Emergency Triage, Treat, and Transport (ET3) Model
Measure 1: Risk Adjusted Post-Ambulance Provider Triage Emergency Department (ED) Visit Rate Measure

Risk Adjusted Measure Methodology Report
Chapter 6, Deliverable 6-3a

Including:
Measure Testing Summary Report (Chapter 6, Deliverable 6-2a)
Alpha Testing Reports (Chapter 6, Deliverable 6-4a)
Beta Testing Reports (Chapter 6, Deliverable 6-5a)

Centers for Medicare & Medicaid Services: Measure Instrument Development and Support

Quality Measure Development and Analytic Support, Option Year 3

Contract Number: HHSM-75FCMC18D0042, Task Order HHSM-75FCMC19F0003

Submitted February 24, 2023, to:
Teresa Winder-Wells Contracting Officer Representative
Centers for Medicare & Medicaid Services

Prepared by:
Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation
Arjun Venkatesh, MD, MBA, MHS, Project Director

This material was prepared by Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation (CORE), under contract to the Centers for Medicare & Medicaid Services (CMS), an agency of the U.S. Department of Health and Human Services. The contents presented do not necessarily reflect CMS policy.

YaleNewHavenHealth CORE CENTER FOR OUTCOMES RESEARCH AND EVALUATION

Risk Adjusted Post-Ambulance Provider Triage Emergency Department (ED) Visit Rate Measure Methodology Report

Submitted By:

Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation (YNHHSC/CORE)

Prepared For:

Centers for Medicare & Medicaid Services (CMS)

February 2023

Center for Outcomes Research & Evaluation Project Team

Arjun Venkatesh, MD, MBA, MHS –Project Director
Nicole Voll, MPH, PMP – Project Lead
Cameron Gettel, MD, MHS – Project Co-Lead
Shu-Xia Li, PhD – Lead Analyst
Li Qin, PhD – Analyst
Sarah Attanasio – Project Coordinator
Hannah Stiles – Research Associate
Isabella Epshtein – Research Associate
Afrin Howlader, MPH – Project Manager
Valery Danilack, MPH, PhD – Senior Health Services Researcher
Rachel Johnson-DeRycke, MPH – Project Director
Former Project Director: Elizabeth Drye, MD
Former Research Staff: Elina Kurkurina, MPH; Jake Miller, MS; Richard Sgrignari, BS
Former Analyst: Yixin Li, MS
Additional Team Members: Faseeha Altaf, MPH, Kristina Burkholder, MS, CAS
Clinical Consultants: Karthik Murugiah, MD, Rebekah Heckmann, MD
Former Contract Director and Senior Director of Quality Measurement Programs: Susannah Bernheim, MD, MHS

Acknowledgements

This work is a collaborative effort, and the authors gratefully acknowledge and thank our many colleagues and collaborators for their thoughtful and instructive input, including our subject matter expert Jeremiah Kinsman. Acknowledgment of input does not imply endorsement of the methodology and policy decisions.

We would like to acknowledge and thank Teresa Winder-Wells and Timothy Day, (former colleagues Monica Thorpe, Brillia Perez, Patrice Holtz, Susan Pierce-Richards, Chadwick Morgan, Sarah Goldman, David Goldstein); and the Center for Medicare & Medicaid Innovation (Innovation Center) for their contributions to this work.

Table of Contents

List of Figures

List of Tables

1. Measure Introduction

The Centers for Medicare & Medicaid Services (CMS), through the Center for Medicare and Medicaid Innovation (Innovation Center), has contracted Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation (CORE) to develop quality measures for ambulance providers participating in the Emergency Triage, Treat, and Transport (ET3) Model (Participants). The ET3 Model is a new voluntary payment model by the Innovation Center that provides opportunities for Participants to provide options for treatment and care for patients with lower acuity conditions other than transport to hospital emergency departments (EDs).

This measure is entitled Risk Adjusted Post-Ambulance Provider Triage Emergency Department (ED) Visit Rate Measure (Post-Triage ED Visit Rate Measure). It is one of two measures that CORE is developing to assess the performance of Participants in the ET3 Model. This measure will assess the use of ED care for patients who had been initially triaged by a Participant to a non-ED alternative destination (TAD) or received treatment in place (TIP). TIP may be administered directly by a qualified healthcare practitioner in person or via telemedicine. This measure is developed for assessing the quality of care and triaging decisions by ambulance providers , and it addresses the quality domain of effective care.

CORE has developed the detailed measure specifications to implement the measure concept, consistent with the approach to outcomes measurement development set forth in the National Quality Forum (NQF) guidance for outcome measures[1] and aligning with CMS Measures Management System (MMS) Blueprint guidance[2]. This report describes the methods the measure developers employed to build the measure, including the datasets used and the analytic results that informed measure decisions. A companion report describes the second measure, which addresses the domain of efficient care.

Please see the Glossary for definitions of key terms used in this report, and ET3 Model-specific terminology. Throughout this report, the measure developers use terminology advanced by the ET3 Model, but for simplicity in explaining the measure development and specification, some terms may vary from the Model terminology.

ET3 Model Background

Medicare regulations reimburse ambulance providers for transporting patients to a hospital, ED, skilled nursing facility, or dialysis center, and generally do not reimburse for transporting patients to a lower acuity setting. This reimbursement structure could incentivize unnecessary ED utilization. Lower acuity patients seeking care in EDs can contribute to ED crowding, which has been linked with patients leaving the hospital before being seen by a provider, poor health outcomes, and increased mortality[3]. Therefore, allowing ambulance providers to facilitate treatment in place or transport lower acuity patients to alternative destinations (e.g., an urgent care or a physician's office) may lower ED utilization rates, can ease overcrowded EDs, and lead to better health outcomes and higher patient satisfaction[4]. For further information on the ET3 Model and background please visit: https://innovation.cms.gov/innovation-models/et3/.

The Innovation Center announced the ET3 Model, which aims to provide Medicare-enrolled ambulance providers with greater flexibility to address the needs of lower acuity patients who have an encounter with an ambulance provider after contacting 9-1-1. The five-year, voluntary payment model beginning in 2021 expands the destinations for which CMS will reimburse, including transport services to a non-ED facility, and facilitation of TIP by a qualified healthcare provider as an alternative option. The ET3 Model offers the potential to provide person-centered care, encourage appropriate use of services, and increase efficiency in the Emergency Medical Services (EMS) system.

Measure Intent

The intent of the Post-Triage ED Visit Rate Measure is to assess the quality of care delivered to patients by Ambulance Providers. The measure will assess the quality of triage decisions made by Ambulance Providers for lower acuity patients not transported to the ED, by measuring patient's use of the ED following TAD/TIP. Having non-ED alternatives such as TAD/TIP may be beneficial for patients, ambulance providers, and payers. Allowing ambulance providers to divert lower acuity conditions away from an ED has the potential to lead to improved patient outcomes, increased ambulance provider efficiency, and lower costs for payers.[4]

Once implemented, this measure will help ensure that incentivizing TAD/TIP does not lead to unintended consequences. Once an Ambulance Provider facilitates TAD/TIP, it will be held accountable for any subsequent ED use or death for that patient within a short timeframe (3 days) after a TAD/TIP encounter. Performance scores will identify high performers, whose protocols and practices enable them to safely provide high quality TAD/TIP care. The goal of the measure is not to set a performance target of zero ED visits within 3 days of triage to TAD/TIP care, but rather to encourage lower ED visit utilization in certain instances that likely represent appropriate application of TAD/TIP treatment choices.

This measure is intended to fill a gap in existing national quality measures for ambulance providers by assessing patient outcomes after provider triage. There are currently no nationally implemented measures that assess the appropriateness of care and outcomes of ambulance provider triage for lower acuity patients. In 2002, the National Highway Traffic Safety Administration (NHTSA) identified performance measurement as a priority area for EMS practitioners in the United States. To date, only one outcome measure has been developed for the EMS community, and it is not related to paramedicine services relevant within the ET3 Model.[5,6]

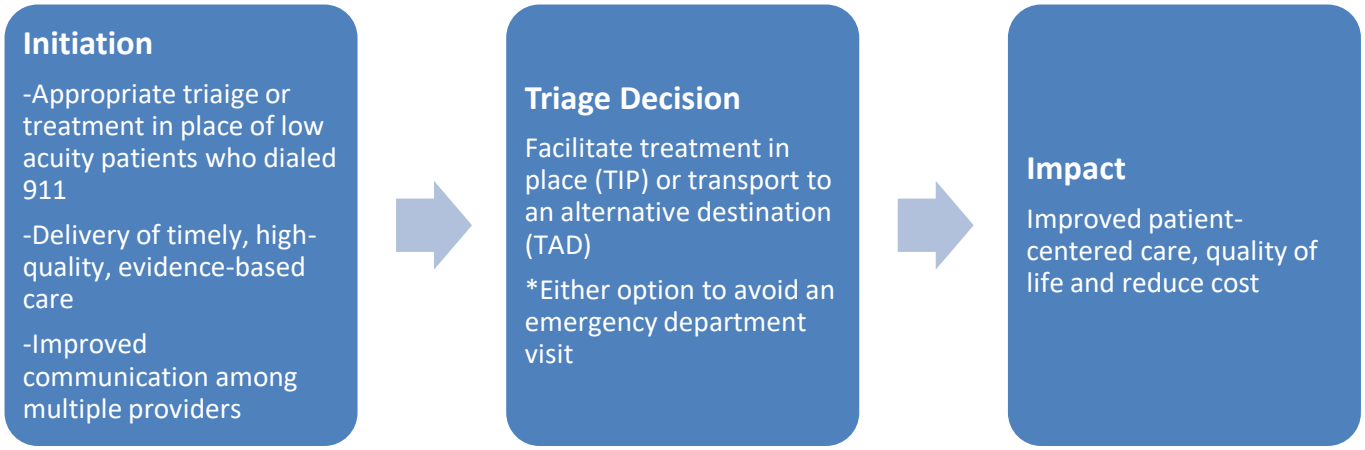
The scientific literature does support ET3-like ambulance provider and supplier Interventions to improve the effectiveness of care. There have been several studies outlining protocols that allow ambulance providers to provide pre-hospital care to patients with lower acuity conditions. One study in Houston integrated telehealth into fire department emergency response protocols and demonstrated a reduction in incidents requiring ambulance transports to the ED.[7] In another example, Los Angeles implemented a successful pilot program in which the fire department responded to emergency calls with a nurse practitioner who offered patients treatment in place, suggested alternative non-ED destinations, or linked patients with social services. Half (400 patients) were treated in place or medically cleared and transported to an alternative site for specialty care. Of the patients who were treated in place or transported to alternative sites, only 6.5% (26 patients) required emergency services within 3 days.[8]

The logic model in Figure 1 below describes how services from Ambulance Providers can triage lower acuity patients to receive TAD/TIP to avoid unnecessary ED visits, potentially leading to more patient-centered care. These Interventions can improve patient-centered care and improve patient quality of life, and reduce health care costs.

