NATIONAL QUALITY FORUM
Driving measurable health improvements together

Attribution for Critical Illness and Injury

FINAL ENVIRONMENTAL SCAN REPORT

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Contents

Executive Summary

Attribution is a method used to assign patients and their outcomes to providers or entities for measuring quality of care or determining reimbursement. Many patient attribution approaches used today focus on chronic conditions and assign responsibility for care and outcomes of patients to a single provider or provider group. These attribution models are often designed by public or private payers, and accountability is often based on patients' pre-existing affiliations with health plans and health systems.

As the United States (U.S.) healthcare system increasingly links payment to quality, this project aims to provide an essential foundation for best attributing patients and care in complex situations involving multiple entities. Two such situations are public health emergencies and high-acuity emergency events. In a public health emergency, government entities (i.e., federal, state, and local) and multiple private healthcare systems and entities within them may respond to the event and provide care. High-acuity emergency events, such as a severe motor vehicle collision involving multiple patients, also involve many providers, including prehospital, emergency department (ED), hospital, and post-acute care staff. In these larger, complex, and unplanned situations, questions exist about how to appropriately attribute quality and outcomes, as well as reimbursement, across the myriad of entities involved. Appropriate attribution methods would advance quality improvement efforts and support cooperation of entities during all phases of response.

With funding from the Centers for Medicare & Medicaid Services (CMS), the National Quality Forum (NQF) is exploring attribution for such complex situations, with the focus on high-acuity emergency care sensitive conditions (ECSCs) (e.g., trauma, burn) and mass casualty incidents (MCIs), such as the current coronavirus disease 2019 (COVID-19) pandemic, bombings, or natural disasters. Care for these conditions and events is often organized based on the availability of providers in the geographic areas where the injury or event occurs. Multiple entities and providers, affiliated with different healthcare, public safety, or other first responder organizations, are involved in the rescue, transportation, and treatment of patients. An ill or injured person's health outcomes and survival often hinge on the ability of different organizations within a geographic region to coordinate as a single system.

Although there is limited evidence to support the best quality measurement attribution method for MCIs and emergencies, this environmental scan highlights related findings to advance multistakeholder dialogue on appropriate approaches. This report summarizes findings from 38 articles on readiness, emergency care survival, ECSCs, attribution, transport, COVID-19, hospital service area/geographic variation, disaster response, trauma care access, quality frameworks, and federal emergency care. It includes 128 existing quality measures that could be used to assess the provision of emergency care. It also outlines key themes for building attribution models for emergencies: establishing the goal, defining the population/geographic regions as well as the teams involved in response, timing, data considerations, incentives, and unintended consequences. These themes center on the prevailing finding that novel attribution approaches should recognize the unpredictability of large-scale emergencies and encourage all entities in a region to proactively plan together for these events. The Attribution for Critical Illness and Injury Committee will discuss these findings and develop recommendations for the future development of new attribution methods for ECSCs and MCIs that promote team-based, patient-centered care and align incentives to achieve optimal health outcomes.

Introduction

As the U.S. healthcare system moves toward more advanced value-based models, quality measurement and reimbursement approaches that attribute patients are becoming increasingly important. Attribution is the methodology used to assign patients and their quality and cost outcomes to providers or clinicians.[1] Most attribution approaches in use today assign patients to a single, central unit (e.g., primary care provider) for outcomes related to chronic conditions. The method used for patient attribution is important, as evidence indicates that the model used influences measure performance results and reimbursement (e.g., shared savings, rewards, or penalties).[2] In the context of value-based payment, attribution approaches determine which provider or group of providers is assigned the responsibility for observed care processes, outcomes, and costs. Attributed providers may be ultimately rewarded or penalized based on performance results. Conversely, nonattributed providers who also participated in care may not be measured directly; thus, neither is rewarded nor penalized. Trade-offs clearly occur when designing and selecting an approach of shared accountability across multiple providers.

Certain attribution approaches may help to incentivize providers to work together to ensure better health outcomes for their patients. For example, in a bundled payment model or an episode-based payment model, attributed clinicians working across an episode are incentivized to deliver care more efficiently. Some of these models have proven effective. For example, a recent evaluation of bundled payments for orthopedic and surgical procedures studied negotiated preferred prices for selected providers and all related care (i.e., attributed providers) within 30-days post procedure.[3] After the program was implemented, episode prices for three surgical procedures declined by more than 10 percent. State-level attribution has also been effective in reducing costs. Maryland's Global Budget Revenue (GBR) model, for example, uses global payments attributed to a hospital's entire population rather than paid through traditional fee-for-service reimbursement.[4,5] While there has been considerable attribution of care to fiscal entities (e.g., accountable care organizations [ACOs], hospitals), work to date has revealed there is no gold standard attribution approach for quality and outcomes when multiple providers are involved across time and geography.

Attribution issues are particularly relevant in high-acuity emergency illness and injury (e.g., trauma, burn, stroke, prehospital cardiac arrest, and acute myocardial infarction)—termed *emergency care sensitive conditions* (ECSCs)—and public health emergencies, such as the COVID-19 pandemic.[6] Care for these scenarios is frequently driven by proximity[7,8] or system factors, such as Emergency Medical Services (EMS) destination protocols or post-acute care referral patterns.[9] These events often involve multiple providers and entities that span different healthcare systems and organizations. Organizations must work together before disasters occur and organize systems (e.g., trauma or stroke systems) to deliver care effectively. In such cases, a population/geographical-based attribution approach that assigns patients to a provider/entity based on patient location may be preferred. This approach may incentivize *co-opetition*, the concept of care coordination at the system or regional level as opposed to the individual provider level, and increase healthcare system readiness.

Background

This project builds on foundational work on attribution that established a framework for attributing care to providers or entities and strengthening attribution in measurement programs. Previous work funded

by CMS, NQF's Attribution: Principles and Approaches (2016), provided guidance to the field on selecting and implementing attribution models, including an Attribution Model Selection Guide that specified the necessary elements of an attribution model. A subsequent project, Improving Attribution Models (2018), put forward additional considerations for the design of attribution models specific to patients with multiple chronic conditions, substance use disorders, physical or intellectual/development disabilities, and the dual-eligible population.

In 2019, NQF, with funding from CMS, also published a measurement framework for healthcare system readiness that considers approaches to care delivery and the organization of resources prior to, during, and after emergencies or disasters. Measuring the quality of a healthcare system's "readiness" is key to ensuring that the health of individuals in a community is maintained and that individuals with health needs receive appropriate and time-sensitive care during emergencies. Other works on emergency care transitions and population-based trauma outcomes have also stressed the importance of population-based care and measurement approaches in emergency situations. While these foundational efforts have helped to form the basis for population-health focused measurement, current attribution approaches do not focus on the community or geographical level, such as regional accountability.

Performance measurement systems that assess response and quality of care for acute illnesses and injuries and public health emergencies are limited. Considering who should be held accountable for morbidity and mortality in mass casualty incidents (MCIs) is both conceptually and technically complex. Localized emergencies and larger threats to health, such as mass casualty events or public health emergencies, require a system-wide response, including timely diagnosis, tracking, interventions, and coordination, to achieve quality patient outcomes. Furthermore, treatment models across regions and settings in which care is provided may be altered when such emergencies arise. Data sharing issues may also pose a challenge to attributing ECSC-related outcomes when patients receive treatment from multiple providers who may not belong to the same healthcare system or organization and whose electronic health records (EHRs) may not be interoperable.

