42	Average cost for missed medical appointment	Once	Health care provider surveys, national estimates	CSV
43	Number of safety events	Daily, weekly, monthly	HIRTA, vendors	CSV
44	Average one-way trip cost	General	HIRTA, 3rd party contractor	CSV
45	HIRTA admin cost for Medicaid trips	General	HIRTA	CSV
46	Slots offered	General	In-app survey, traveler survey	CSV

6.2. Data Collection Through Deployment System

Table 24 list the data that will be collected by the system. Access level is defined for accessing data as follows:

- **Open** - Data that can be used by the public with no or limited licensing restrictions. This data is available to the public without needing to request permissions and will be provided to the USDOT-managed public system. These datasets will be provided after anonymizing and aggregating raw private datasets to protect PII.

- **Private** - Data that cannot be shared with external users. Access to this data is limited and only granted with IRB and project team approvals.

Details on how HIRTA team categorizes each dataset is provided in the Data Management Plan (DMP) [6].

6.3. Data Collected Outside Deployment System

As indicated in Section 4, some of the measures will require data collected by the external systems owned by healthcare partners and DCHD. The purpose of those datasets is to primarily help determine the impact of increased transportation access on missed medical appointments and subsequently measured net financial outcomes. This data will include:

- Missed appointments linked to lack of transportation access (this information will be obtained from surveys of health care providers)

- Resources spent in number of person-minutes in scheduling a transportation service from HIRTA for a medical appointment

- Data on referral and tracking of results as managed by health navigators at the DCHD

6.4. Data Quality Check Approach

The following subsections describe the approach HIRTA team will take in verifying the quality of the data before it is utilized for calculating performance measures or is shared externally. Also, the data will be processed to correct any issues before it is used or shared externally.

A detailed survey plan with questionnaire and data quality check process will be finalized after obtaining IRB's approval.

The following subsections provide the process that will be used by the HIRTA team for performing data quality checks.

Missing Data

It is common for transit datasets to have missing data from records. This may happen due a variety of reasons, such as malfunctioning on-board hardware, issues with the data

communication network or system, data input error from the driver, and incorrect configurations. If any of the datasets are missing data, those will be flagged for review through an automated review process. Subsequently, the dataset will be filtered for those anomalies to ensure the analysis is not impacted. Also, a corrective action will be taken to ensure that the issue causing the missing data is resolved immediately.

Missing data may be observed in survey responses as well if respondents do not answer a question. Depending on the sample size and significance of question, the HIRTA team may reach out to respondents or develop a process to filter the responses to remove any bias in the results.

Insufficient Data

There may be situations when data is not sufficient to conduct an analysis. This may occur due to low trip volume, low number of expected events (e.g., safety, no-shows, cancellations), service cancellations due to severe weather or other reasons, missing data, and others. If such situations occur, the HIRTA team will evaluate the effects of data insufficiency and identify corrective actions. This may include identifying qualitative measures or collecting additional data which may supplement the analysis and findings. An initial data sufficiency check will be performed in Phase 2 when preliminary data starts to become available. A sufficiency check will be performed for all data types including baseline/before data.

For survey responses, if data obtained is not sufficient for analysis, follow-up surveys may be conducted, or indirect metrics may be calculated for a PM using available data.

Invalid Data

Data may be invalid or inaccurate due to data entry errors, or data may be generated incorrectly by the system based on invalid configurations. Data validity checks will be performed by the system on a continuous basis before a data is used for reporting or sharing.

Outliers

Due to unique situations tied to individuals or individual events (e.g., higher than expected dwell time at a pick-up location, longer than expected travel time on a trip, high number of unfulfilled trips in a day due to a weather event), outlier data may be generated. Additional logs (e.g., driver messages, dispatcher messages) will be consulted when outliers are observed to eliminate any bias in the interpretation of results.

Collinearity

PMs and experiments are defined in Section 4 to remove any issues caused by data correlation between data variables used to calculate metrics. This may be an issue particularly for regression analyses and may impact the statistical significance of dependent variables. In most cases this can be addressed by using the appropriate statistical method and accounting for this in the model.