Through the ET3 Model, this measure can be implemented for performance measurement. The burden for implementing this measure is low since the measure will use existing claims data routinely submitted for reimbursement without additional data collection.

Specifically, services provided by Ambulance Providers include appropriate triage or facilitation of treatment in place of low acuity encounters; delivery of timely, high-quality, evidence-based care in alternative destinations or at the patient's home; educating patients about alternative destinations for care; and improved communication among multiple providers.

Figure 1 Post-Triage ED Visit Rate Measure Logic Model



2. Methods & Measure Specifications

In this section, the measure development process is outlined, including our development approach, the measure specifications, and the data sources used.

Throughout measure development, special consideration was given to feasibility to ensure that the measure is able to be developed and implemented in a minimally burdensome manner for providers. This measure will utilize Medicare Fee-For-Service (FFS) claims that Ambulance Providers routinely submit for reimbursement, so no extra data submission will be required.

Approach to Measure Development

The development of the Post Triage ED Visit Rate Measure is a collaboration between CORE and the Innovation Center. The CORE team consists of a multidisciplinary panel of clinicians, health service researchers, and analysts with expertise in outcome measures development, along with an advisory group on measure development consisting of clinical, statistical and methodological experts. As part of the measure development process, CORE conducted a literature review examining drivers of ED utilization and an environmental scan to better understand the quality measurement landscape for EMS and emergency medicine. The Innovation Center tasked CORE with developing and testing the detailed measure specifications to implement the measure concept. At each step during measure development, including forming a data set for development and operationalizing the cohort and outcome, CORE developed and analyzed options, made recommendations to the Innovation Center, and decided with them on the final approach.

Measure Specifications

This risk-adjusted outcome quality measure calculates a risk-standardized score for Ambulance Providers in the voluntary ET3 Model. Bullets below represent a brief overview of the measure specifications, with further details in sections below.

- The **measure cohort** includes Medicare patients 18 years and older who had an eligible encounter with a Ambulance Provider and received TAD/TIP rather than being transported to the ED.
- The binary **measure outcome** is whether a patient had an ED visit or death within three days after a TAD/TIP encounter. The outcome does not count ED visits with a principal diagnosis code of mental health/substance use disorders (MH/SUD).
- The final **risk adjustment** model has 14 clinical variables including age.
- The **measure score** is a risk-standardized ED visit rate.

Data Sources

Final measure testing was conducted using **the ET3 Model Dataset**. The ET3 Model Dataset contains claims data submitted by Ambulance Providers from January 2021 – August 2022 (20 months) available in the Chronic Conditions Data Warehouse (CCW) in September 2022 and other administrative and claims data necessary for measure calculation.

- For cohort construction, carrier claims data and outpatient claims data were used to identify ET3 Interventions were collected.
- Revenue center codes were used to identify ED services using hospital inpatient and outpatient facility claims from the CCW
- The Medicare Beneficiary Summary File (MBSF) was used to identify beneficiary date of birth/death, Part A and B enrollment status, and Medicare/Medicaid dual eligibility status
- For risk adjustment, diagnoses listed in inpatient, outpatient, and carrier claims 12 months prior to the ET3 encounter were used to identify candidate clinical risk factors.
- Hospice enrollment data was utilized to determine the hospice enrollment status at the time of ET3 Intervention.

To select the risk model variables, a TAD/TIP Development Proxy Dataset was constructed using Medicare FFS claims (calendar year 2019) to identify and test appropriate risk model variables to ensure that a representative and large national data was used. Details on the TAD/TIP Development Proxy Dataset are in Appendix A. Candidate risk variables were based on the NQF-endorsed Multiple Chronic Conditions Measure. 30 candidate risk variables were identified and consistent with prior nationally endorsed quality measures for consideration in this measure. The 30 variables were grouped to 14 final variables to accommodate the limited denominator counts available early in the ET3 Model adoption.

Cohort Definition

The cohort includes patients who have an encounter with an ambulance provider whose triage decision is to either transport them to an alternative non-ED destination (TAD) or to facilitate treatment in-place (TIP).

Inclusion Criteria

Patients are eligible for inclusion in the measure if contain the following criteria:

- Are enrolled in Medicare FFS Part A and Part B for at least 6-months (out of the 12-months prior) prior to TAD/TIP encounter plus coverage at time of Intervention and one-month post-Intervention for outcome identification.
    - **Rationale:** 6-month enrollment is required for claims-based risk-adjustment to adequately

identify comorbidities and other risk variables.

- Are aged 18 years and older.
    - **Rationale**: The ET3 Model includes all adult Medicare FFS beneficiaries.
- Have an encounter with a Ambulance Provider where the patient was triaged to TAD/TIP. The patients can have multiple TAD/TIP encounters, and all encounters will be included in the cohort.
    - **Rationale**: This decision supports the measure intent and the encounter-level approach of the identified cohort.
- Are not enrolled in Medicare hospice at the time of TAD/TIP encounter with the Ambulance Provider . Hospice status is identified through enrollment in Medicare hospice services in the patient enrollment file.
    - **Rationale**: Patients in hospice care have complex medical needs and have an outcome rate unrelated to Ambulance Provider decision-making or quality of care. Excluding patients receiving hospice care ensures that Ambulance Providers still offer TAD/TIP services to these beneficiaries, which are likely to be highly aligned with hospice service beneficiary preferences. These will also address ambulance provider concerns of higher-than-expected ED utilization or death among these beneficiaries within 3 days.

Of note, Patients who refuse TAD/TIP at the encounter would not be eligible for the cohort, as they do not meet the inclusion criteria.

Exclusion Criteria

The measure does not have any exclusion criteria.

Measure Outcome

The measure outcome is met if a patient has an ED visit or death within three days after a TAD/TIP encounter. . Patients seeking higher acuity emergency care or dying within a short time period after having been triaged to lower acuity care may be a sign of poor quality of initial care.

Of note, “emergency care” includes observation stays and inpatient stays when admitted through the ED. Direct inpatient admissions are not considered “emergency care” or an outcome.

All-cause mortality events were used and all-cause ED visits for outcome events. It is highly subjective to determine whether the ED visits are clinically ‘related’ to the ET3 Intervention, and so it would also be difficult to conclude with 100% accuracy that an ED visit or death was unrelated to a recent TAD/TIP encounter.

Subsequent ED visits with a principal discharge diagnosis related to MH/SUD listed in Table 1 are not counted as outcome events.

- **Rationale**: This approach aims to incentivize use of the Intervention (TAD/TIP) among all patients when appropriate, including patients with MH/SUD concerns who have historically been higher users of ambulance services and ED care. Detailed rationale includes:
    - For patients being primarily treated at the hospital for MH/SUD, a visit to the ED following TAD/TIP may not be indicative of ambulance provider decision-making or triage quality of care.
    - Due to the vast differences in protocols for EMS services of each town, county and state, and the availability of community-based mental health treatment, patients experiencing a MH/SUD-related emergency may be forced to seek ED care following TAD/TIP regardless of the quality of the care provided by the ambulance providers. However, the measure purposely includes the initial encounters in the measure cohort to encourage use of TAD/TIP on this patient population

without penalty for a subsequent ED visit, if it is for a primary MH/SUD diagnosis.

- MH/SUD diagnosis codes are typically seen in high-frequency ED users. If counted as outcome events, this decision could lead to higher measure outcome scores if included in both the cohort and outcome and further discourage provider use of ET3 Interventions for this vulnerable group who may benefit from TAD/TIP services in the right context.

Table 1 contains the CMS Hierarchical Condition Category Codes (HCC) of the mental health and substance use disorder codes. HCCs are groups of International Statistical Classification of Diseases and Related Health Problems (ICD-10) diagnosis codes. **One individual ICD-10 code was added** (R45851 Suicidal Ideation; from HCC Minor Symptoms, Signs, Findings, modified). The full list of ICD-10 codes contained within these HCCs are in in the accompanying data dictionary Excel file.