Accordingly, measurement approaches for emergency care should account for the contributions of various entities involved in quality emergency response to achieve the best health outcomes. At least 14 federal departments (Appendix B), in addition to healthcare and public health organizations at the state and local levels, play an important role in emergency preparedness, response, and recovery.[10] There is a need to incentivize a comprehensive, team-based approach to care delivery for emergencies through approaches that appropriately attribute outcomes to those providers or entities that can have influence over them. Current measurement attribution approaches do not account for shared accountability across multiple entities involved in, preparing for, responding to, and providing care, which reduces their applicability to assessing quality of care for emergencies, such as critical illnesses or injuries, infectious diseases, public health emergencies, and mass casualty events. Measurement science must continue to evolve to ensure attribution methods are of sound design and create aligned incentives across the healthcare system to achieve the best outcomes for patients.

For this effort, NQF will build on previous work developing guidance for attribution and emergency care measurement. This project will help to assess and illustrate system-level healthcare quality during emergencies and support future adoption of attribution approaches that account for a team-based approach to emergency care in value-based models. Evidence to support the best way to attribute patients for ECSCs and MCIs is limited; therefore, NQF seeks to establish consensus-based

recommendations for developing measurement attribution approaches for emergencies. These recommendations would help to incentivize multiple stakeholders involved in care delivery to work collaboratively in an integrated, population health-focused manner to improve patient outcomes. To accomplish this goal, NQF, with funding from CMS, convened a multistakeholder Committee (Appendix A). The Committee will provide input and guidance on developing geographical/population-based attribution models applicable to quality measurement of emergency care.

This environmental scan provides the Committee with a comprehensive understanding of goals, approaches, and challenges in the development of geographical/population-based quality measure attribution approaches related to care for emergencies. It summarizes information that can inform how to leverage attribution in quality measurement to encourage various entities within a geographic area to act as a single system to respond to mass casualty events. Specifically, this environmental scan reviews and synthesizes the following items:

- Guidance for healthcare system readiness and emergency response, including the various ways in which a patient's outcomes are linked to a provider
- Frameworks for creating attribution models and how they relate to assessing quality of care for high-acuity ECSCs
- Measures related to healthcare system readiness and emergency care
- Program or measure attribution approaches that include geographic- or population-based approaches or assign patients to multiple entities

The results of the environmental scan will be used to inform a report that documents the Committee's recommendations on the necessary elements and theoretical and empirical approaches for the development of population/geographic-based quality measurement attribution approaches for emergency care. This work will help to advance the development of attribution approaches that encourage care coordination, are population health-focused, and can be used to strengthen accountability at the system level and across payers to improve outcomes for patients with ECSCs. CMS may consider and test these attribution recommendations in the design of measurement approaches and programs in the future. This work can also support how private sector entities think about attribution for unplanned emergencies and serve as an input to developers working on measures related to emergency response and emergency-focused care.

Approach

The environmental scan was conducted using three interrelated approaches. First, NQF reviewed and summarized the body of literature related to regional- or team-based emergency response and relevant attribution considerations. Second, a scan of existing quality measures for high-acuity emergencies was performed. Third, NQF identified examples of existing attribution approaches that contain population- or team-based components. Each of these approaches is outlined below.

Literature Review Methods

A structured PubMed search was conducted of available literature published in English over the last five years to identify studies reporting ECSC and attribution model development that consider healthcare system readiness and geographic- or population-based approaches within quality performance measurement. Search terms included a series of terms for health system readiness, emergency

preparedness, emergency response, and attribution. For health system readiness, search terms for emergency preparedness and emergency response works included the following: quality measurement of high-acuity emergency care sensitive conditions; emergency preparedness measurement; public health emergency preparedness measurement; health system readiness measurement; emergency response measurement; public health emergency performance measurement; emergency preparedness performance measurement; health system readiness performance measurement; emergency response performance measurement; ECSC measurement; ECSC measures; ECSC preparedness; ECSC readiness; and ECSC response measurement. For attribution works, search terms included the following: attribution approaches for health outcomes; public health attribution approaches; health quality attribution; health system-level attribution approaches; emergency care attribution; and population-level attribution models. These terms were searched independently of each other to examine the breadth of articles available.

A "snowball" approach was utilized to identify relevant documents from seminal reports identified by experts, as well as related articles that were uncovered during the PubMed search and references within articles. A grey and white literature search to identify documents of websites from federal agencies and organizations, such as CMS, the U.S. Department of Health and Human Services (HHS), and NQF, was conducted. This literature is inclusive of resources for health system readiness/emergency preparedness protocols and approaches to attribution/creating attribution models. Lastly, NQF consulted experts in the field, including the Committee, to identify additional literature for inclusion.

Studies were screened for relevance based on the following inclusion and exclusion criteria:

Inclusion Criteria:

- Literature focused on U.S. healthcare system
- Literature that included empirical testing literature focused on emergency response development and considered healthcare system readiness and geographic- or population-based approaches within quality performance measurement
- Literature focused on attribution model guidance within quality performance measurement

Exclusion Criteria:

- Literature published prior to 2015 (unless considered as seminal works)
- Literature not in the English language
- Literature not focusing on or not inclusive of the U.S. healthcare system
- Literature focused on approaches to ECSC and attribution modeling not within the context of quality performance measurement
- Literature not focusing on or inclusive of healthcare system readiness and geographic- or population-based approaches within quality performance measurement
- Literature that consists of opinion papers, blogs, and/or comments
- Literature that does not include empirical testing

Measure Scan Methods

In addition to literature, NQF also conducted an environmental scan to identify available performance measures focused on ECSCs and their accountable units. This information provides a baseline of measures that could be used in a measurement system for emergency care and helps to establish how

current measures attribute responsibility for various aspects of emergency care. NQF's scan for measures included the NQF's Quality Positioning System (QPS), CMS Measure Inventory Tool (CMIT), American College of Emergency Physicians (ACEP), Clinical Emergency Data Registry (CEDR), Qualified Clinical Data Registry (QCDR), the National EMS Quality Alliance, and NQF's 2019 Healthcare System Readiness Report. Search terms to identify such measures included trauma, stroke, cardiac arrest, high-consequence infectious diseases, radiation or chemical exposure, bombings, natural disasters, motor vehicle accident, sepsis, mass shootings, epidemics, COVID-19 pandemic, emerging infectious disease, pediatric critical care, infectious disease, overdose, train derailment, mass casualty, gunshot wound, myocardial infarction, septic shock, ED, and EMS. NQF also searched all NQF-endorsed measures specified at the population level of analysis (i.e., community, county, city, regional, and state) as these measures may provide examples of models applicable to attribution for ECSCs since they are aggregated at a higher level.

Measures were included if they were current and applicable to the specific high-acuity ECSC focus of this work. Some measures identified using the search terms above were deemed not clinically relevant. For example, when searching *emergency department* within CMIT, 111 results populated; measures related to chronic home health care, visits for patients receiving outpatient chemotherapy, and follow-up visits for patients with multiple chronic conditions were excluded.

Attribution Model Review Methods

The method used to identify attribution models used in programs or in individual performance measures was an iterative process. This review was not intended to comprehensively include all existing attribution approaches currently in use. The Committee was interested in identifying illustrative approaches that either attribute patients and/or assign responsibility at the geographic or population level, or models that attribute patients to multiple entities. The Committee considered measurement reporting or value-based programs focused on higher levels of accountability, such as at the federal, individual state, Accountable Care Organization (ACO), or health plan level. First, the 2016 Attribution Report was reviewed; then an internet search was conducted to identify other programs/models. Internet search terms included the following: patient attribution; attribution healthcare measurement; multiple attribution healthcare measurement; medical attribution; geographic attribution; population attribution; and attribution emergency care. NQF's QPS was searched to identify select examples of measures specified at the population level of analysis and to gather information related to their attribution approaches.