Exposure to Personal Identifiable Information (PII)

One key issue the HIRTA team will be careful about in every dataset is any exposure to PII. The DMP has already identified potential datasets that could expose to PII and what will be done to prevent any exposures. As defined in the DMP, the following two approaches will be used to remove any PII exposure.

- **Anonymization**: System-generated data will be anonymized at trip, driver, and Traveler level datasets so PII is not included. A similar strategy will be adopted for survey data.

- **Aggregation:** Certain datasets may still contain information (e.g., address) which could be utilized to decipher PII. Therefore, for public data and controlled access to private data, an aggregated dataset will be provided.

6.5. Data Sharing Framework

Data will be shared using the following standard formats:

- CSV: non-spatial data will be shared using text-based files using CSV format. Files will include a header and data. Details on the header fields will be available in the metadata.

- JSON: will be used for sharing spatial data.

- SHP: shape file format may be used for sharing spatial analysis conducted using survey data.

A detailed data sharing approach is provided in DMP that includes details on how the HIRTA team will treat data public or private. Also, the DMP provides details on versioning, metadata, and frequency of data sharing.

7. Performance Reporting

7.1. Data Management

The following types of data will be collected for use in the various analyses:

- Trip performance variables (i.e., number of trips, trip length, number of safety events) will be reported by HIRTA. They may be provided in raw or reduced format. If needed, a unique user ID may be assigned. However, any PII will be stripped before the data are provided to Iowa State researchers.

- Participant and control survey variables include all data reported and reduced from any survey instrument used to question users of the Health Connector app and individuals in the control group. Data will be collected by researchers at ISU. As a result, both raw and reduced data will be stored at ISU. Some information may be collected so that duplicate responses can be identified, but no PII will be collected.

- The driver/medical facility surveys include any data requested or collected through a survey of transportation drivers or medical facilities. This may include information such as number of drivers who report participants having issues finding the pick-up point or number of missed medical appointments. Data may be collected by HIRTA or the ISU research team. As a result, both raw and reduced data will be stored at ISU. No PII will be collected.

Data for analyzing and reporting performance measures will be stored at ISU. All of the team members who will have access to the data, including IT, have IRB training. Data will be stored on CyBox, which is a FERPA- and HIPAA-compliant file storage system. All access to CyBox is password controlled with encryption. Data are stored in user-created files, and only users who are granted permission can access files. Most of the anticipated data will be gathered and stored in databases. Although no PII information will be collected, any PII that is discovered will be cleansed from the data. For instance, a user may list their name in a question that allows text entry.

7.2. Analyzing Performance Measures

Performance measures will be calculated from the available data. Performance measures can be presented using simple comparisons or charts. Performance measures can be compared to each other or as before versus after using simple tools such as ANOVA or chi-squared tests.

Relationships, including dependencies, between variables will also be explored using statistical methods such as regression analyses. For instance, the relationship between missed appointments and inability to utilize the wayfinding feature of the Health Connector app could be evaluated.

7.3. Reporting

Travel performance metrics (i.e., availability of transportation options, ETA prediction accuracy, number of trips) will be regularly calculated and reported once per quarter. This information will be provided in the regular project progress reports to USDOT. This information will be presented in a dashboard which shows an aggregate summary of each metric. Information may be displayed using bar charts, summary tables, pie charts, etc. The team has access to and expertise with Tableau (data visualization software), which can be used to prepare dashboards.

Survey statistics will be evaluated. The methodology for collecting, reducing, and analyzing data will be provided in a report format. Summary information will also be presented using charts or tables so the information can be understood. It is expected this information will be provided to USDOT in annual reports (as available) as well as interim and final reports.

8. Performance Measurement and Evaluation Support Schedule

Table 25 provides a schedule per the current understanding of the HIRTA team for conducting performance measurement and supporting independent evaluation. Relevant Phase 1 and 2 activities for PMESP finalization are also listed. The survey schedule will need to be added as Phase 2 progresses.