Table 1 Condition Category Codes (HCC) of Mental Health and Substance Use Disorder Not Counted in Measure Outcome

Hierarchical Condition Category (HCC)	Condition Category Label
54	Substance Use with Psychotic Complications
55	Substance Use Disorder, Moderate/Severe, or Substance Use with Complications
56	Substance Use Disorder, Mild, Except Alcohol and Cannabis
57	Schizophrenia
58	Reactive and Unspecified Psychosis
59	Major Depressive, Bipolar, and Paranoid Disorders (Except 360 sequela codes; see Data Dictionary Excel)
60	Personality Disorders
61	Depression
62	Anxiety Disorders
63	Other Psychiatric Disorders
202	Drug Use, Uncomplicated, Except Cannabis
203	Alcohol/Cannabis Use or Use Disorder, Mild or Uncomplicated; Non-Psychoactive Substance Abuse; Nicotine Dependence

Three hundred sixty codes were removed from CC59 that were 'sequela codes', defined as the residual effect (condition produced) after the acute phase of an illness or injury has terminated. These sequela codes are distinct from initial encounter codes that reflect an acute or initial healthcare need. These are unlikely to be coded as a primary diagnosis due to the nature of sequela codes and clinically these were deemed rarely to be a cause of an acute visit.

Attribution

Each TAD/TIP encounter will be attributed to the Ambulance Provider who filed a Medicare FFS claim for TAD/TIP. If multiple Ambulance Providers filed valid TAD/TIP encounters on the same day, all Ambulance Providers would be held accountable for the patient's outcome, with the patient attributed to both Ambulance Providers. The Ambulance Providers are identified by their National Provider Identification (NPI) Number.

Approach to Risk Adjustment

In this section, the conceptual framework was described for risk adjustment and how it is outlined in this report. The goal of risk adjustment is to account for differences across Ambulance Providers in patient demographic and clinical characteristics that might be related to the outcome but are unrelated to the quality of care provided. Accounting for case-mix differences is important because it recognizes that some Ambulance Providers care for older, sicker patients and others who may be more likely to have an ED visit after a TAD/TIP encounter even if properly triaged. Through the risk adjustment modeling, a higher expected outcome rate is estimated for providers who care for patients with more of these risk factors.

The risk adjustment model was developed using a large dataset of Medicare beneficiaries described as the TAD/TIP Development Proxy Dataset in Data Sources section. This dataset was used to identify candidate variables (including clinical and social risk factors) and select final variables from the candidate variables. Once the risk model was applied to the ET3 Model Dataset, the risk model was further reduced to 14 variables to accommodate the fewer encounters to date within the ET3 Model. The final variables are presented in Final Risk Variable Selection section.

In summary, the TAD/TIP Development Proxy Dataset was used in following report sections to develop the risk model:

- Candidate Clinical and Demographic Risk Variables; and
- Candidate Social Risk Variable Testing.

The risk model was finalized as outlined in the Final Risk Variable Selection section and assessed using the ET3 Model Dataset. All risk model and measure score results are from the ET3 Model Dataset, in the Measure Results sections.

Candidate Clinical and Demographic Risk Variables

Considered clinical medical history and age as candidate variables:

- Comorbidities for inclusion in risk adjustment were identified through inpatient and outpatient administrative claims during the six months prior to entering the cohort.
- Aligned with other CMS outcome measures by using the Yale-Modified FY20 v24 CC Map which is derived from the publicly available CMS condition categories (CMS-CCs) to group ICD-10 diagnosis codes into CMS-CCs, and select comorbidities based on clinical relevance and statistical significance.

The process of selecting candidate risk variables for the model were as follows:

- Using the Yale-Modified FY20 v24 CC Map, examined all CMS-CCs to assess frequency of each comorbidity and bivariate associations with the outcome with odds ratios.
- Then grouped clinically and statistically similar CMS-CCs together. To alleviate burden of yearly reevaluation, mostly aligned with the NQF-endorsed (#2888) Merit-Based Incentive Payment System multiple chronic conditions (MIPS MCC) measure. More information about the MIPS MCC measure can be found on CMS website.
    - MCC measure's risk model similarly covers a broad population, groups conditions together in a clinically and statistically sensible manner and is NQF-endorsed.
- Clinician review resulted in removal of clinically unrelated candidate variables.
- Age was added as a categorical variable.
- This resulted in 60 clinical candidate risk variables plus age, in Appendix B, Table A4.
  The TAD/TIP Development Proxy Dataset patients were split into two parts: the Development Sample

and the Validation Sample. Then a stepwise model selection was run once to select risk variables using logistic regression and retained any variable that was statistically significant and validate the risk model in Validation Sample.

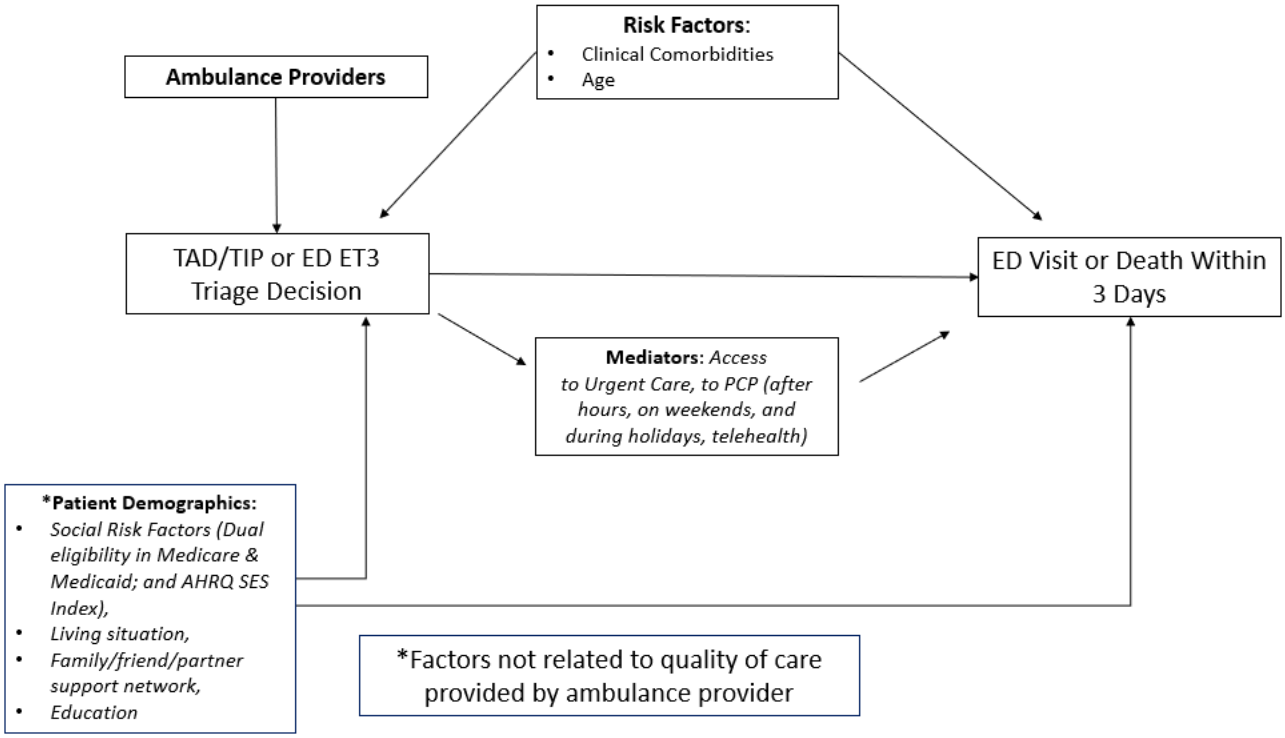
- This retained 30 risk factors (groups of CMS-CCs as comorbidities) that included age. Results are in Table A5 in Appendix C Expanded Risk Adjustment Variables.

Candidate Social Risk Variable Testing

Clinical and demographic risk variables were selected before evaluating social risk variables, as adjusting for clinical risk and frailty is recognized to attenuate the impact of social risk factors, and this approach allowed assessment of the marginal impact of social risk factors inclusion. Social risk variable testing was completed using both the TAD/TIP Development Proxy Dataset and the ET3 Model Dataset. Results are shown for the ET3 Model Dataset, although they are supported by the TAD/TIP Testing Dataset.

Figure 2 below describes a conceptual model for ED visitation and includes certain factors potentially unrelated to the quality of care provided by the ambulance provider. Many factors conceptually influence the outcome of an ED visit or death within three days, most notably the triage decision. A patient's comorbidities are also likely to influence the outcome, as patients with more comorbidities are likely to have a higher risk of a subsequent ED visit if initially triaged to TAD/TIP services. There are also mediators, such as a patient's access to, or knowledge of, unscheduled care services and resources, which can both reduce the risk of an ED visit (e.g., if they have learned how to access telemedicine from the ambulance provider) or possibly increase the risk of an ED visit if they require in-person medical attention and there are no other care options. Finally, a patient's demographics, such as their social risk and living situation, can conceptually influence the outcome. If a patient has a live-in caretaker or visiting nurse, this knowledge may influence the ambulance provider's triage decision.

Figure 2 ET3 Conceptual Model of Impact of Social Risks



Using the above conceptual model, two social risk factors were identified for analyses based on a lower acuity,

population-wide cohort, and availability of data: a) Dual eligibility in Medicare & Medicaid; and b) AHRQ SES Index (quartiles). Dual eligibility is often used as an indicator for patients with lower income, who are often sicker. This variable is a claims-based and reliable variable. Agency for Healthcare Research and Quality (AHRQ) has created an index assessing socio-economic status of geographic areas using a variety of factors using data from the American Community Survey[1]. The AHRQ SES Index quartiles at zip code level, with the lowest quartile representing patients with lowest economic status and the highest quartile representing the wealthiest patients with the highest economic status. To assess the SRF impact on model performance, adjusted (for clinical risk factors) logitistic models were estimated with each SRF to determine associations with the outcome.