Environmental Scan Findings

Literature Review Findings

Thirty-eight articles were included in the literature review (Appendix C). Eleven key themes emerged during the literature review: (1) emergency preparedness, (2) emergency care survival, (3) ECSCs, (4) attribution approaches, (5) emergency medical transport (EMT), (6) COVID-19, (7) hospital service area/geographic variation, (8) natural disaster response, (9) access to trauma care, (10) quality framework, and (11) federal emergency care. Table 1 depicts the themes in the literature and the associated articles for each theme.

Table 1 – Key Themes of Literature Review

Theme	Title	Year
Readiness	Pandemic influenza and major disease outbreak preparedness in U.S. emergency departments: A survey of medical directors and department chairs[11]	2020
	Pandemic influenza and major disease outbreak preparedness in U.S. emergency departments: A selected survey of emergency health professionals[12]	2020
	Emergency Preparedness and Mass Casualty Considerations for Anesthesiologists[13]	2018
	Pharmacy Emergency Preparedness and Response (PEPR): a proposed framework for expanding pharmacy professionals' roles and contributions to emergency preparedness and response during the COVID-19 pandemic and beyond[14]	2021
Emergency Care Survival	Measuring Emergency Care Survival: The Implications of Risk-Adjusting for Race and Poverty[15]	2018
ECSCs	Defining the Emergency Care Sensitive Condition: A Health Policy Research Agenda in Emergency Medicine[6]	2010
	Quality Through Coopetition: An Empiric Approach to Measure Population Outcomes for Emergency Care-Sensitive Conditions[16]	2018
	Evidence-Based Emphasis: Improving systems of care in time-sensitive emergencies[17]	2017
	Identification of Emergency Care–Sensitive Conditions and Characteristics of Emergency Department Utilization[18]	2019
Attribution Approach	The impact of interhospital transfer on mortality benchmarking at Level III and IV trauma centers: A step toward shared mortality attribution in a statewide system[19]	2020
	Primary Care Selection: A Building Block for Value-Based Health Care[20]	2019
	The Challenge of Attribution: Responsibility for Population Health in the Context of Accountable Care[21]	2012
	Patient Attribution: The Model for all Value-based Care[22]	2018
	Raising the Bar in Attribution[2]	2017
Emergency Medical Transport	Geographic Discordance Between Patient Residence and Incident Location in Emergency Medical Services Responses[9]	2017
	Association of Race/Ethnicity With Emergency Department Destination of Emergency Medical Services Transport[23]	2019
	Emergency Medical Services Response Times in Rural, Suburban, and Urban Areas[24]	2017
	Description of Medication Administration by Emergency Medical Services during Mass-casualty Incidents in the United States[25]	2016
	Description of procedures performed on patients by emergency medical services during mass casualty incidents in the United States[26]	2015

COVID-19	A Rapid Assessment of Disaster Preparedness Needs and Resources during the COVID-19 Pandemic[27]	2021
	Rapid deployment of an emergency department-intensive care unit for the COVID-19 pandemic[28]	2020
	Factors associated with hospital admission and critical illness among 5279 people with coronavirus disease 2019 in New York City: prospective cohort study[29]	2020
	Return Hospital Admissions Among 1419 COVID-19 Patients Discharged from Five U.S. Emergency Departments[30]	2020
	Analysis of Hospital Resource Availability and COVID-19 Mortality Across the United States[31]	2021
Hospital Service Area/ Geographic Variation	A systematic review of the magnitude and cause of geographic variation in unplanned hospital admission rates and length of stay for ambulatory care sensitive conditions[32]	2015
	State of the National Emergency Department Workforce: Who Provides Care Where?[33]	2018
	Do Hospital Service Areas and Hospital Referral Regions Define Discrete Health Care Populations?[34]	2015
	Who provides what care? An analysis of clinical focus among the national emergency care workforce[35]	2020
Disaster Response	The Role of Telehealth in the Medical Response to Disasters[36]	2018
	Telemedicine in the intensive care unit: its role in emergencies and disaster management[37]	2015
	Virtual First Responders: the Role of Direct-to-Consumer Telemedicine in Caring for People Impacted by Natural Disasters[38]	2018
	Hurricane Impact on Emergency Services and Use of Telehealth to Support Prehospital Care[39]	2020
Access to Trauma Care	Disparities in access to trauma care in the United States: A population-based analysis[7]	2017
	Race/Ethnicity and Geographic Access to Urban Trauma Care[8]	2019
Quality Framework	Value-Based Approaches for Emergency Care in a New Era[40]	2017
	A Quality Framework for Emergency Department Treatment of Opioid Use Disorder[41]	2019
Federal Emergency Care	Emergency care and the national quality strategy: highlights from the Centers for Medicare & Medicaid Services[42]	2015
	The U.S. Emergency Care Coordination Center[43]	2017

Articles in the literature review related to access to trauma care examined the geographic, demographic, and socioeconomic disparities in access to such care in the U.S. and found that disparities exist for vulnerable populations as defined by insurance status, income, and rurality.[7] In terms of disparities by

race/ethnicity, Black-majority census tracts are associated with disparities in geographic access to trauma centers.[8]

Readiness articles that were identified through the literature review focused on major disease outbreak preparedness and emergency preparedness for specific professions. For instance, one article detailed a framework to integrate pharmacy professionals with interdisciplinary public health teams to provide improved patient care and population health interventions.[14] Another article looked at the preparations that anesthesiologists should undergo for mass casualty events and emergency responses.[13] Several articles assessed the preparedness of EDs for disease outbreaks and identified that major gaps exist in terms of planning among hospitals.[11,12] Moreover, barriers exist in emergency preparedness among hospitals, and several that have been identified include challenges in funding, a lack of dedicated disaster preparedness personnel, communication among disaster response agencies, and local administration support.[12]

Articles that described ECSCs utilized empiric approaches to propose improved systems of care for dealing with ECSCs.[17] One study used cluster analysis to identify regional use patterns for emergency conditions that require a community-wide system response.[16] Additionally, another article identified and examined those conditions for which morbidity and mortality are associated with timely access to high quality emergency care and determined the characteristics of ED visits for those conditions.[18] ECSC-related ED visits had longer lengths of stay and higher charges associated with them on average when compared to non-ECSC visits.[18]

Attribution approaches in the literature vary from attributing care through transfers between hospitals to models for value-based healthcare. Injured patients may be transferred between hospitals; therefore, the timing of measurement for attributing care is important in this scenario. The literature appreciates the challenge of developing an attribution system across the continuum of care, and one proposed methodology for attributing care is to allow providers throughout the continuum to understand how they perform relative to other providers while accounting for the variability present in other phases of care.[19] A different attribution approach that can be undertaken is that of co-opetition, in which patterns of hospital use for ECSCs define emergency care service regions and are then benchmarked referent to other regions.[16] Federally, HHS has emphasized the importance of tying Medicare payments to quality and shifting a significant amount of its payments to alternative payment models, such as ACOs and bundled payments for improved coordination and integration of care.[2]

Articles that assessed hospital service areas and geographic variation have found differences in the provision of emergency care and staffing. An examination of the current ED workforce throughout the U.S. found that there are notable differences between urban and rural areas and the type of clinicians staffing emergency care departments.[33] Furthermore, clinical focus among the national emergency care workforce varies in that emergency medicine physicians have double the clinical focus when compared to nonemergency medicine physicians who provide emergency care.[35] These differences can be used to identify best structure and process standards for EDs. Other articles have called for geographic models to account for differences between emergent and nonemergent care,[33] as the accountable geographic units that are in current use, such as Hospital Service Areas and Hospital Referral Regions, vary in their ability to describe where patients receive their hospital care.[34]

Emergency care survival measurement in the literature appreciates risk adjustment for sociodemographic variables, such as race, ethnicity, and poverty, when analyzing ECSC mortality. Sociodemographic risk adjustment has been found to improve the apparent performance of some hospitals that treat a substantial population of non-White, Hispanic or poor patients, leading to the potential to affect pay-for-performance initiatives.[15] However, debate exists regarding the appropriateness of utilizing social risk adjustment in healthcare performance measurement.[44]