Table 25. Performance Measurement and Evaluation Support Schedule

ID	Event Title	Description	Phase	Date
1	Draft PMESP Is delivered to USDOT	Initial Draft PMESP with basic information known at the time of writing.	Phase 1	Aug 2021
2	Final DMP	PMESP is updated with USDOT comments addressed.	Phase 1	Nov 2021
3	IRB application submitted	Data and performance management approach along with details regarding engaging human subjects in the study submitted to IRB for approval; May take up to 6 weeks per ISU process	Phase 1	Phase 1: Oct 2021 Phase 2: Aug 2023
4	System requirements finalized	Requirements on performance and data developed; walkthrough conducted, and requirements finalized.	Phase 1	Nov 2021
5	IRB approval and Draft Human Use Approval (HUA) summary complete	IRB approval is received, and HUA summary is developed for USDOT review.	Phase 1	Phase 1: Nov 2021 Phase 2: Sept 2023
6	PMESP updated as needed based on IRB input, HUA Summary	Per suggested updates to DMP, PMESP may need to be updated.	Phase 1	Dec 2021
7	Final Human Use Approval (HUA) summary complete	HUA summary document finalized per USDOT comments.	Phase 1	Dec 2021
8	ICTDP Finalized	Data and performance management approaches are finalized per finalized Phase 1 DMP and PMESP.	Phase 1	Jan 2022
9	Revised PMESP	Updates to the Phase 1 PMESP and details added based on current understanding of performance measures.	Phase 2	Oct 2023

ID	Event Title	Description	Phase	Date
10	Phase 2 IRB Approval	IRB approval is received, and HUA summary is developed for USDOT review.	Phase 2	Nov 2023
11	Draft Internal Data Analysis Plan	Internal document for planning specific statistical considerations and logistics with regard to data collection, transfer and evaluation.	Phase 2	Nov 2023
12	Final Internal Data Analysis Plan	Internal document for planning specific statistical considerations and logistics with regard to data collection, transfer and evaluation.	Phase 2	Jan 2024
13	Collect Baseline Data	Includes baseline operational data as well as 'before' surveys for applicable performance measures.	Phase 2	Jan 2024
14	Provide Baseline Data to USDOT	Baseline operational data as well as 'before' surveys for applicable performance measures will be shared with USDOT to receive feedback.	Phase 2	March 2024
15	Initial upload of Health Connector data collected during testing	Initial set of data transferred to reporting database in line with system testing and preliminary analysis.	Phase 2	June 2024
16	Data Dashboard Development	Development of interface or report used to communicate findings	Phase 2	June 2024
17	Data transferred to USDOT	Daily updates of after case data (testing and go-live) are provided to USDOT and IE	Phase 2/3	Mar 2024 - Jan 2026
18	Go-live	Go-live	Phase 3	Aug 2024
19	Data Review	Data Review conducted with USDOT and IE to ensure datasets are complete	Phase 3	Sep 2024
20	Evaluation Period Start	Phase 3 evaluation period begins	Phase 3	Aug 2024
21	Sharing of Performance Report	Performance results of system operations are shared daily or monthly as required for the measures.	Phase 3	Aug 2024- Jan 2025
22	Evaluation Period End	Phase 3 evaluation period (18 months) ends	Phase 3	Jan 2025
23	Draft Final Analysis Report submitted	Draft Final Analysis Report submitted to USDOT	Phase 3	Jan 2025
24	Final Analysis Report submitted	Draft Final Analysis Report submitted to USDOT	Phase 3	Feb 2025

References

1. ITS4US Deployment Broad Agency Announcement (693JJ3-20-BAA-0004).

2. HIRTA Proposal for ITS4US Deployment.

3. Mobility Performance Metrics (MPM): Federal Transit Administration (FTA Report No. 0152) https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/147791/mobility-performance-metrics-integrated-mobility-and-beyond-fta-report-no-0152.pdf

4. Accessible Transportation Technologies Research Initiative (ATTRI) Performance Metrics and Evaluation, Final Evaluation Framework Report: U.S. Department of Transportation (FWHA-JPO-20-784) dot_50748_DS1.pdf