Final Risk Variable Selection

The expanded risk model of 30 risk variables was tested in the ET3 Model Dataset. The risk model was then reduced to fewer variables for use with lower volumes of data, by clinically further grouping risk variables together. Additionally, two variables representing MH/SUD were removed since the ED visit with a primary diagnosis related to MH/SUD is not counted as a measure outcome. The candidate social risk variables were then tested in the ET3 Model Dataset, detailed in the measure results section below. Since no SRF variable was significantly associated with outcome, none were added to the final risk model.

The final risk model uses 14 variables. These 14 risk factors are displayed in Table 2 below. The frequencies of each risk factor, estimates, and odds ratios with 95% confidence interval are displayed in Table 5.

Table 2 Final (Condensed) Risk Factors Used for Testing and Measure Implementation

Risk Factor
Age (categorical as: 18-65; 66-75; and 76+)
Chronic Obstructive Pulmonary Disease and Asthma (CC 111, 112, 113, 118), **Pleural effusion/pneumothorax** (CC 117), **Pneumonia** (CC 114, 115, 116)
Congestive Heart Failure (CC 85), **Vascular or circulatory disease** (CC 106, 107, 108, 109)
Dialysis Status (CC 134), **Disorders of Fluid/Electrolyte/Acid-Base** Balance (CC 24), **Urinary Obstruction and Retention** (CC 142)
Gastrointestinal disease (CC 31, 32, 33, 35, 36), **Pancreatic disease** (CC 34)
Head Injury (CC 166, 167, 168)
Hematological diseases (CC 46, 48), **Iron deficiency anemia** (CC 49)
Hypertension (CC 95), **Hypertensive Heart Disease** (CC 94), **Ischemic heart disease** (CC 86, 87, 88, 89)
Marked disability/frailty (CC 21, 70, 71, 73, 157, 158, 159, 160, 161, 189, 190)
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders (CC 147), **Pregnancy** (CC 150, 151, 152, 153, 155, 156)
Septicemia/shock (CC 2)
Advanced cancer (CC 8, 9, 10, 13)
Advanced liver disease (CC 27, 28, 29, 30)
Cellulitis, Local Skin Infection (CC 164), **Bone/joint/muscle infections/ necrosis** (CC 39, 40, 41, 42)

Risk Model Performance

Several summary statistics were computed to assess model performance: c-statistic (see details below), discrimination in predictive ability, and calibration statistics (a measure of over-fitting) for Risk Model Testing.

The c-statistic is a summary score of how accurately a statistical model can distinguish between a patient with and without an outcome. For binary outcomes, the c-statistic is identical to the area under the Receiver Operator Curve. A c-statistic of 0.50 indicates random prediction, implying all patient risk factors are not useful in prediction of the outcome. A c-statistic of 1.0 indicates perfect prediction, implying patients' outcomes can be predicted completely by their risk factors and are not predicted by factors such as quality of care. While a higher c-statistic is desirable, for risk-standardization purposes, the measure developers did not want to maximize it by adjusting for factors that should not be included in adjustment.

Discrimination in predictive ability measures the ability to distinguish high-risk subjects from low-risk subjects. Better model performance is suggested by the observation of larger differences in observed outcome rates between the lowest decile and highest decile ranked using predicted probabilities.

Calibration statistics in the validation sample are calculated to measure model over-fitting. Over-fitting refers to the phenomenon in which a model describes the relationship well between predictive variables and the

outcome in the Development Sample but fails to provide valid predictions within the Validation Sample. Two statistics were calculated for over-fitting using the Validation Sample and models built with the Development Sample: γ0 and γ1. If the γ0 in the validation sample is close to zero and the γ1 is close to 1, there is little evidence of over-fitting, a desirable characteristic.

Measure Score Calculation and Testing

To calculate the final measure score, or Risk Standardized ED Visit Rate (RSEDVR), used a hierarchical generalized linear model (HGLM)- based approach common for CMS quality measures.[1,2] The approach accounts for the clustering of patients within ambulance providers, and the variation in patient case-mix and sample size across providers.rs.

Let Y_{ij} denote the outcome of whether there is ED visit after a TAD/TIP patient encounter *i* by ambulance providers j (Y_{ij} equals to 1 if a patient visits the ED within three days, or 0 otherwise); Z_{ij} denotes the set of risk factors for the patient at time of the encounter. The outcome is assumed related linearly to the covariates via a logit function:

$$\text{logit}(\text{Prob}(Y_{ij} = 1)) = \alpha_j + \boldsymbol{\beta} * \mathbf{Z}_{ij} \quad (1)$$

$$\alpha_j = \mu + \omega_j \; ; \; \omega_j \sim N(0,\tau^2)$$

$$j=1,\ldots,J; \; i=1,\ldots,n_j$$

where $\boldsymbol{Z_{ij}} = (Z_{ij1}, Z_{ij2}, \ldots Z_{ijk})$ is a set of *k* encounter-level covariates; and *J* denotes the total number of ambulance providers and n_j denotes the number of index encounters for ambulance providers *j*; α_j represents the ambulance provider specific intercept; μ is the adjusted average intercept over all ambulance providers; and τ^2 is the between provider variance components. The hierarchical logistic regression model will be estimated using the SAS software system (GLIMMIX procedure).

To derive the *RSEDVR*, the predicted number of ED visits and the expected number of ED visits for each Ambulance Provider was calculated. The predicted number of ED visits for each will be calculated as the sum of the predicted probability of ED visits for each encounter from hierarchical logistic regression model output including the agency specific (random) effect. The expected number of ED visits for each ambulance provider will be similarly calculated as the sum of the predicted probability of ED visit for each encounter with the average intercept. So, using the notation of the previous section, the measure score for each ambulance provider, $RSEDVR_j$, is calculated as:

$$\text{RSEDVR}_j = \text{pred}_j/\text{exp}_j * \bar{y}$$

where

$$\text{pred}_j = \Sigma \text{logit}^{-1}(\alpha_j + \hat{\boldsymbol{\beta}} * \mathbf{Z}_{ij}) \quad (2)$$

$$\text{exp}_j = \Sigma \text{logit}^{-1}(\mu + \hat{\boldsymbol{\beta}} * \mathbf{Z}_{ij}) \quad (3)$$

, $\hat{\boldsymbol{\beta}}$ represents the estimated coefficients for risk factors, and $\bar{y}$ is the population outcome rate.

The confidence interval of the $RSEDVR_j$ can be obtained use bootstrap-based methods developed previously[3].

Measure Score Variation

We examined the extent of RSEDVR variation across Ambulance Providers using summary statistics such as mean, standard deviation, median, interquartile ranges, etc.

Reliability

For **data element reliability**, this measure will use routinely submitted claims data to identify the measure's cohort, risk-adjustment variables, and outcome. We utilized only those data elements from the claims that have both face validity and reliability. To ensure that we use data elements that are reliable, we avoid the use of data elements that are thought to be coded inconsistently across hospitals or providers. Specifically, we use claims-based data elements that are consequential for payment and which are audited. We identify such variables through empirical analyses and our understanding of CMS auditing and billing policies and seek to avoid variables which do not meet this standard. Additionally, CMS has in place several auditing programs used to assess overall claims code accuracy, to ensure appropriate billing, and for overpayment recoupment. CMS routinely conducts data analysis to identify potential problem areas and detect fraud, and audits important data elements used in our measures. Using claims data imposes no costs on providers and eliminates provider burden, which is important since providers have limited time to dedicate to reporting. These models have demonstrated consistent performance across years of claims data.

For **measure score reliability**, we calculated signal-to-noise reliability scores for ambulance providers. We used the formula for signal-to-noise reliability presented by Adams et al[14]. to calculate the provider-level (NPI-level) reliability scores.[1,2] To estimate the overall signal and noise, we first calculated the intraclass correlation coefficient (ICC) for the agency j using the estimates of between- entity variance τ^2 and the formula for ICC presented by Nakawaga.[15] Specifically, the signal-to-noise reliability score for agency *j*, R_j, is calculated as:

$$R_j = \frac{n_j ICC}{1 + (n_j - 1)ICC}$$

while

$$ICC = \frac{\tau^2}{\tau^2 + \pi^2/3}$$

where n_j is the number of TAD/TIP encounters for Ambulance Providers j, τ^2 is the between agency variance in theHGLM model specified above and represent the signal, and $\pi^2/3$ represents the noise variance for a logistic regression model.

R_j ranges from 0 to 1.0. The higher the score, the higher of reliability. Also, we can see that the reliability of Ambulance Provider measure score will vary depending on the number of TAD/TIP encounters. Entities with higher volume will tend to have more reliable scores, while those with lower volume will tend to have less reliable scores.

Validity

To systematically assess face validity, a Quality Workgroup was convened and composed of 11 members that included particpants in the voluntary CMMI ET3 Model and other key national EMS stakeholders. Members were selected with diverse experiences, backgrounds, perspectives and involvement in the EMS setting, with selection criteria outlined below:

- Emergency Medical Service (EMS) subject matter experts (SMEs) from diverse backgrounds (e.g., fire/municipal, private-for-profit/non-profit, hospital based, large/small providers, urban/rural, super-rural)
- EMS Medical Directors
- Continuous Quality Improvement (CQI)/Quality Assurance (QA) Managers with direct ET3 Intervention experience
- Non-Participant Quality Oversight SMEs (e.g., individual SMEs from National EMS Quality Alliance [NEMSQA], National Association of EMS Physicians [NAEMSP], National Association of EMS Officials [NASEMSO]).