Emergency medical transport articles have described the medications and procedures that are commonly administered during MCIs by emergency transport personnel. While medications such as oxygen, crystalloids, and narcotic pain medications are frequently administered in MCIs, advanced EMS procedures are infrequently administered during MCIs.[25] Additionally, geographic discordance has been reported between a patient's residence and incident location in EMS responses, as this proxy is valid for elderly populations but less likely to hold true for other age groups.[9] Likewise, emergency medical response times differ for rural, urban, and suburban areas. Likely due to structural and resource constraints, rural areas have more than double the median EMS response time, with 10 percent of encounters waiting almost half an hour for the arrival of EMS personnel.[24] Another study examined the association between race and ethnicity with EMS transport and ED destinations and found considerable differences in ED destinations on the basis of race and ethnicity for Medicare patients residing in the same ZIP codes. Black and Hispanic patients were more likely to be transported to a safety-net ED when compared to White patients in the same ZIP code.[23]

Articles that describe disaster responses have illustrated the role of telehealth in disaster management and response. The use of telehealth options during disaster responses has been increasing, as it allows for a response from outside the affected community[36], thus decreasing the likelihood of having an overburdened healthcare system after a disaster, as well as increasing patient outcomes.[37] Telemedicine further aids in disaster response and recovery by improving patient triage, monitoring, and access to specialists, as well as decreasing healthcare provider burnout.[37] Furthermore, telemedicine can address issues with triage, stabilization, and diversion during natural disasters. Telehealth options may be provided in association with state and local emergency management operations through various shelters, as well as during other emergency medical responses.[39] Additionally, telehealth usage provides the ability to expand the health workforce response both quickly and cost effectively, with the substantial caveat being that the response requires infrastructures such as Wi-Fi or cellular service to remain in place.[38]

While previous disaster responses have enabled community-based organizations to respond to the COVID-19 pandemic, the pandemic has also created new challenges to preparing for and responding to natural disasters.[27] The COVID-19 pandemic required quick and flexible solutions to meet the flood of ED patients who presented with the disease, both in terms of acuity and volume. This mandated the creation of proactive and innovative solutions by EDs for critically ill patients. One approach that was undertaken was the creation of a temporary ED intensive care unit (ICU) and development of interdisciplinary COVID-19-specific care delivery models to care for critically ill patients.[28] This involved the conversion of the ED observation unit into a COVID-19 specific unit, as well as an increase in staff and training in critical care protocols and procedures.[28] Other studies have looked at the factors that are associated with hospital admission and critical illness among COVID-19 patients. Trepidation over surges in hospital occupancy require emergency providers to preserve inpatient resources and determine which patients benefit most from hospital admission.[30] While age and comorbidities were initially found

to be predictors of hospital admission, critical illness, and mortality among COVID-19 patients, patient outcomes seem to be improving over time, suggesting improvements in care.[29] Moreover, early excess death among hospitalized COVID-19 patients resulted from limited hospital resources and underscores that the effect is reduced as hospitals create innovative hospital capacity protocols and care models that increase resource flexibility and limit system overload.[31]

Quality framework articles that were identified through the literature review have utilized value-based approaches for the integration of emergency care with other healthcare delivery settings. For instance, the Merit-Based Incentive Payment System from the Medicare Access and Children's Health Insurance Program Reauthorization Act can be used as a framework for improving the value of emergency care and incorporating quality and resource use measures across healthcare delivery systems.[40] Such models encourage care coordination between emergency care and primary and subspecialty care, as well as facilitate the conception of health information exchange systems, leading to quality improvement.[40] Another article detailed the creation of a multistakeholder quality improvement framework for ED treatment of opioid use disorder. This framework requires the coordination of numerous parties, such as clinicians, hospitals, and EHR vendors, and highlights the importance of creating cross-sector partnerships to develop an emergency care learning healthcare system.[41]

Articles on federal emergency care mention the complexity of the federal government's role in delivering emergency care in the U.S. The U.S. Emergency Care Coordination Center (ECCC) is an example of a federal initiative that oversees the management of infectious diseases that threaten the public's health within the private sector healthcare system; the ECCC has collaborated with leadership within the Hospital Preparedness Program (HPP) to develop healthcare coalitions, as well as the American Burn Association on surge management. The Center also works on the development of crisis standards of care, as well as ED and hospital post-incident assessment tools.[43] All six of the priorities from the National Quality Strategy are affected by emergency care provision, given its span across clinical conditions and multiple settings of care.[42]

Measures Related to Emergency Response

A full list of measures related to emergency response, public health emergencies, and relevant acute or high-acuity emergency conditions can be found in Appendix D. The tables below quantify the measures located in the scan by search term or source to show the current scope and topic area of each measure, the level of analysis to connect accountability, and the type of measure for alignment of goals and progress.

Table 2 – Measure Scan Findings Quantified by Search Term or Source

Search Term / Source	Count of Measures (n=128)
Stroke	26
Infectious Diseases	18
NQF Healthcare System Readiness Report (2019) (Source)	17

Clinical Emergency Data Registry (Source)	15
Myocardial Infarction	15
National EMS Quality Alliance (Source)	11
Sepsis and Septic Shock	10
Population: Community, County or City, Population: Regional and State	8
Trauma	3
ED	3
Emergency Medicine	1
Cardiac Arrest	1

Table 3 – Measure Scan Findings Quantified by Level of Analysis

Level of Analysis (if available)	Count of Measures (n=160)*
Facility	66
Population	23
Population: Regional and State	17
Population: Community, County, or City	6
Clinician: Group/Practice, Individual	23
Individual EMS Professional, EMS Agency	11
Health Plan	9
Integrated Delivery System	9
Other	19

*Count total is higher than total measures included due to some measures being applied to multiple levels of analysis.

Table 4 – Measure Scan Findings Quantified by Measure Type

Measure Type (if available)	Count of Measures (n=128)
Process	63
Outcome	58
Structure	5
Composite	2

Additionally, NQF's Healthcare System Readiness Report put forward many measure concepts that can be further developed and included as part of an all-hazards measurement system to assess healthcare system readiness. Since the measure concepts are not fully developed, they were not included in the measure list. Nevertheless, the concepts remain relevant, and this project may help to advance their development by considering the appropriate level of accountability for certain aspects of emergency response.

Measurement Program and Model Attribution Findings

Our search resulted in several illustrative examples of attribution approaches that incorporate population/geographic methodology. Although our findings are not exhaustive, they are intended to serve as examples of approaches. Appendix E describes the attribution details of six programs and five individual measures. Four of the programs are Medicaid models, one is a new federal approach being tested, and the remaining one is a state-level public reporting initiative. No models were identified that attribute patients and their outcomes based on geography or to multiple providers, specifically for emergency conditions, public health emergencies, or unplanned, acute events. Nonetheless, components of existing population or geographic-based approaches may generally be applicable to the future development of quality measure attribution for emergencies.

Geographic-Based Approaches

Geographically-defined[45] state Medicaid models provide examples in which patients may be attributed based on where they live versus which providers they use. This approach may incentivize greater collaboration with public health agencies that track patient outcomes based on geography.[21] Using a global or geographic budget approach may drive organizations to coordinate care to address the needs of patients in a community. Even models that include a global or geographic payment approach to establish partnerships with accountable organizations seem to employ a different method for attributing patients to the accountable organizations. However, components of these approaches may still be relevant to emergency response, which requires involvement from multiple people and agencies and varies from community to community.[46]

Geographic-based Direct Contracting (Geo) is an example of a new model that will be tested by the Center for Medicare & Medicaid Innovation (CMMI). The model assigns responsibility for the outcomes of patients in a defined geographic region. Direct Contracting Entities (DCEs) in Geo will assume financial risk in return for enhanced flexibilities, making it possible for these entities to offer Medicare beneficiaries an increased focus on care coordination through care delivery innovation.[47] This approach can drive greater coordination between healthcare providers and community resources to improve quality—incentives that are relevant to building attribution for improving the quality of system-level emergency care. Other components of this type of model include measures used to assess outcomes, regional boundaries, risk adjustment methods, and beneficiary incentives (e.g., engaging patients); these should be considered alongside attribution rules when designing a geographic-based model.

