



Identifying Measures and Data Elements for the HRSA Evidence-Based Tele-Emergency Network Grant Program

Marcia M. Ward, PhD;^A Fred Ullrich, BA;^A Kimberly A. S. Merchant, MA;^A Nicholas M. Mohr, MD, MS;^B Paula Weigel, PhD;^A A. Clinton MacKinney, MD, MS;^A Sarah Heppner, MS^C

^AUniversity of Iowa, College of Public Health, Iowa City, IA; ^BUniversity of Iowa, Carver College of Medicine, Iowa City, IA; ^CHRSA Federal Office of Rural Health Policy, Rockville, MD

Introduction and Background

Emergency departments (EDs) face numerous challenges meeting the needs of patients who present with diverse conditions including life-threatening injuries and illnesses. Thus, EDs must be prepared for any number and condition of patients, which requires adequate staffing and resources at all times. These challenges are compounded in small and rural hospital EDs, where staffing and resources are often limited. To address these challenges, the Federal Office of Rural Health Policy (FORHP) in the Health Resources and Services Administration (HRSA) established the Evidence-Based Tele-Emergency Network Grant Program (EB TNGP). In 2014, this program awarded grants to six ED-based telehealth (tele-ED) networks to expand the delivery of tele-ED in rural hospitals across the U.S.¹

Also in 2014, FORHP contracted with Mathematica Policy Research and its partner, the RUPRI Center for Rural Health Policy Analysis at the University of Iowa, to identify a standardized set of measures that could be used to evaluate the impact of tele-ED (Harris et al., 2017)². In 2015, FORHP awarded a cooperative agreement to the then newly created Rural Telehealth Research Center (RTRC) to further customize the measures to the six EB TNGP grantees and then to systematically collect data from them on all of their tele-ED cases over a 26-month period³.

Initial Project to Identify Tele-ED Measures

The first project began with a systematic review of the published literature (Ward et al., 2015), a search of measure databases, and a review of websites for organizations involved in telehealth or emergency medicine to identify existing measures that could be employed to assess the impact of tele-ED in rural hospitals. The environmental scan produced a vast inventory of measures relevant to ED care and a narrower subset of measures relevant to telehealth. None of the 1,200 measures identified in the search were applicable to *both* ED and telehealth care. To narrow the list of measures to those best suited to assess the value of tele-ED care, each measure was evaluated against a set of redefined criteria. Building upon the approach employed by the National Quality Forum (NQF, 2009), the following

Key Findings

- A first project conducted an extensive literature review and search of existing measures by key organizations. The resulting inventory of 1,200 measures was assessed against six criteria, which yielded 23 measures. An Excel-based tool, termed the Tele-Emergency Performance Assessment Reporting Tool (T-PART), was constructed.
- The second project refined the 45 data elements and T-PART needed for systematic data collection in the Evidence-Based Tele-Emergency Network Grant Program (EB TNGP).
- The EB TNGP grantees used the T-PART to submit data on 4,324 tele-ED cases over a 26-month period.

¹ Funding for the EB TNGP provided under grant numbers G01RH27868, G01RH27870, G01RH27871, G01RH27872, G01RH27873, and G01RH27869

² The project to identify a standardized set of measures was completed under contract number HSH2502013000181/HSH25034002T

³ Funding for the Rural Telehealth Research Center provided under cooperative agreement number UICRH29074

criteria were employed: (1) meet most of NQF's evaluation criteria related to clearly defined measure specification, reliability and validity, importance, feasibility, and utility to stakeholders and the study objectives; (2) include measures from as many Institute of Medicine (2012) quality domains (structure, process, outcomes, access, experience, and efficiency) as possible; (3) be applicable to conditions and populations most commonly treated in rural hospital EDs; (4) measure aspects of care that are likely to be affected by the use of tele-ED technology; (5) be applicable to the face-to-face treatment of patients presenting for similar conditions and procedures for comparative purposes; and (6) be as parsimonious as possible to minimize provider reporting burden and maximize response rates. When the identified measures were assessed against the evaluation criteria, the resulting set encompassed 12 measures applicable to all presenting conditions or services provided in a rural ED and an additional 11 measures that were applicable to specific presenting conditions (e.g., stroke symptoms). The measures were operationalized into a set of component data elements. In addition to a training manual, an Excel-based tool, termed the Tele-Emergency Performance Assessment Reporting Tool (T-PART), was created for data collection (Harris et al., 2017).

Second Project to Refine Data Elements for Systematic Data Collection and Analysis

RTRC built on the efforts of the first project by refining the measures, data elements, and T-PART to enable complete data collection from each of the EB TNGP grantees on all of their grant-funded telehealth encounters. To that end, the data elements were reviewed for feasibility by comparing them with Centers for Medicare & Medicaid Services (CMS) quality measures. In addition, the incidence of presenting complaints in rural EDs was reviewed to target clinical measures that would yield adequate data for statistical analysis. The revised set of data elements, a training manual, and the T-PART tool were pilot-tested by all six grantees.