Workgroup members were provided measure methodology details prior to the workgroup meeting and informed about the measure specifications and rationale during a live session, encouraged to make suggestions, and asked the following questions:

- Do you believe the measure, as specified, can be used to distinguish between better or worse quality of care among ambulance providers?
    - Responses were limited to one of the following: strongly agree, somewhat agree, somewhat disagree, strongly disagree.
- How do you think this measure will provide useful information for providers and please provide rationale?

To assess construct validity, the correlation would be assessed between the Emergency Department Visit Post-Ambulance Provider Triage Measure and other quality measures and quality indicators. However, this outcome quality measure assesses a novel Intervention for a unique provider type. As such, there are no other relevant existing external quality measures available for such construct validity testing. Assessment of measure validity will likely be examined further in reevaluation comparing outcomes results to proprietary National Emergency Medical Services Information System (NEMSIS) measures of ambulance provider and supplier quality.

3. Measure Results

Testing results presented in the following section were completed using the ET3 Model Dataset.

Measure Cohort

The final cohort in the ET3 Model Dataset included 1,552 encounters from 46 Ambulance Providers. Figure 3 below shows the cohort flowchart and derivation of the analytic sample.

Figure 3 ET3 Model Dataset Cohort Flowchart

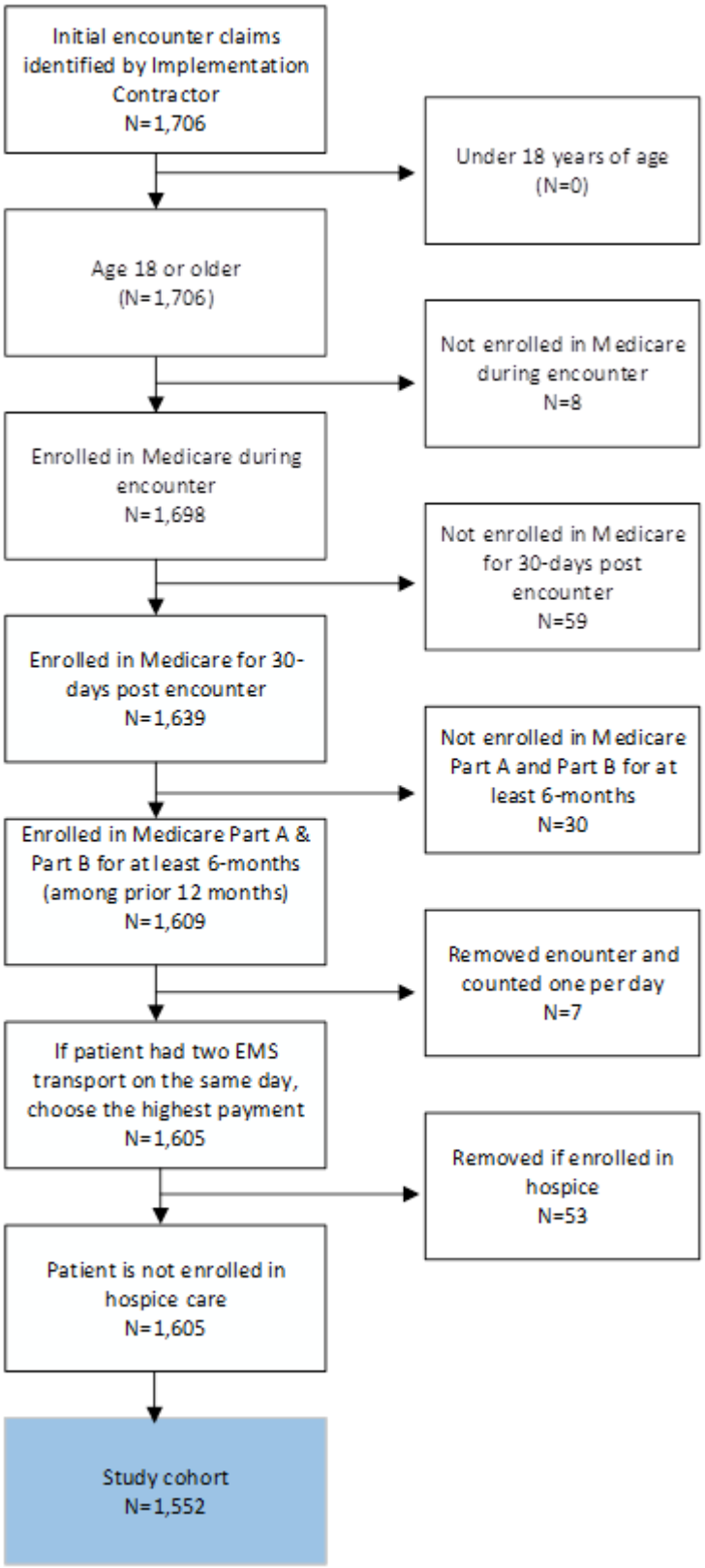


Table 3 shows the patient demographics of the final 1,410 patients (with a total of 1,552 TAD/TIP encounters). The cohort's mean age was 74 years, with a standard deviation of 14 years. There were more females than males, with a majority White (race) and a significant minority of Black (race) represented. Approximately one-quarter of the cohort were dually enrolled in Medicare and Medicaid.

Table 3 ET3 Model Dataset Patient Information

Description	N (%)
Age in Measure Year	-
Mean (SD)	74 (14)
Minimum, Maximum	24 (108)
Q2, Interquartile Range (QR)	76 (16)
≥65	1,151 (81.63%)
<65	259 (18.37%)
Sex	-
Male	582 (41.28%)
Female	828 (58.72%)
Race/Ethnicity	-
Unknown	14 (0.99%)
White	1,096 (77.73%)
Black	267 (18.94%)
Other	6 (0.43%)
Asian	6 (0.43%)
Hispanic	17 (1.21%)
North America Native	4 (0.28%)
Dual Enrollment at time of TAD/TIP	-
No	1,095 (77.66%)
Yes	315 (22.34%)

As shown in Table 4, 15 out of 46 Ambulance Providers had 20 or more encounters. Across all 46 Ambulance Providers, the mean number of encounters per Ambulance Provider was 34, with a standard deviation of 75. Ambulance Providers had a wide range of encounters, from 1 to 407. With a minimum case threshold applied of 20 encounters, the mean number of encounters per Ambulance Provider increased to 94.

Table 4 ET3 Model Dataset Cohort Volume

Description	All Ambulance Providers	Ambulance Providers with 20+ Encounters
Number of Ambulance Providers	46	15
Total number of encounters	1,552	1,416
Mean (SD)	34 (75)	94 (110)
Range (min.-max.)	1 - 407	23 - 407
Median (IQR)	6 (1 - 33)	41 (33 - 112)

Risk Model Variables and Model Performance

Table 5 shows each risk variable along with their frequencies, estimates, and odds ratios (ORs) using a 95% confidence interval, for the 14 final risk variables in the risk model.

Table 5 Risk Model Variable Frequencies, Parameter Estimates and Odd Ration Estimates Using Logistic Regression Model, ET3 Model Dataset

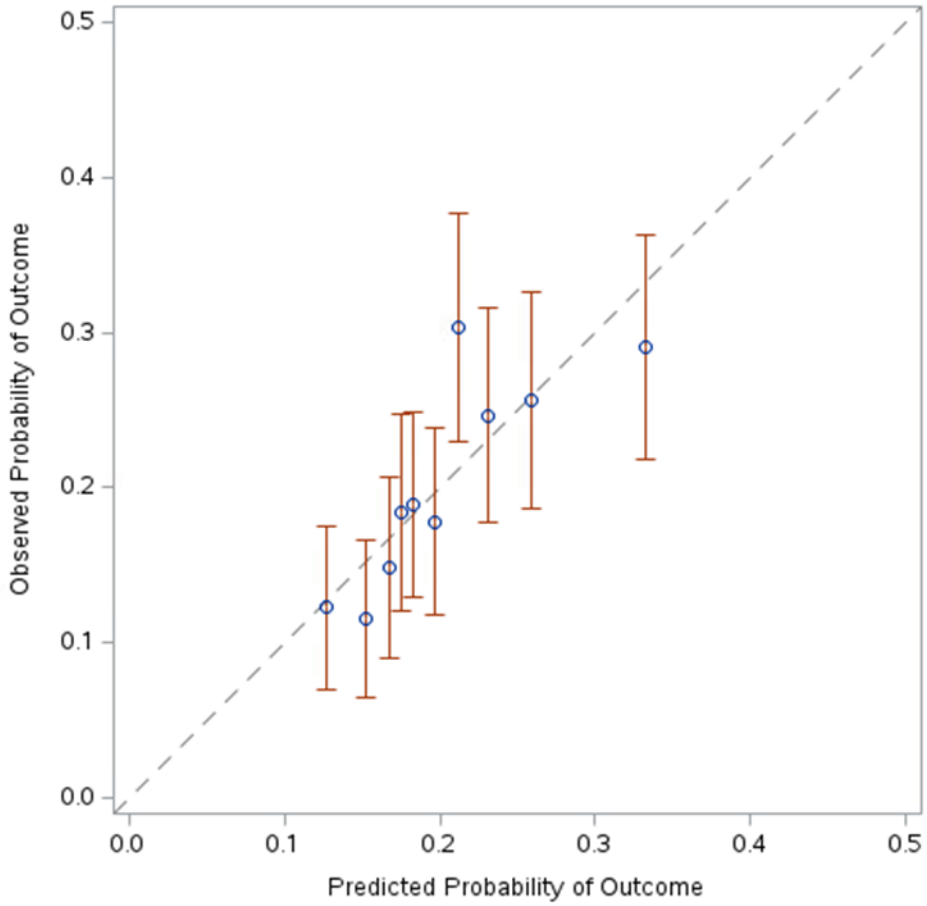
Risk Variable	Risk Factor Prevalence (%)	Parameter Estimates (Standard Error)	Odds Ratio (LOR-UOR)
Age 18-65	22%	-0.3663 (0.1866)	0.693 (0.481-1)
Age 66-75	30%	0.008833 (0.1529)	1.009 (0.747-1.362)
Age 76+	49%	Ref: 0	Ref: 1
Congestive Heart Failure; Vascular or circulatory disease	56%	0.1042 (0.163)	1.11 (0.806-1.528)
Dialysis Status; Disorders of Fluid/Electrolyte/Acid-Base Balance; Urinary Obstruction and Retention	41%	0.2395 (0.1593)	1.271 (0.93-1.737)
Gastrointestinal disease; Pancreatic disease;	23%	0.04544 (0.1655)	1.046 (0.756-1.448)
Head Injury	12%	0.3719 (0.1956)	1.45 (0.988-2.129)
Hematological diseases; Iron deficiency anemia	44%	-0.08702 (0.1603)	0.917 (0.669-1.255)
Hypertension; Hypertensive Heart Disease; Ischemic heart disease	76%	-0.05244 (0.1849)	0.949 (0.66-1.364)
Marked disability/frailty	19%	0.1774 (0.1723)	1.194 (0.852-1.674)
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders; Pregnancy	3%	0.4618 (0.3686)	1.587 (0.77-3.27)
Septicemia/shock	10%	0.3986 (0.2142)	1.49 (0.979-2.268)
Advanced cancer	6%	-0.02758 (0.267)	0.973 (0.576-1.642)
Advanced liver disease	4%	-0.1305 (0.3361)	0.878 (0.454-1.697)
Bone/joint/muscle infections/ necrosis; Cellulitis, Local Skin Infection	49%	-0.1262 (0.1422)	0.881 (0.667-1.165)
Chronic Obstructive Pulmonary Disease and Asthma; Pleural effusion/pneumothorax; Pneumonia	51%	0.1481 (0.1492)	1.16 (0.865-1.554)