A 2018 report from the Society of Actuaries stated, "Geographic-based attribution is done through assignment of a network or use of zip code or county of residence, which has a high capture rate but lacks the sensitivity for reflecting care utilization across the spectrum."[22] Benefits of a geographic model include the potential to capture individuals who do not often interact with the healthcare system and incentivize a team-based model to care delivery for all patients within a region. A major complexity of developing a geographic-based model is determining the right level of granularity for accountability. Challenges of geographic attribution also include defining the "population"[21] and aligning the care and goals across both public health and healthcare delivery organizations. Aggregating the data of distinct practices in the same region, when clinically appropriate, may allow for sufficient volume for measurement and may be an option if the entities are working together to deliver care.[48]

Population-Level Measure Examples

There are 63 NQF-endorsed measures specified at the population level. Five select references of population-level measures are included to illustrate how individual measures assign outcomes at the population level (e.g., county, state level). The example population-level measures are intended for use in quality improvement efforts to improve care transitions and/or reduce hospitalizations. Unique regional patient characteristics should be considered if measures will be used to compare outcomes across, and hold accountable, entities at the regional level (e.g., local government, all health systems in a region, or various emergency response entities in a region). For example, a key consideration referenced during NQF's evaluation of several of these measures was that Medicaid benefits vary by state, and states have different definitions and eligibility requirements.[49] Geographic attribution may have variable applicability across regions. For example, using ZIP codes may be the best for attribution in certain areas, while using Metropolitan Statistical Area (MSA) may be more appropriate for others. Data standardization and availability across regions, as well as whether data can be shared with all entities responsible for patients within a region, will also need to be considered in building population-based measurement models for system-level care.

Attribution to Multiple Providers

Attribution to multiple providers, or a *one-touch* model, consists of methods relevant to this project objective. A one-touch attribution method can be generally defined as an approach that holds any healthcare entity responsible for a patient for whom they have provided care, resulting in multiple entities that may be responsible for the same patient. This attribution approach could potentially foster greater levels of accountability for all patients across the emergency delivery system. These approaches acknowledge that many patients receive care from more than one provider and may also more accurately reflect providers' actual patient pool. However, current attribution approaches assign patients to a single provider or entity. A 2016 NQF report found that of 30 implemented attribution models, only four (13.3 percent) attributed care to multiple providers.[1] An example of this method would be assigning an episode of care to each physician with more than 20 percent of claims dollars included in the episode, an approach used for network tiering, thereby providing physicians with feedback report and public reporting.[50] Models that attribute to multiple providers generally do not assign a different weight per provider. A recent article proposes advancing the concept of a weighted multi-attribution model (WMAM), in which organizations or providers would be measured on their actual contribution to care and outcomes for a specific patient.[51] Potential challenges of attributing multiple providers include the complexity involved in defining the team or multiple entities involved during a specific time period and determining who should be assigned responsibility and to what extent.[19,21,22,49] In addition, there may be challenges in capturing accurate and complete data, such as level of effort in terms of hours, level of cognitive effort, and devices or drugs each provider used during emergency situations, including mass casualty incidents.

Discussion

Key Themes

Several themes emerged during the environmental scan that should be considered when developing attribution approaches for emergency care and response. For each theme, several questions that warrant further discussion and preliminary considerations provided by the Committee can be found below.

Goal of the Attribution Methodology

What are the desired outcomes and goals of health systems during mass casualty events? Which entities provide care or services, and what should each entity be accountable for? What accountability mechanisms should be deployed?

The first step in developing a quality measurement attribution method is to identify the goal. There may be several goals of an attribution model for large-scale emergency events. For example, the goal may be to incentivize readiness for mass casualty events among entities in a region, to assess coordination across multiple healthcare and nonhealthcare entities (e.g., police, firefighters, EMTs, and public health departments), to determine if each entity involved in response is carrying out their responsibilities effectively, and/or to support longitudinal measurement of outcomes for patients across providers, settings, and time. Data collection and measure reporting during a mass casualty event should support entities' understanding of care quality without creating undue burden or shifting resources away from saving as many lives as possible and improving patient outcomes during emergency events.

Defining the Population/Geographic Regions

How should populations be defined and by what criteria should individuals be assigned to a particular population? Should all patients in a region be considered, or only those who interact with the medical system? How can we ensure an attribution approach is data driven? To what extent do existing data provide the information needed to support fair and accurate attribution for high-acuity ECSCs?

Determining the appropriate level of granularity is a key component of geographic-based attribution. ZIP codes, counties, and MSAs are examples of geographic units that can be considered, each with their own pros and cons. Data-driven approaches to attribution should consider existing patterns in patient healthcare use for ECSCs. In areas with overlapping EMS systems, hospital catchments, or other resources, overlap between entities is expected. The data approaches should account for this "within-area" overlap (i.e., identify all the resources that would be shared among a particular population when a disaster occurs).

Rather than limiting attribution to consistently using one unit (e.g., ZIP code, MSA), attribution could be built by "stacking" geographies that can be selected depending on the specific scenario. Geographic discordance should be thoughtfully considered. Different geographic populations have different needs, and patients may not receive care in the same region where they reside. Many rural areas do not have larger hospitals with access to the same resources or high-level trauma centers. During a mass casualty event, patients may require more resources and may need to be transferred out of a region. The region would have to possess a large enough span to include not only the people, but also the resources available to treat this same population when a mass casualty event occurs.

The start of the incident may also be the trigger to define the population. However, a mass casualty event can affect everyone in a region, regardless of whether that person interacts with a medical system regularly. Focusing only on patients who interact with a medical system could leave out people who would benefit from outcome measures to improve overall health and condition management without outcome representation. All people represent potential patients in these scenarios; the volume of patients in a mass casualty event or public health emergency is a function of the population, population density, and scale/characteristics of the disaster.

Timing of Attribution

What are the options for attribution timing for mass casualty events and individual emergencies, and what are the pros and cons for each option?

The timing of measurement attribution may vary based on the event. For some emergencies, there will be a definite start and end of the incident, while for others they may be more ambiguous. Outcomes for patients at the beginning of a public health emergency may also have to be measured differently than outcomes occurring weeks or months into the public health emergency when hospitals could be overcrowded and treating patients transferred from other facilities due to resource constraints.

Whether prospective or retrospective approaches are preferred may depend on the type of public health emergency and intent of attribution. A prospective model may be a tactic to incentivize improved system outcomes since entities would know ahead of time the population for which they are accountable. Defining populations, identifying all relevant stakeholders, and aligning incentives in advance may allow agreements and systems to develop within a region. A retrospective attribution approach, one that assigns patients after care has been provided, may help to reduce concerns from providers about being attributed patients whose outcomes they do not feel they have influence over. However, while outcomes can and should be tracked after an event, it is not clear how these outcomes would be tied to incentives if they lack comparison groups.

Data Considerations

How should capturing nonclaims-based data points be approached in these scenarios, and where would the responsibility for collecting this information fall within the care process?

Claims data could help to identify patients who were treated for a specific diagnosis, such as COVID-19 (after the diagnosis code was created) or a certain bioterrorism attack that has a diagnosis code related to the illness. However, it may be more difficult to attribute using claims data for an event causing multiple traumatic injuries, such as an earthquake or bombing, as the diagnosis would not be specific to the event. Registration and assessment data could also be used to identify patients affected by mass casualty events, which should be included in quality measures.