5. Concept of Operations (ConOps): Heart of Iowa Regional Transit Agency ITS4US Deployment Project (FHWA-JPO-21-859) https://rosap.ntl.bts.gov/view/dot/57469

6. Data Management Plan (DMP): Heart of Iowa Regional Transit Agency ITS4US Deployment Project (JPO-21-867) https://rosap.ntl.bts.gov/view/dot/61727, to be updated

7. Paul Hughes-Cromwick et. al., “Cost Benefit Analysis of Providing Non-Emergency Medical Transportation”, Transit Cooperative research Program, Transportation research Board, Report Number: 22055

8. Data Privacy Plan (DPP): Heart of Iowa Regional Transit Agency ITS4US Deployment Project (FHWA-JPO-22-971), to be published

Acronyms and Glossary

Access2Care

A transportation broker for State of Iowa Medicaid program that performs booking and scheduling and works with service providers such as HIRTA for successful delivery of Medicaid-eligible trips.

ADA – Americans with Disabilities Act

Refers to the civil rights legislation passed and signed into law in 1990 to prevent discrimination against people with disabilities.

Billing

Refers to the process of invoicing third-party funding sources (e.g., Medicaid) after a successful delivery of a trip. Billing is typically done on a monthly basis.

CHA CHIP – Community Health Assessment & Community Health Improvement Plan

Refers to the Community Health Needs Assessment developed for Central Iowa in 2021. Follow on surveys from that report to be conducted in 2024.

Cost Allocation

Refers to the process of associating a funding source that should be billed for a trip in a shared ride scenario when riders covered by separate funding sources share the vehicle for their trips and trip purposes at the same time.

CTAA – Community Transportation Association of America

One of the project Partners who will lead stakeholder engagement on this project.

DCHD – Dallas County Health Department

One of the project Partners who will lead integration with healthcare services.

DR – Demand Response

Refers to a service that is not run on a fixed route or a schedule (e.g., dial-a-ride, vanpool etc.). This requires making trip booking by contacting the service provider (e.g., HIRTA). However, DR is different than an ADA Paratransit service which is provided as a complement to a fixed route and is governed by specific requirements provided in 49 CFR- Part F. HIRTA operates only DR Service in Dallas County and all discussion in this document is related to DR Service.

Dispatching

Refers to an operations management function which involves assigning vehicle, tracking fleet location, managing schedule adherence, managing trip manifests and other operational functions.

DMP – Data Management Plan

The Data Management Plan is Task 3 of Phase 1 and will describe the approach for data collection, processing, storage, and utilization.

DOT – Department of Transportation

The government department responsible for transportation. In this report, this generally refers to either the State of Iowa's DOT or the United States DOT referred to as Iowa DOT and USDOT, respectively.

EHR – Electronic Healthcare Record

Refers to the healthcare information management system used by hospitals for patients' healthcare-related appointments, transactions, and records management.

GTFS – General Transit Feed Specification

GTFS is a standard to provide static public transportation schedule information. The standard has been expanded to include real-time passenger information (GTFS-real-time), flexible services (GTFS-flex) and accessible routing within stations (GTFS-pathways).

HIPAA – Health Insurance Portability and Accountability Act of 1996

Provides guidelines for data protection of sensitive patient health information.

HIRTA – Heart of Iowa Regional Transit Agency

Rural, regional public transit agency in central Iowa. HIRTA will serve as Proposer/Applicant for the ITS4US project.

HN – Health Navigator

Refers to services provided by Dallas County Health Department to Dallas County residents in identifying resources as necessary for improving social determinants of health.

Information and Referral

Refers to public and private entities that help their customers in identifying resources for health and human services and other needs.

ISU– Iowa State University

Iowa State University is a public research university with multiple campuses in the State of Iowa and will be engaged as the research and evaluation partner in Phases 2 and 3.

KPI – Key Performance Indicators

Represents primary metrics used to assess the success of a project or operations.

LEP – Limited English Proficiency

Refers to individuals who have a limited ability to read, speak, write, or understand English.