Final List of Data Elements for Systematic Data Collection and Analysis

Table 1 presents the final set of 45 data elements identified by RTRC for data collection by the EB TNGP grantees. Four of the data elements were collected to describe the study sample. Clinical process measures were included for specific time-urgent intervention conditions (acute myocardial infarction, chest pain, severe sepsis/shock, and stroke) using existing CMS quality measures. Doing so reduced additional data reporting burden because hospitals were already reporting these clinical process measures to CMS. All but three of the data elements were standard items reported in ED electronic medical records. One exception was the Emergency Severity Index, which is used in larger EDs but not standard in small rural EDs (Gilboy et al., 2011). The other exceptions were two data elements related to charges, which required accessing billing data that often lagged clinical data by a month or more. In total, the elements allowed data to be collected at the necessary level for subsequent statistical analysis and reporting of project findings. RTRC created a dictionary of all data elements to define terms, indicate allowable values, and provide abstractor notes. Data use agreements were established between RTRC and each grantee, and all involved entities secured Institutional Review Board Human Subject Review approval. To facilitate both the signing of the data use agreements and Institutional Review Board approval, no protected health information was involved and data were de-identified prior to transmission to RTRC. EB TNGP grantees were expected to use the T-PART to collect the defined data elements from their rural hospital partners, and to export and submit on a scheduled basis de-identified visit-level data files to RTRC for analysis. RTRC performed data monitoring and management activities to verify data accuracy, completeness, consistency, and timeliness.

Use of Data Elements for Addressing Research Questions in the EB TNGP

The ultimate goal of RTRC's project was to conduct comparative effectiveness analysis to help establish the evidence base for tele-ED. That work was carried out by incorporating the revised data elements into the T-PART tool to obtain data on all tele-ED encounters and a comparison sample of non-tele-ED encounters from EB TNGP grantees. The data collection period covered November 2015 through December 2017. During this period, the EB TNGP grantees provided services to 4,324 tele-ED encounters. These cases and non-tele-ED control encounters for selected intervention conditions (acute myocardial infarction, chest pain, severe sepsis/shock, and stroke) were used for manuscripts on comparative effectiveness analyses of each of these conditions (Miller et al., 2020; Mohr et al., 2020; Swanson et al., 2019). In addition, manuscripts were published focusing on comparing and contrasting general tele-ED services with specialized tele-ED services for pediatrics (Weigel et al., 2019b) and behavioral health (Weigel et al., 2019a). Additional manuscripts were written describing the time to treatment (Heppner et al., in press) and the rate and effect of averted transfers. The findings from this EB TNGP effort have contributed substantially to the evidence base for tele-ED.

Notes

- Gilboy N, Tanabe T, Travers D, Rosenau A. *Emergency Severity Index (ESI): A Triage Tool for Emergency Department Care, Version 4. Implementation Handbook 2012 Edition*. Rockville, MD: Agency for Healthcare Research and Quality; 2011.
- Harris Y, Gilman B, Ward MM, Ladinsky J, Crowley J, Warren C, Caplan C, Ward MM. Building the evidence base for tele-emergency care: Efforts to identify a standardized set of outcome measures. *Telemed J E Health*. 2017; 23(7):561-6.
- Heppner S, Mohr NM, Carter KD, Ullrich F, Merchant KAS, Ward MM. HRSA's Evidence-Based Tele-Emergency Network Grant Program: Multi-site prospective cohort analysis across six rural emergency department telemedicine networks. *PLoS Medicine*, in press.
- Institute of Medicine. *The Role of Telehealth in an Evolving Health Care Environment*. Washington DC: National Academies Press; 2012.
- Miller A, Ward M, Ullrich F, Merchant K, Swanson M, Mohr N. Emergency department telemedicine consults are associated with faster time-to-ECG and time-to fibrinolysis for myocardial infarction patients. *Telemed J E Health*. 2020 Feb 28. DOI: 10.1089/tmj.2019.0273 [Epub ahead of print]
- Mohr NM, Campbell KD, Swanson MB, Ullrich F, Merchant KAS, Ward MM. Provider-to-provider telemedicine improves adherence to sepsis bundle care in community emergency departments. *J Telemed Telecare*. 2020 Jan 5. DOI: 10.1177/1357633X19896667. [Epub ahead of print].
- National Quality Forum. *National Voluntary Consensus Standards for Emergency Care: A Consensus Report*. Washington, DC: National Quality Forum; 2009.
- Swanson M, Miller A, Ward MM, Ullrich F, Merchant KAS, Mohr N. Emergency department telemedicine consults consistently decrease time to head CT interpretation in a multi-network cohort. *J Telemed Telecare*. 2019. DOI: 10.1177/1357633X19877746. [Epub ahead of print].
- Ward MM, Jaana M, Natafagi N. Systematic review of telemedicine applications in emergency rooms. *International J Medical Informatics*, 2015; 84(9):601-16.
- Weigel P, Bhagianadh D, Merchant KAS, Wittrock A, Rahmouni H, Bell M, Laws S, Ward MM. Tele-Emergency behavioral health in rural and underserved areas. *J Telemed Telecare*. 2019a. DOI: 10.1177/1357633X19887027. [Epub ahead of print].
- Weigel PA, Merchant KAS, Wittrock A, Kisse J, Ullrich F, Bell A, Marcin J, Ward MM. Paediatric tele-emergency care: A study of two delivery models. *J Telemed Telecare*. 2019b. DOI: 10.1177/1357633X19839610. [Epub ahead of print].