For some MCIs, capturing all patients affected will be a challenge; data may reside in different sources, ranging from EMS interactions to hospital data to insurance claims. Health Information Exchanges (HIEs) currently allow healthcare staff and providers to appropriately access and securely share a patient's vital medical information electronically.[52] HIEs could serve as a structure or health information platform for the transfer and communication of MCI patient-specific information and quality measurement. A patient registry is an organized system that uses observational study methods to collect uniform data (clinical and other) to evaluate specified outcomes for a population defined by a particular disease, condition, or exposure, and that serves one or more predetermined scientific, clinical, or policy purposes.[53] The creation and maintenance of MCI-specific patient registries may help gather information and track patient outcomes over time.

Team-Based Attribution

What information or data should be used to determine who/which entity can influence the outcomes of interest? If multiple providers have influence over an outcome, under what circumstances should multiple attribution approaches be considered? What weighting approach should be used? In other

words, what information would be needed to help determine whether all the providers should be held equally accountable for an outcome, or if some of them should be held more accountable?

Building team-based attribution models can be approached using a person-centered perspective (i.e., where did a person receive care, by whom, and for what purpose?). Identifying the care that has the most impact on the patient's outcome and considering what resources are available could be used to help identify which entity has more influence on an outcome. For example, a level I trauma center may have more resources available for saving a patient's life during a trauma than a small rural hospital. A rural hospital will likely try to stabilize the patient for transport to the trauma center as quickly as possible, and EMS could be responsible for performing life-saving measures on a patient during transport, but the trauma center may have more influence over the ultimate outcome. Appropriate weighting, however, may depend on each individual case. For example, the most influential factor on an outcome for one person might be associated with the timeliness of transport to care, and for others, a specific intervention by a surgical specialist. Costs per episode and which providers they are associated with should also be considered.

In determining the weighting options, the sequence of delivery should be considered. It may be reasonable to weigh accountability more heavily at the beginning of the episode since the providers involved at the beginning will be responsible for coordinating care to some extent downstream. A potential challenge of a multiple, "layered" attribution for an episode is that upstream care can influence outcomes further down the chain, thus potentially affecting outcomes that are attributed to the secondary or tertiary accountable provider's care. If the care delivered early in the process has negative impacts on outcomes, how do we properly hold each party accountable for their care and not disadvantage the provider downstream?

Another approach would be identifying commonly delivered services or processes for the episode of interest that should occur every time. There are likely some process measures that could be applied more routinely for each level of service accessed by a person and that might not need to be weighted but applied based on the trajectory of care. For example, in a specific situation, certain protocols should be followed, and services should be administered. The rendering provider could be held accountable for doing those things or not. State and local laws and policies may also affect care processes, such as transport and transfer protocols, and should be considered.

Furthermore, system structure, organization, and type are influential components of emergency care delivery. Do the regionalized systems (especially trauma systems) lead to better response and outcomes than nonregionalized ones? How should we define the appropriate care type when there are four levels of trauma centers? Would a regionalized approach offer a better response?

Aspirational Approaches

What are some of the actionable attribution approaches to incentivize high quality, coordinated care for emergencies that would be acceptable to those being measured?

Attribution can be used as a tool to drive system change and alignment. An aspirational attribution approach may also allow the data ecosystem to mature. The goal of the quality measurement system (e.g., quality improvement, accountability) should be considered at the start of making attribution decisions. Additionally, fairness is a key goal of any attribution model.

For example, if attribution will be used for penalties versus bonuses, attribution considerations may differ (e.g., bonuses may be appropriate for volunteer EMS agencies, but penalties may not be). When value-based purchasing and reimbursement are tied to attribution, quality measure feasibility, reliability, validity, and applicability across all measured entities may limit the measures that can be considered.

Unintended Consequences

What are the potential unintended consequences of attribution decisions for quality measurement of emergency care?

Attribution could have consequences that are intended as well as unintended. Using regional attribution for an event might prove to be a catalyst for cross-system collaboration, education, and training. The model could incentivize a more unified approach to an event and consequently have an impact on overall patient outcomes. However, the attribution model employed may incentivize resources and attention to be devoted to certain care processes and patient populations to the detriment of other important aspects of care. Discussing unintended consequences of attribution models for emergency care up-front could help mitigate adverse consequences.

Types of Quality Measures

Outcome measures reflect the impact of the healthcare service or intervention on the health status of patients, such as surgical complication rates or mortality rates.[54] Outcome measures may currently represent the "gold standard" in quality measurement, but an outcome is the result of numerous factors likely beyond providers' control.[54] Process measures indicate what a provider does to maintain or improve health, either for healthy people or those diagnosed with a healthcare condition.[54] These measures can inform consumers about medical care for a given condition and can contribute toward improving health outcomes.[54] Structural measures give consumers a sense of healthcare providers' capacity, systems, and processes to provide high quality care, such as provider-to-patient ratios and the number of board-certified physicians.[54] While outcome measures are commonly prioritized, process or structural measures may also be appropriate to consider for this scope of work. Process and structure must exist as an infrastructure for achieving access to favorable individual outcomes for infrequent events that are not otherwise innately incentivized.

Measurement Gaps

Sound quality measures are needed to build performance measurement systems for emergency care and response. Measures should assess how the entire emergency response system is functioning together across the range of services, from identification of needs to transport to ED to hospital and post-acute care to recovery. A 2013 Health Affairs article discussing the landscape of measurement in the ED described that, ideally, quality measurement would be able to assess how one regional EMS system compares with another.[55] This type of measurement, comparing one coordinated system with another, remains challenging today due to fragmentation and complexities of measurement, including attribution methods for emergency care and response.

Several questions that explore further concepts specific to emergency care measurement include the following:

- Do existing measures reflect key components of emergency response for mass casualty events? How would measures assess key components of emergency response when the health system is strained with surges of patients?
- What measures should be prioritized and used together to assess whether emergency response is high quality?
- Do available measures hold the right entities accountable? Are measures specified at the population level designed to assess accountability at this level, or are they intended to measure at a more granular level (e.g., facility) but are being rolled up?
- How would the measure data be collected and shared across providers and organizations that play a role in emergency response?

Conclusion

Evidence to support the best approach for quality measurement attribution for unplanned events and emergencies is limited. Literature describing emergency response pathways, a review of existing quality measures for emergencies, foundational frameworks for designing attribution approaches, and components of existing models can help to inform the development of the Committee's guidance. The Committee will discuss key themes and approaches identified in this environmental scan through a series of web meetings. NQF will also conduct key informant interviews to expand upon environmental scan findings. Findings of this work will lay the foundation for how to attribute outcomes during emergencies to incentivize system-wide, coordinated care delivery approaches.

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Appendices

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Appendix B: Federal Organizations Emergency Response

According to the Disaster Information Management Research Center, many government entities play a role in responding to certain types of emergency response.[10] Ranging from natural disasters or food-borne illness, these governmental organizations have different specialties and focuses. The U.S. disaster response falls into two broad areas of responsibility: general operational and medical responsibility.[56] General operational responsibility of disaster response generally falls to the Department of Homeland Security (DHS) and the Federal Emergency Management Agency (FEMA). Medical responsibility falls to the Department of Health and Human Services (HHS), the Office of the Assistant Secretary for Preparedness and Response (ASPR), the Centers for Disease Control and Prevention (CDC), and the National Institutes of Health (NIH).