MPM - Mobility Performance Metrics

Refers to mobility performance metrics published by the Federal Transit Administration. The performance measures identified in this report are mapped to mobility performance metrics.

NDSP – Non-Dedicated Service Provider

NDSP refers to operators providing service under contract (e.g., taxis) to an agency (e.g., HIRTA).

NEMT – Non-emergency Medical Transportation

The provision of transportation to patients for medical appointments, lab visits, and other routine care. Generally, used in the context of Medicaid service only.

PII – Personally Identifiable Information

Refers to any data that can distinguish an individual, either alone or when linked with other available data.

Provider

Provider in this context mainly refers to an entity performing service delivery for requested trips, sometimes also referred as service provider. The HIRTA team has also used healthcare partners as providers in some cases but referred as ‘healthcare providers.’

Reservation

Refers to the act of booking a trip based on a request from a Traveler. Reservation is available to only registered Travelers.

Scheduling

Refers to the process of identifying driver and vehicle resources and their runs/shifts for a given workday. Scheduling is typically performed for all requests received until 24 hours in advance. Booking within 24-hour notice and on-demand is offered but not encouraged due to limited system capacity and resources.

SEMP – System Engineering Management Plan

A System Engineering Management Plan describes how systems engineering process of planning, design, and deployment is applied to a project.

SMP – Safety Management Plan

A Safety Management Plan describes the steps to be taken to ensure the safety of the project stakeholders and beneficiaries.

Smart Device

Refers to smartphone, smartwatch and similar personal devices that may be internet enabled and are equipped with sensors.

TNC – Transportation Network Company

Encompasses a group of companies that provide on-demand ride hailing services.

VOC – Via Operations Center

Technology provided by Via that will be used to assist customer care and operations staff with Traveler registration, eligibility management, reservations, scheduling, dispatching, billing, and administration activities. (Also referred to as “MOD TMS”)

Wayfinding

Refers to the tools and technologies that assist in orientation, locating objects, and step-by-step navigation to destinations in outdoor and indoor environments using visual markers, sensors or physical signage.

Additional Measures Considered

Table 26. Additional Measures Considered

MPM-Impact Stage	MPM-Trip Stage	MPM-Category	Goal	Objective	Performance Measures	Description	Priority
Core	Pre-trip	Availability	G2	G2O1	**Number of availability of options by underserved group needs**	Measuring the capability of the system to meet the needs of all underserved groups. Measured individually for each of the 6 target groups (e.g., persons with disabilities, low income, rural, older adults, veterans, and persons with LEP.)	Medium
Core	Pre-trip	Availability	G2	G2O1	**Trip deferment**	Measuring the instances when trips were not taken due to lack of options. Measured as number of trips deferred/100 trips	Medium
Core	Trip	Availability	G2	G2O3	**Service redundancy**	Available capacity for dynamic reassignment in the event of a service anomaly. May be searched by Traveler or automatically assigned by the system. Measured as number of available options at the point of disruption.	Medium

MPM-Impact Stage	MPM-Trip Stage	MPM-Category	Goal	Objective	Performance Measures	Description	Priority
Core	Pre-trip	Reliability	G2	G2O1	**Transportation option reliability**	Percentage of time same menu of options are available for recurring trips for each underserved group when searched per their preferences (e.g., persons with disabilities, low income, rural, older adults, veterans, and persons with LEP.)	Medium
Core	Post-trip	Reliability	G2	G2O3	**Travel-time reliability**	Measured as standard deviation of actual travel time	Medium
Core	Trip	Time	G2	G2O1, G2O3	**Offset time**	measured in terms of window needed for pick-up time. Current standard is +/-10 minutes	Medium
Core	Trip	Time	G2	G2O1, G2O3	**Wait time**	Delta between Traveler's arrival at pickup location and actual pickup time. Measured in number of minutes	Medium
Core	Post-trip	Safety	G2, G5	G2O3, G5O1	**Impact of trips not taken (deferred/no-showed/missed)**	Traveler input on impact of trips not taken. Consequential impact or higher order care needed linked to trips not taken.	Medium