Risk model performance statistics are outlined below:

- C-statistic indicated acceptable model discrimination at 0.605.
- The model has acceptable calibration, as shown in Figure 4. Split sample overfitting calibration statistics were not presented due to the small sample size could give rise to unstable results.
- A wide range of outcome rates between lowest and highest predicted probability decile (12.7% vs. 33.3%) indicates good model discrimination and calibration.

Figure 4 shows the encounter-level calibration plot using the predicted probability deciles (10 blue open circles) for the outcome. The X-axis is the average predicted probability for an outcome in each decile, the Y-axis is the observed outcome rate. The vertical lines represent the confidence intervals, which are wide. Some deciles are over-predicting, while others are under-predicting. These results are likely the consequence of the low volume of data to date within the ET3 Model.

Figure 4 Observed Probability of Outcome vs. Predicted Probability of Outcome – Patient-Level Logistic Regression (ET3 Model Dataset)



Model performance was examined inclusive of a Ambulance Provider random effect using a HGLM technique. In this model, the a c-statistic was found to be 0.66, supporting earlier findings of large variation in performance between Ambulance Providers and demonstrating the model is able to capture patient-level risk as well as variation between Ambulance Providers. Risk factors did not appear to be associated with patient outcomes as heavily as anticipated, with the measure believed to be capturing more provider and supplier "quality" differences.

Social Risk Factor Testing Results

Data in Table 6 shows the parameter estimates, standard error, and odds ratio with 95% confidence interval. Data suggests that, after adjusting for clinical risk factors, dual eligibility status was not significantly associated with outcome. Additionally, there was no statistically significant association between AHRQ SES index quartiles with the outcome after adjusting for clinical risk factors. Due to a lack of statistical association, neither variable was included within the final risk model.

Table 6 ET3 Model Dataset Empiric Testing of Social Risk Factors

Risk Variable Description	Parameter Estimates (Standard Error)	Odds Ratio (LOR-UOR)
Dual Eligibility Status: Yes	0.216 (0.172)	1.241 (0.886-1.739)
AHRQ SES Index 1: Lowest economic status	0.138 (0.173)	1.148 (0.818-1.610)
AHRQ SES Index 2	0.112 (0.174)	1.118 (0.796-1.572)
AHRQ SES Index 3	-0.330 (0.210)	0.719 (0.476-1.085)
AHRQ SES Index 4: Highest economic status	Ref: 0	Ref: 1

Measure Score Variation

Examination of provider-level results in Table 7 includes measure scores of the RSEDVR for all Ambulance Providers and the Ambulance Providers with at least 20 encounters, along with summary statistics such as mean (SD), median (IQR), and the range.

A wide range in performance scores was observed between providers, which indicatedpossible opportunity for quality improvement.

Table 7 ET3 Summary Statistics of Measure Score, Risk Standardized ED Visit Rate (RSEDVR), for All Providers and Providers with 20 or More Patients, ET3 Model Data January 2021 – August 2022

Statistics	All Providers (N=46)	Providers with 20+ Encounters (N=15)
Number of Encounters	1,552	1,416
Mean (SD)	20.62% (3.25%)	20.20% (3.62%)
Median (IQR)	19.91% (19.15- 22.15%)	21.57% (17.67- 23.03%)
Range (min. - max.)	12.33- 33.05%	12.33- 25.72%

Reliability

For measure score reliability, signal-to-noise ratios were calcued among Ambulance Providers with 20 encounters or more. Shown in Table 8, the mean reliability was 0.338 for all providers with a standard deviation of 0.297. At least half of the providers with 20 or more encounters have a reliability over 0.719 (mean), which CORE defines as acceptable to high reliability.

Table 8 ET3 Model Dataset Signal-to-Noise Reliability Results for All Providers and Providers with 20+ Encounters

Statistics	All Providers (N=46)	Providers with 20 + Encounters (N=15)
Number of Encounters	1,552	1,416
Mean (SD)	0.338 (0.297)	0.719 (0.138)
Median (IQR)	0.210 (0.046-0.615)	0.665 (0.615-0.844)

Validity

All 11 Quality Workgroup members responded to questions outlined in the Methods section. Of relevance to

face validity, Quality Workgroup members rated the ability of the measure to help distinguish better and worse quality of care of ambulance providers. Nine out of 11 of Quality Workgroup members (82%) strongly agreed or somewhat agreed that the Risk Adjusted Post-Ambulance Provider Triage Emergency Department (ED) Visit Rate Measure was able to distinguish better or worse quality of care.

Table 9 Face Validity Results Distinguishing Quality of Care of Ambulance Providers

Statements - Respondents	**Strongly Agree**	**Somewhat Agree**	**Somewhat Disagree**	**Strongly Disagree**
Statement 1: Importance – TEP	3	6	2	0

Quality Workgroup stakeholders, which included particpants strongly supported the face validity of the measure and its inclusion in CMMI's voluntary payment model.

- Stakeholders (inclusive of measured entities) raised no major threats to measure validity.
- Stakeholders (inclusive of measured entities) raised no concerns about the adequacy of risk adjustment.
- Stakeholders (inclusive of measured entities) raised no concerns around the construct of the measure score.

Among Quality Workgroup members who agreed the measure exhibits face validity, one stakeholder stated that the risk adjustment and overall measure calculation was well thought out. Another stakeholder agreed that the measure can determine where quality improvement can be assessed and be used to improve the standard of care provided by ambulance providers. Additionally, stakeholders agreed that the Risk Adjusted Post-Ambulance Provider Triage ED Visit Rate Measure will provide useful information to ambulance providers and to CMS. Several Quality Workgroup members stated that this measure would provide beneficial information to ambulance providersto identify provider education effectiveness and triage appropriateness, acknowledging the correlation between the assessment capability of a given provider and the subsequent outcome of a given patient. With patient safety being of paramount concern, this measure allows ambulance providers to determine whether the TAD/TIP encounter they provided was clinically appropriate and did not result in an ED visit or death within 3 days. No members of the Workgroup selected "strongly disagree."

Among the two stakeholders who somewhat disagreed, one person praised the risk adjustment and measure calculation but suggested a potential need to account for ED visits 'related' to the initial triage chief complaint or potentially providing the ED discharge diagnosis to ambulance providers, so they are able to evaluate further themselves. The measure developer agreed with the commenter that aggregate data regarding the ED discharge diagnosis should be provided, and that request will be considered once the measure is implemented. Another person who selected 'somewhat disagree' noted that the measure captured the quality of triage, but perhaps not the level of care provided during the TAD/TIP Intervention.

Finally, the measure developers agree with the stakeholders, and reiterate this measure is a first step towards identifying patient safety in triage decisions andencourage other measures in this space to complement the Post-Triage ED Visit Rate Measure.

4. Conclusion

In this report, the development and testing of the Risk Adjusted Post-Ambulance Provider Triage Emergency Department (ED) Visit Rate Measure is described. The evidence provided shows the Post Triage ED Visit Rate Measure of the ET3 Model is feasible, reliable, and has a stable statistical model with attractive features.

The primary goal of the measure is to assess the triage decision making by Ambulance Providers for lower acuity patients not transported to the ED, by measuring patient's use of the ED or death following TAD/TIP Intervention. Allowing ambulance providers to provide or facilitate services for lower acuity conditions away from an ED can lead to improved patient outcomes, increase ambulance provider/supplier efficiency, and lower costs for payers[4]. This measure evaluates Ambulance Providers performance on this goal through assessing the post-triage rate of ED use by patients who are triaged to receive lower acuity, non-ED care.