HHS

ASPR

ASPR provides information about preventing, preparing for, and responding to any adverse health effects of national public health emergencies and disasters.[57] ASPR aims to provide strong leadership, including clear policy direction and improved threat awareness, and works to create a regional disaster health response system that leverages and enhances existing programs (e.g., the HPP and the National Disaster Medical System [NDMS]).[57] The organization advocates for the sustainment of robust and reliable public health security capabilities with the CDC and other HHS components and advances the medical countermeasures enterprise by capitalizing on advances in biotechnology and science to develop and maintain a robust stockpile of safe and effective vaccines, drugs, diagnostics, and supplies to respond to attacks, emerging disease outbreaks, and pandemics.[57]

HPP

The HHP is a cooperative agreement program administered by ASPR that establishes a foundation for national healthcare preparedness. As the only source of federal funding for healthcare system preparedness and response, HPP promotes a consistent national focus to improve patient outcomes during emergencies and disasters and enables rapid recovery.[58]

Regional Disaster Health Response System (RDHRS)

ASPR aims to address gaps in coordinated patient care during disasters through the establishment and maturation of a new RDHRS. The RDHRS aims to establish a network of state-level clinical response assets as well as interstate regional assets to create a more coherent, comprehensive, and capable healthcare disaster response system that can respond to current health security threats and integrate into daily care delivery systems. Through the RDHRS, ASPR aims to optimize clinical surge capacity, provide clinical expertise to support healthcare surge planning, and ensure that appropriate clinical expertise is integrated as a partner in emergency planning.[59]

Emergency Triage, Treat, and Transport (ET3) model

ET3 is a voluntary, five-year payment model that will provide greater flexibility to ambulance care teams to address emergency healthcare needs of Medicare Fee-for-Service (FFS) flexibility beneficiaries following a 911 call. Under the new model, CMS will continue to pay to transport an FFS beneficiary to a hospital ED or covered destination and will pay participants to transport to an alternative destination partner (e.g., a PCP office, urgent care clinic, or community mental health center) or to initiate and facilitate treatment with a qualified healthcare partner either at the scene or via telehealth.[60]

CDC Emergency Preparedness and Response

The CDC has many departments related to emergency preparedness and public health response. The Center for Preparedness and Response and NDMS[61] is a part of the CDC response that includes the Emergency Operations Center (EOC), which is staffed by emergency response professionals 24/7 responding to infectious diseases, such as Ebola, polio, and most recently, COVID-19. Other responses include deadly foodborne outbreaks; cases of lung injury associated with e-cigarette product use; devastating earthquakes, hurricanes, and tsunamis; and environmental disasters, such as oil spills and water contamination.[62] During emergencies, the CDC quickly deploys scientific experts, coordinates the delivery of supplies and equipment to the site, monitors response activities, provides resources to state and local public health departments, and develops and distributes crisis and risk communications that are timely, accurate, consistent, and actionable.[62] The CDC outlines Public Health Emergency Preparedness and Response Capabilities as national standards for state, local, tribal, and territorial public health agencies.

Other departments under the CDC include the Agency for Toxic Substances and Disease Registry – Emergency Response, Emergency and Terrorism Preparedness for Environmental Health Practitioners, National Institute for Occupational Health and Safety (NIOSH) Emergency Preparedness and Response, and the Office of Public Health Preparedness and Response.[10]

NIH

NIH is the nation's medical research agency and is involved in emergency and disaster response related to human and environmental health through its institutes. The National Institute of Environmental Health Sciences (NIEHS) responds to emergencies that threaten public safety and environmental health by organizing and coordinating resources to bring the emergency under control. The Disaster Information Management Research Center (National Library of Medicine Disaster Health) provides informational response by developing and providing access to those health information resources and technology through all phases of disaster management. Other clinical institutes of NIH include the National Cancer Institute, National Institute of Allergy and Infectious Diseases (NIAID), and the CounterAct program.[56]

Department of Homeland Security

FEMA

FEMA, under the U.S. Department of Homeland Security, is the federal agency that coordinates the response of federal agencies to disasters and the communication of information about disasters between federal agencies and the public, particularly within the first 48 hours after an event.[63]

National Domestic Preparedness Consortium (NDPC)

Under FEMA, the NDPC is a partnership of a national organization whose membership is based on the urgent need to address the counterterrorism preparedness needs of the nation's emergency first responders within the context of all hazards, including chemical, biological, radiological, and explosive Weapons of Mass Destruction (WMD).[64]

U.S. National Response Team (NRT)

The NRT consists of 16 federal agencies with responsibilities, interests, and expertise in various aspects of emergency response scenarios.[65] The NRT provides technical assistance, resources, and coordination

on preparedness, planning, response, and recovery activities for emergencies involving hazardous substances, pollutants and contaminants, oil, and WMD in natural and technological disasters and other incidents of national significance. Federal agency partners include FEMA, HHS, the Environmental Protection Agency (EPA), Coast Guard, Department of State, Department of Defense, Department of Energy, Department of Agriculture, Department of the Interior, Department of Commerce, Department of Transportation, Nuclear Regulatory Commission, General Services Administration, Department of Justice, and the Department of Labor.[65]

Central Intelligence Agency (CIA)

The CIA provides evidence-based foreign intelligence related to national security, including the potential terrorist use of chemical, biological, radiological, and nuclear agents.[66]

Department of Agriculture (USDA)

USDA has the primary responsibility of protecting America's food supply. The USDA has a comprehensive biosecurity system with mechanisms designed to prevent the introduction of harmful plant and animal pathogens into the system of agriculture and food production.[67]

Department of Defense (DoD)

The armed service branches of the DoD are the frontline military defense against terrorist threats. The DoD's Defense Threat Reduction Agency focuses on safeguarding Americans from WMD, including chemical, biological, radiological, and nuclear explosives, by reducing the present threat and preparing for future threats.[68]

Department of Energy (DOE)

The Emergency Operations unit of the National Nuclear Security Administration (NNSA), part of the DOE's mission to enhance national security in relation to nuclear energy, directs responses at DOE and NNSA facilities and field sites, and to nuclear and radiological emergencies within the U.S. and abroad.[69]

Department of the Interior (DOI)

The DOI's Hazards and Facilities Team works to ensure adequate capability to prepare and respond to incidents caused by natural or human effects that affect federal lands, resources, facilities, tenants, employees, visitors, and adjacent landowners.[70]

Department of State

The office of the Bureau of Counterterrorism coordinates all U.S. government efforts to improve counterterrorism cooperation with foreign governments and coordinates responses to major international terrorist incidents in progress. This office develops, coordinates, and implements American counterterrorism policy.[71]

Department of Transportation (DOT)

DOT contains several important agencies that prepare for and respond to emergency situations, including the Federal Aviation Administration, the Federal Railroad Administration, and the Office of Hazardous Materials Safety.[72]

EMS Quality Alliance

Funded by the National Highway Traffic Safety Administration and in partnership with the National Association of State EMS Officials (NASEMSO), EMS Compass is an initiative engaging a wide range of EMS stakeholders to develop initial performance measures relevant to EMS agencies, regulators, and patients. The effort evolved into the National EMS Quality Alliance in 2017, engaging the American College of Emergency Physicians (ACEP), to facilitate the development of a mechanism, organizational structure, and sustainability model that enables meaningful assessment of EMS.[73]

Environmental Protection Agency (EPA)

The EPA's Chemical Emergency Preparedness and Prevention Office (CEPPO) provides leadership, advocacy, and assistance to prevent and prepare for chemical emergencies, respond to environmental crises, and inform the public about chemical hazards in their communities.[74]

Nuclear Regulatory Commission (NRC)

The NRC is ready to respond to an event at an NRC-licensed facility that could threaten public health and safety or the environment. NRC's priority is to provide expert consultation, support, and assistance to state and local public safety officials responding to the event. Once the NRC incident response program is activated, specialists obtain and evaluate event information to assess the impact of the event on public health and safety in the environment.[75]

Transportation Security Administration (TSA)

The TSA was developed in 2001, in response to the events of September 11, to protect the country's transportation systems, including strengthening security systems at airports and coordinating transportation matters for the federal government in the event of a future terrorist incident.[76]

Appendix C: Literature Review References Summary Table

Please refer to Sheet 1 of Excel file, found here.