Table 1: Data Elements in the T-PART Version 2 for Data Collection by the EB TNGP Grantees

Variable name		Brief variable definition
1	ED visit arrival time	Enter the time the patient checked into the ED or arrived by ambulance.
2	ED visit arrival day of week	Enter the day of the week the patient checked into the ED.
3	ED exam start time	Enter the time the patient was first examined by a clinician.
4	ED visit departure time	Enter the time the patient left the ED.
5	ED visit departure day	Enter the day of the week the patient left the ED.
6	ED discharge disposition	Enter the patient's discharge status from the ED.
7	Tele-ED consultation	Identify whether the patient received tele-ED consultation during the ED visit.
8	Tele-ED consultation start time	Enter the time the tele-ED consultation started (when the tele-ED physician first meets with the patient or clinician, or first reviews patient information).
9	Tele-ED consultation end time	Enter the time the tele-ED consultation ended. The consultation ends when the tele-ED physician has completed all tele-ED services associated with the patient.
10	Tele-ED technical success	Indicate whether the voice and video quality were sufficient to complete the tele-ED consultation.
11	Averted local admission	Indicate whether the tele-ED consultation averted local admission (for tele-ED patients who were treated and released only).
12	Averted transfer	Indicate whether the tele-ED consultation averted inpatient transfer.
13	Transfer mode of transportation	Enter the mode of transportation to the receiving inpatient facility to which the tele-ED patient was taken (for tele-ED patients with a transfer only).

	Variable name	Brief variable definition
14	Transfer distance	Enter the distance (in miles) to the receiving inpatient facility (for tele-ED patients with a transfer only).
15	Age	Select the patient's age category.
16	Sex	Select the patient's sex.
17	Race	Select the patient's race.
18	Ethnicity	Select the patient's ethnicity.
19	Reason for visit	Indicate the main reason for the patient's visit.
20	Principal diagnosis	Indicate the principal ICD-10 code for the ED visit.
21	Emergency severity index	Select the patient's emergency severity index (ESI) level.
22	Chest pain symptoms	Indicate if the patient had symptoms of chest pain. (Used for skip logic below)
23	Acute myocardial infarction	Indicate if the patient had acute myocardial infarction. (Used for skip logic below)
24	ECG performed	Indicate if the patient received an ECG.
25	ECG time	Enter the time the patient received an ECG.
26	Aspirin received	Indicate if the patient had aspirin within 24 hours of ED arrival or before ED transfer.
27	Fibrinolytic administration	Indicate if the patient received fibrinolytic therapy.
28	Fibrinolytic administration time	Enter the time the patient received fibrinolytic therapy (for patients who are eligible for fibrinolytic therapy only).
29	Stroke	Indicate if the patient had a stroke. (Used for skip logic below)
30	Stroke Symptom – time last known well	Enter the time that the patient was last known to be without the signs and symptoms of the current stroke.
31	Last know well week day	Enter the day of the week that the patient was last known well.
32	Head CT scan ordered	Indicate if the patient received a CT.
33	Head CT scan time	Enter the time the patient received CT.
34	Head CT interpretation time	Enter the time a CT was interpreted.
35	tPA initiation	Indicate if the patient received tPA.
36	tPA initiation time	Enter the time the patient received tPA treatment (for patients who are eligible for tPA).
37	Severe sepsis or septic shock	Indicate if the patient had severe sepsis or septic shock. (Used for skip logic below)
38	Sepsis lactate	Indicate if lactate level was measured within 3 hours.
39	Sepsis blood culture	Indicate if blood cultures were drawn prior to antibiotics.
40	Sepsis antibiotic	Indicate if broad spectrum antibiotics were administered.
41	Sepsis fluid resuscitation	Indicate if resuscitation with 30 mL/kg crystalloid bolus was administered if septic shock is present.
42	Primary payer	Select the primary payer billed for the ED visit.
43	CPT code	Select the CPT code for the ED visit.
44	Billed amount for CPT code for the ED visit	Enter the amount billed for the CPT code for the ED visit.
45	Total billed amount for ED visit	Enter the total amount billed for the ED visit (do not include professional charges).

The study described in this article was funded by the Federal Office of Rural Health Policy (FORHP), Health Resources and Services Administration (HRSA), U.S. Department of Health and Human Services (HHS) under cooperative agreement number 6 UICRH29074-01-01. The views expressed in this research brief are those of the authors and do not necessarily reflect official policies of HHS or HRSA, nor does mention of the department or agency names imply endorsement by the U.S. Government.