Measure specifications incorporated guidance from CMS, statistical experts, and subject matter experts, including ambulance providers and organizations. The measure is ready for use in the ET3 Model for performance-based payment. Further work to be conducted in the future includes construct validity testing and measure re-evaluation.

5. References

1. AHRQ. Agency For HealthCare and Quality. 2022.
2. National Quality Forum. Measure Evaluation Criteria and Guidance for Evaluating Measures for Endorsement. 2019.
3. The Centers for Medicare and Medicaid Services (CMS). Blueprint for the CMS Measures Management System. 2019.
4. Carter EJ, Pouch SM, Larson EL. The relationship between emergency department crowding and patient outcomes: a systematic review. Journal of nursing scholarship : an official publication of Sigma Theta Tau International Honor Society of Nursing 2014;46:106-15.
5. Krumperman K, Weiss S, Fullerton L. Two Types of Prehospital Systems Interventions that Triage Low-Acuity Patients to Alternative Sites of Care. South Med J 2015;108:381-6.
6. Administration USDoTNHS. Emergency Medical Services Performance Measures. Recommended Attributes and Indicators For System and Service Performance https://rosap.ntl.bts.gov/view/dot/59040
7. NEMSQA EMS Compass 2.0 Measure Set. 2020. https://www.nemsqa.org/measures
8. Langabeer JR, 2nd, Gonzalez M, Alqusairi D, et al. Telehealth-Enabled Emergency Medical Services Program Reduces Ambulance Transport to Urban Emergency Departments. The western journal of emergency medicine 2016;17:713-20.
9. Sanko S, Kashani S, Ito T, Guggenheim A, Fei S, Eckstein M. Advanced Practice Providers in the Field: Implementation of the Los Angeles Fire Department Advanced Provider Response Unit. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors 2020;24:693-703.
10. Agency for Healthcare Research and Quality. Chapter 3: Creation of New Race-Ethnicity Codes and SES Indicators for Medicare Beneficiaries. https://archive.ahrq.gov/research/findings/final-reports/medicareindicators/medicareindicators3.html2008.
11. Debuhr J, McDowell K, Grady J, et al. 2020 Condition-Specific Readmission Measures Updates and Specifications Report. https://qualitynet.org/inpatient/measures/readmission/methodology2020.
12. Debuhr J, McDowell K, Grady J, et al. 2020 Condition-Specific Mortality Measures Updates and Specifications Report. https://qualitynet.org/inpatient/measures/mortality/methodology2020.
13. Krumholz H, Normand S-L, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. https://qualitynet.org/inpatient/measures/mortality/methodology2007.
14. Adams JL, Mehrotra A, Thomas JW, et al. Physician Cost Profiling-Reliability and Risk of Misclassification: Detailed Methodology and Sensitivity Analyses. Rand health quarterly 2012;2:3.
15. Nakagawa S, Johnson P, Schielzeth H. The coefficient of determination R2 and intra-class correlation coefficient from generalized linear mixed-effects models revisited and expanded. bioRxiv; 2016.

6. Glossary

Table A1 Outcome Measure Definition Components

CORE Terminology	Definition
Measure Cohort	The group of patients/encounters included in the measure
Measure Outcome	Result of care, or endpoint of care (i.e., what happens to the patient) specific to this quality measure
Risk Adjustment	Statistical model within a measure that considers how sick patients are so that providers can be fairly compared to each other, even if one provider takes care of patients who are sicker. The risk-adjustment model intends to "adjust for" factors so that differences in performance on the measure are due to quality of care, rather than patient and provider characteristics. The goal of risk adjustment is to make the comparison of providers fairer and more meaningful.

Table A10 ET3 Model Terminology and Definitions

ET3 Model Terminology	Measure Report Terminology	Definition from ET3 Model
Participant	Model Participant	Medicare-enrolled ambulance provider (measured entity) participating in the ET3 Model, who has executed the Model Participant Agreement
ET3 Model Beneficiary	Patient	An individual who is (1) entitled to benefits under Medicare Part A and enrolled under Part B; (2) is suffering from a complaint for which a 9-1-1 call is placed, and a Participant is dispatched; and (3) is located in the Model Region when the Participant arrives on scene
Patient	Patient	An individual, regardless of health insurance status, who is suffering from a complaint for which a 9-1-1 call is placed, and a Participant is dispatched and who is located in the Model Region when the Participant arrives on the scene
Encounter	TAD/TIP Encounter, or cohort-eligible Encounter	Contact with an ET3 Model Beneficiary that begins when the Participant arrives on the scene of a 9-1-1 emergency response in the Model Region following a 9-1-1 call and ends when the ET3 Model Beneficiary to whom the 9-1-1 call was places is no longer in the physical care of the Participant, Qualified Health Care Practitioner or a Qualified Health Care Practitioner's Downstream Practitioner. Specifically, this report refers to cohort-eligible encounters: where the patient is either transported to an alternative (no-ED) location, or they receive treatment in place.

ET3 Model Terminology	Measure Report Terminology	Definition from ET3 Model
Alternative Destination Site	TAD	Non-Participant Partner that (1) furnishes Covered Services, or arranges for Covered Services to be furnished by a Downstream Practitioner, to ET3 Model Beneficiaries following Transport to an Alternative Destination Site; and (2) is a Medicare-enrolled provider of services as defined under Section 1861(u) of the Act, as may be amended from time to time; a group practice; a Medicare-enrolled Physician or Non-Physician Practitioner; or an individual or entity that is not Medicare-enrolled
Treatment in Place	TIP	(1) A Telehealth Treatment in Place Intervention; or (2) an In-Person Treatment in Place Intervention

7. Appendix

Appendix A. TAD/TIP Development Proxy Dataset

The ET3 team at CORE has created an initial TAD/TIP Development Proxy Dataset for measuring ED visits post-ambulance provider triage. The purpose for creating a TAD/TIP Development Proxy Dataset is to mimic the patients we anticipate being in the measure (model beneficiaries) and to conduct alpha testing and select clinical risk factors for lacking of sufficient amount of real life data.

Ambulance Provider Claims

To identify EMS claims with the destination of facility-based ED, containing only those claims for ground ambulance we applied several limitations. The removal of all EMS claims which did not have:

1) Place of service (POS) as "ambulance – land" 41 in carrier claims or;

2) Outpatient revenue center claim code: 0540; **and**

3) Claim lines contains the healthcare common procedure coding system (HCPCS) for emergency ambulance transports: A0427 or A0429.

We further required the destination code in the HCPCS modifier to be "H" (hospital); removed duplicate claims and restricted the National Provider Identifier (NPI) to be for our Model Participants. And finally, if multiple EMS encounters occur in the same day, we chose one encounter since there is no timestamp information on EMS claims and we were unable to determine which event occurred first.

ED Facility Claims: Proxy Index ED Visit

For the proxy index ED visits, we removed from the ED visits discharges that may represent facility transfers. We also limited proxy index ED visits to include ED discharges on the same day or the next day, as longer ED stays are indicative of requiring more complex care. We removed ED discharges that overlap or are adjacent to index admission from an acute care hospital or a critical access hospital. The target cohort contains new encounters from a 9-1-1 call, having an overlap or adjacent admission has the potential to be an unplanned readmission for the same condition, so these were removed.

To define and remove claims with high intensity care, we looked at how medical services were provided, or conditions identified that would have required treatment specific to emergency departments; care that would not be given in urgent care center (as substitute for alternative destinations). High intensity care was a definition CORE created by comparing the frequency of the Healthcare Common Procedure Coding System (HCPCS) codes at an ED compared to the HCPCS codes at an urgent care center, to identify and remove codes that never occurred in an urgent care claim, representing treatment that likely could not be performed at an urgent care center. Additional excluded codes included HCPCS code such as many procedural codes, most advanced imaging codes, critical care evaluation and management codes; principal diagnosis codes such as and cardiac arrest/ hemorrhage of vascular codes. Please see details in bullet list below.

Definition of 'high intensity ED care', which were removed from cohort:

- Any claims with claim lines containing principal discharge diagnoses (ICD-10 codes) of:
    - "T82838A" Hemorrhage of vascular device/graft and

    - "I149.A" Cardiac arrest, cause unspecified and all other codes under cardiac arrest.
        - **Rationale**: CORE determined that these diagnoses would not be appropriate for urgent care or treatment in place and would require an ED admission regardless of severity.
- Any claims with claim lines containing HCPCS (procedures or conditions) that did not have at least some of those HCPCS claim lines found in urgent care claims. If an ED claim contained any of these excluded claim lines, the entire claim was removed from the cohort as being indicative of containing high intensity care (i.e., care not found given in urgent care).
    - This excluded many HCPCS codes, including those categorized as Drug Administration
        - Examples include dopamine and benztrapoline mesylate
- Any claims with claim lines containing specific High Intensity HCPCS/CPT Category codes that clinically were not representative of urgent care services
    - Evaluation and Management (E&M) codes for critical care:
        - "99291" Critical care, evaluation and management of the critically ill or critically injured patient; first 30-74 minutes; and
        - "99292" Critical care, evaluation and management of the critically ill or critically injured patient; each additional 30 minutes (List separately in addition to code for primary service).
            - **Rationale**: These HCPCS codes are used to identify patients that are critically ill and are appropriate for ED care and not urgent care.
    - Radiology Services for CT or MRI scans, identified using CMS' Medicare Appropriate Use Criteria Program for Advanced Diagnostic Imaging – Code List
        - **Rationale**: Radiology services that would not be available in an urgent care setting
    - Radiology Services for Nuclear Medicine
        - **Rationale**: Radiology services that would not be available in an urgent care settings as urgent care centers would not have the storage or equipment to support the terminal half-life
    - Surgery codes of low frequency in urgent care but higher frequency in ED care
        - **Rationale**: Surgery codes were reviewed closely by our clinicians; if the frequency was >0.05% in ED and <0.001% in urgent care of all ED and urgent care claim lines, we concluded that these codes were likely more appropriate to be aligned with an ED settings and possibly only very advanced urgent care locations could accommodate these procedures

After the encounters had been reviewed for the above exclusion criteria, the decision was made to exclude all encounters for patients who were enrolled at hospice care. **Rationale**: Patients in hospice care have complex medical needs and have an outcome rate unrelated to quality of care by Model Participant decision-making or quality of care. Excluding these patients from both the TAD/TIP Development Proxy Dataset and the measure specification prevents bias against administering care in place for minor ailments and to improve patient comfort. For this TAD/TIP Development Proxy Dataset, those patients would not represent our intended proxy, where low acuity ED visits are meant to represent future eligible cases for TAD/TIP.