MPM-Impact Stage	MPM-Trip Stage	MPM-Category	Goal	Objective	Performance Measures	Description	Priority
Core	Post-trip	Safety	G2, G5	G2O3, G5O1	**Measurable improvements in health with trips taken**	Measurable outcomes in health: • Critical care: (dialysis, cancer treatment delivered) • Preventive care (vaccinations targets met) • Ad-hoc: (urgent care needs addressed)	Medium
Core	Trip	Customer Satisfaction	G2	G2O3	**Enhanced on-board experience**	Traveler's input on information provided while on-board and general on-board experience	Low
Core	Post-trip	Customer Satisfaction	G2	G2O1, G2O2, G2O3	**Improved experience with patient care**	Traveler input on improved experience with availability of Health Connector tools	Low
Core	Post-trip	Customer Satisfaction	G2	G2O2	**Comfort level in unfamiliar environment**	Traveler input on improved experience with availability of Health Connector tools inside unfamiliar surrounding with the help of outdoor and indoor wayfinding tools and other Traveler information.	Low
Tier 1	Trip	Capacity	G3	G3O2	**Accuracy of predictive demand**	Historical analysis of demand to predict the level of capacity needed	Low

MPM-Impact Stage	MPM-Trip Stage	MPM-Category	Goal	Objective	Performance Measures	Description	Priority
Tier 1	Pre-trip	Effectiveness/ Efficiency/ Cost	G4	G4O2	**Resources spent per trip on coordination by agency**	Number of minutes spent per trip by HIRTA, DCHD and healthcare staff in coordination, measured by underserved group category (e.g., persons with disabilities, low income, rural, older adults, veterans, and persons with LEP.)	Medium
Tier 1	Trip	Effectiveness/ Efficiency/ Cost	G3	G3O2	**Wait time**	Avg. number of minutes spent waiting per trip	Medium
Tier 1	Post-trip	Effectiveness/ Efficiency/ Cost	G4	G4O1	**System cost**	Total cost of delivering medical transportation per month without any subsidy;	Medium
Tier 1	Post-trip	Effectiveness/ Efficiency/ Cost	G4, G3	G4O1, G3O3	**Annual system subsidy**	Subsidy levels per trip	Low
Tier 1	Post-trip	Effectiveness/ Efficiency/ Cost	G3	G3O2	**Missed trips per month**	Number of missed trips per month	Medium
Tier 1	Post-trip	Effectiveness/ Efficiency/ Cost	G3	G3O1	**Missed medical appointments due to transportation per month**	Missed medical appointments due to lack of transportation access	Medium
Tier 1	Post-trip	Effectiveness/ Efficiency/ Cost	G4	G4O4	**Efficient cost allocation and billing**	Ability to allocate cost and bill appropriate funding sources in an accurate and timely manner. Measured in terms of staff time spent.	Medium

MPM-Impact Stage	MPM-Trip Stage	MPM-Category	Goal	Objective	Performance Measures	Description	Priority
Tier 1	Post-trip	Utilization	G4	G4O1	**Revenue miles and hours**	Revenue miles and hours spent per trip	Medium
Tier 1	Post-trip	Safety	G5	G5O2	**Incidents**	Number of incidents per 100 trips systemwide	Medium
Tier 1	Post-trip	Safety	G5	G5O2	**Driver injuries**	Number of driver injuries per 100 trips systemwide	Medium
Tier 2	Pre-trip	Accessibility	G1	G1O1, G1O2	**Increased access to medical facilities by underserved**	reduction in number of medical appointment no-shows	Medium
Tier 2	Post-trip	Safety/Health, Social	G1	G1O3	**Health outcome in the Community**	Measurable outcomes in health: Critical care: (dialysis, cancer treatment delivered) Preventive care (vaccinations targets met) Ad-hoc: (urgent care needs addressed)	Medium

U.S. Department of Transportation
ITS Joint Program Office-HOIT
1200 New Jersey Avenue, SE
Washington, DC 20590

Toll-Free “Help Line” 866-367-7487
www.its.dot.gov

FHWA-JPO-21-877

U.S. Department of Transportation