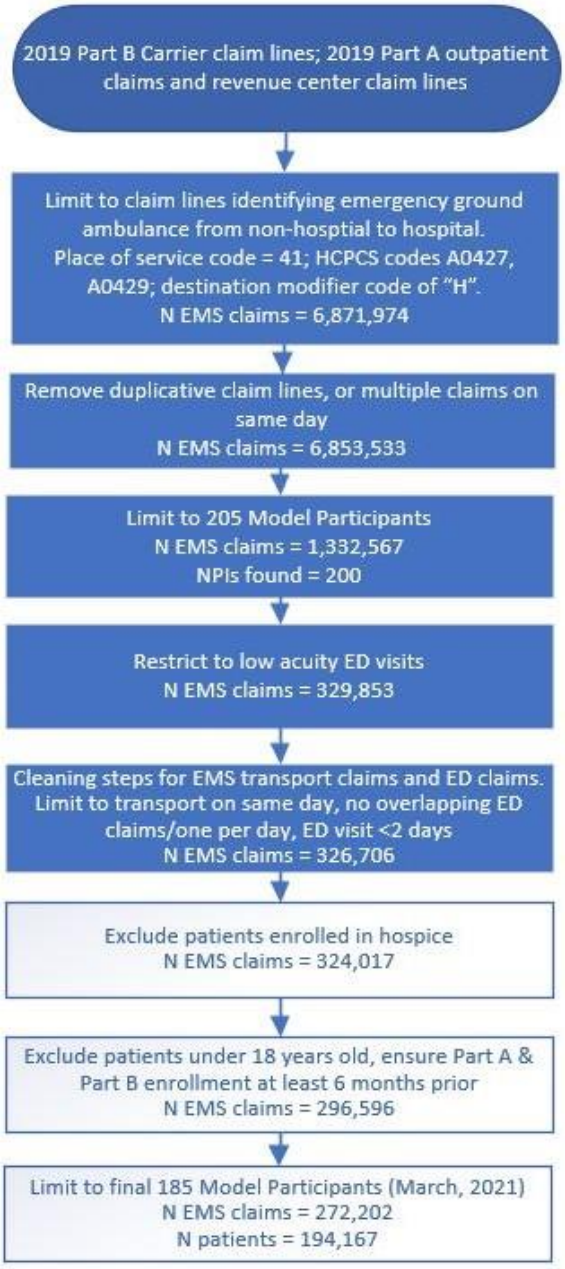
<u>ED Facility Claims: Proxy Outcome ED Visit</u>

We considered an ED visit within three days to be an outcome. Direct inpatient stays were not included.

Results: Cohort

Figure A1 below shows the TAD/TIP Development Proxy Dataset cohort flowchart, with the number of claims remaining in each box at each step.

Figure A1 Cohort Flowchart, TAD/TIP Development Proxy Dataset



Briefly, the dataset is restricted to claims of emergency ground ambulance transports from non-hospital locations (removing facility transfers), same-day transfers to ED visits where the patient was discharged alive within two days. The TAD/TIP Development Proxy Dataset was limited to Participants who had Part A or B claims in 2019 for at least 6-months prior to their cohort-eligible proxy encounter (for patient history to risk adjust), restricted to low acuity ED visits. The only measure exclusion in the cohort was removing patient enrolled in hospice at the time of cohort-eligible proxy encounter (referred to as "encounter" in Alpha Testing Results sections below).

The cohort's mean age is 71 years old with a standard deviation of 16; 70.63% of the cohort is over 65 years old. There are more females than males, with a majority white (race) and a significant minority of black (race) represented. Over a third of the cohort are dually enrolled in Medicare and Medicaid.

Appendix B. Candidate Risk Adjustment Variables

Table A3 ED Visit Post-Ambulance Provider Triage Measure Clinical Candidate Risk Adjustment Variables

Candidate Risk Variables
Age
Alcohol/Drug Use Disorders (CC 202, 203)
Chronic Obstructive Pulmonary Disease and Asthma (CC 111, 112, 113, 118)
Complications of Specified Implanted Device or Graft (CC 176)
Congestive Heart Failure (CC 85)
Depression (CC 59, 61, 63)
Diabetes (CC 17, 18, 19, 123)
Dialysis Status (CC 134)
Disorders of Fluid/Electrolyte/Acid-Base Balance (CC 24)
Eye Infections/Inflammations/Retinal Detachment (CC 120, 121)
Frailty indicators (CC 197, 199, 200)
Gastrointestinal disease (CC 31, 32, 33, 35, 36)
Alzheimer's Disease and Related Disorders or Senile Dementia (CC 51, 52, 53)
Head Injury (CC 166, 167, 168)
Hematological diseases (CC 46, 48)
Hip or vertebral fracture (CC 169, 170)
Hypertension (CC 95)
Hypertensive Heart Disease (CC 94)
Infectious and immunologic diseases (CC 1, 3, 4, 5, 6, 47, 90)
Intellectual Disability (CC 66, 67)
Internal Injuries (CC 172)
Iron deficiency anemia (CC 49)
Ischemic heart disease (CC 86, 87, 88, 89)
Anxiety Disorders (CC 62)
Lower-risk cardiovascular disease (CC 91, 92, 93)
Major Fracture, Except of Skull, Vertebrae, or Hip (CC 171)
Major organ transplant status (CC 132, 186)
Marked disability/frailty (CC 21, 70, 71, 73, 157, 158, 159, 160, 161, 189, 190)
Morbid obesity (CC 22, 178)
Nephritis (CC 141)
Other disability and paralysis (CC 72, 74, 103, 104, 119)
Other neurologic disorders (CC 75, 77, 78, 79, 81, 105)
Other organ transplant (CC 187)
Pancreatic disease (CC 34)

Arrhythmia (CC 96)
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders (CC 147)
Pleural effusion/pneumothorax (CC 117)
Candidate Risk Variables
Pneumonia (CC 114, 115, 116)
Poisonings and Allergic and Inflammatory Reactions (CC 175)
Pregnancy (CC 150, 151, 152, 153, 155, 156)
Psychiatric disorders other than depression (CC 57, 58, 60, 62)
Respiratory failure (CC 82, 83, 84)
Septicemia/shock (CC 2)
Severe Cognitive Impairment (CC 50, 80)
Stroke and TIA (CC 99, 100, 101, 102)
Artificial Openings for Feeding or Elimination (CC 188)
Substance abuse (CC 54, 55, 56)
Traumatic Amputations and Complications (CC 173)
Urinary Obstruction and Retention (CC 142)
Vascular or circulatory disease (CC 106, 107, 108, 109)
Advanced cancer (CC 8, 9, 10, 13)
Advanced liver disease (CC 27, 28, 29, 30)
Bone/joint/muscle infections/ necrosis (CC 39, 40, 41, 42)
Chronic Kidney Disease (CC 135, 136, 137, 138, 139, 140)
Cancer (CC 11, 12, 14, 15)
Cellulitis, Local Skin Infection (CC 164)

Appendix C: Expanded Risk Adjustment Variables

Table A4 ED Visit Post-Ambulance Provider Triage Measure Expanded Risk Adjustment Variables

Risk Factor Description	FY21 Yale Modified V24 CMS Condition Categories (CCs)
Alcohol/Drug Use Disorders	202, 203
Congestive Heart Failure	85
Dialysis Status	134
Disorders of Fluid/Electrolyte/Acid-Base Balance	24
Gastrointestinal disease	31, 32, 33, 35, 36
Head Injury	166, 167, 168
Hematological diseases	46, 48
Hypertension	95
Hypertensive Heart Disease	94
Iron deficiency anemia	49
Ischemic heart disease	86, 87, 88, 89
Marked disability/frailty	21, 70, 71, 73, 157, 158, 159, 160, 161, 189, 190
Pancreatic disease	34
Pelvic Inflammatory Disease and Other Specified Female Genital Disorders	147
Pleural effusion/pneumothorax	117
Pneumonia	114, 115, 116
Poisonings and Allergic and Inflammatory Reactions	175
Pregnancy	150, 151, 152, 153, 155, 156
Psychiatric disorders other than depression	57, 58
Septicemia/shock	2
Substance abuse	54, 55, 56
Bone/joint/muscle infections/ necrosis	39, 40, 41, 42
Urinary Obstruction and Retention	142
Vascular or circulatory disease	106, 107, 108, 109
Advanced cancer	8, 9, 10, 13
Advanced liver disease	27, 28, 29, 30
Cellulitis, Local Skin Infection	164
Chronic Obstructive Pulmonary Disease and Asthma	111, 112, 113, 118