Appendix D: Measure Summary Table

Please refer to Sheet 2 of Excel file, found here.

Appendix E: Attribution Model Examples Table

Please refer to Sheet 3 of Excel file, found here.

Appendix F: Public Comments and Responses

The draft environmental scan report was posted on the project webpage for public and NQF member comment from February 24, 2021 through March 17, 2021. During the commenting period, NQF received 10 comments from two organizations. Comments were elicited through the public commenting tool and additional organizational outreach. The comments below are grouped by theme: defining the scope, attribution model design and approaches, or editorial and organizational. The Committee discussed these comments during their web meeting on April 20, 2021. Responses are included beneath each comment. Public comments are presented as they were received by NQF and have not been edited. NQF thanks all commenters for providing feedback on the report.

Defining the Scope

RELI Group Inc

COMMENT

Executive Summary (ES) p.3: The ES summary could be strengthened by opening with the working definition of attribution used in this paper, especially focusing on the role of attribution in the context of value-based design. Additionally, the ES is heavily focused on the mass casualty incidents (MCI), but the paper is focused on attribution in a broader sense than just MCIs. MCIs aren't mentioned in the introduction.

RESPONSE

NQF added a working definition of attribution to the executive summary and updated the explanation of the project scope in the introduction.

COMMENT

Background: In the last paragraph on this page we suggest more explicitly disentangling normal emergency medical care from MCIs and public health emergencies.

RESPONSE

NQF received this feedback from multiple commenters. NQF added content to the introduction to further clarify emergency care sensitive conditions, the spectrum of critical illness and injury, and mass casualty incidents as well as outline their relationship and unique considerations for measurement attribution. We will also expand these concepts and considerations in the project's final report.

Manatt, Phelps & Phillips

COMMENT

I think the draft would generally benefit from some more detail/structure defining the spectrum of critical illness and injury. The draft mentions a wide range of conditions with differences that have important implications for attribution. For example, a condition like sepsis generally affects people on an individual basis, and individuals' risk of sepsis can be predicted (and mitigated) to a certain extent. In contrast, a mass casualty event like a Las Vegas shooting affects a group of people simultaneously, and in many cases you couldn't reasonably predict which specific people will be involved in this type of mass casualty or a pandemic surge. These different attributes may tend to lead to different attribution approaches; it could be helpful to situate your environmental scan in some sort of framework. For example, we routinely attribute cost/quality related to sepsis, severe stroke and other types of critical

illness to providers/IDS/payers in many VBP models; in contrast, CMS has tried to exempt COVID-related costs from its VBP models to a certain extent.

RESPONSE

NQF received this feedback from multiple commenters. NQF added content to the introduction to further clarify emergency care sensitive conditions, the spectrum of critical illness and injury, and mass casualty incidents as well as outline their relationship and unique considerations for measurement attribution. We will also expand these concepts and considerations in the final project report.

Attribution Model Design and Approaches

RELI Group Inc

COMMENT

Introduction p.3: It would be good to expand on this crucial statement – "certain attribution approaches may help incentivize different providers to work together to ensure better health outcomes". Suggest tying this into the need for additional population health quality measures and referencing the NQF workgroup activities in this area as well as upcoming MMS Measure Blueprint Supplement.

RESPONSE

NQF acknowledges the limited number of measures specified and designed for assessment at the population level. NQF updated the introduction to include examples of team-based care delivery models. The final report will also make key connections between this project and related initiatives to advance the role of population-level measurement.

COMMENT

Background: Can you be more precise than "limited" on how many performance measurement systems assess response and quality of care for acute illness and injuries and public health emergencies.

This section would benefit from including what's been done to attribute outcomes across multiple providers in bundled payment and other relative models. Can some of those methods be leveraged for attribution in this context?

Throughout the paper it may be worth teasing apart the challenges of measuring, let alone attributing, outcomes in MCIs from other acute illness and injury scenarios. There is some discussion of this in the data challenges section (page 17), but it could benefit from expansion. Simply quantifying the denominators and outcomes in MCIs is challenging enough given the current state of data and sharing, so attribution appears much more challenging or near impossible. Should an intermediate goal be expanding the ability of the health system and provider community to document all cases and outcomes in an MCI so that attribution could build off of that?

RESPONSE

Performance measures that hold discrete entities accountable for aspects of emergency care are used in measurement programs. However, there is not a comprehensive measurement system that assesses the coordinated response of various entities involved in care for individual emergencies or mass casualty incidents. Related to readiness, there are the CMS Conditions of Participation and Joint Commission International requirements; however, there are few NQF-endorsed readiness measures. NQF added additional content to the referenced statement in the report based on Committee input.

Bundled payments attribute costs to groups of providers (e.g., a TIN or hospital) or to a particular community (e.g., Maryland's GBR model). NQF will add several examples to the report. NQF is not aware of implemented models that attribute quality metrics and outcomes across multiple entities.

Due to the complexity of quality measurement attribution for ECSCs and MCIs, the Committee discussed focusing on intermediate structure elements related to readiness and process goals for the various entities that provide care during MCIs. The Committee will continue to discuss the challenges of quality measurement during an MCI vs individual emergency scenario and opportunities for more complete data collection during MCIs that could be used for future measurement efforts. This content will be included in the project's final report.

COMMENT

Environmental Scan Findings p. 16: On this page geographic regions based on zip codes is the primary approach to defining populations. Although other factors that might be considered are referenced, the section on geographic regions does not refer specifically to other approaches identified in the environmental scan, such as briefly mentioned in connection with Fn 13 on page 10. Please consider providing a bit more detail on this alternate approach that has been developed. It has similarities to the Dartmouth Atlas Project where systems of care are identified by Hospital Service Areas. You may want to consider referencing the Dartmouth Atlas Project as well.
https://www.dartmouthatlas.org/faq/#research-methods-faq FAQ - Dartmouth Atlas of Health Care
www.dartmouthatlas.org

RESPONSE

NQF updated the report to expand how regions may be defined considering key linkages with the literature review findings. NQF will also review the Dartmouth Atlas Project resource and include information as appropriate in the final report.

Manatt, Phelps & Phillips

COMMENT

Some of your search parameters may be limiting your results. I'm not sure I understood correctly, but I think you are looking just at measures that are specified at a geographic level? A lot of measures related to sepsis/stroke/that kind of critical illness or injury will likely be specified for providers, integrated delivery systems or health plans, but not necessarily at the geographic level. If you decided a priori that the project will only consider geographic attribution, it would be good to talk a bit more about why the other approaches aren't considered since they occupy so much of the current attribution landscape.

RESPONSE

The quality measure scan included but was not limited to measures specified at the population level focused on emergency care – both ECSCs and public health emergencies. Measures specified at more specific levels (e.g., clinician, health plan) were included to represent the availability of potentially relevant measures that could be considered in an approach that assigns responsibility for processes/outcomes to different providers or at multiple aggregation levels.

COMMENT

It might be worth talking a bit more up front about the various purposes of attribution, since that often drives the methodology. For example, in total cost of care models such as ACOs, cost and quality are

routinely attributed to providers who don't do any of the actual work that drives most of the cost—if a primary care provider-led ACO is accountable for a Medicare patient, they are on the hook for the cost of all the care including sepsis, stroke, MVC, GSW, etc. However, you could be trying to solve a different problem, such as identifying/certifying a regional center of excellence. In that case you would want to know what work the provider had done specifically, or would be expected to have done (which could involve attribution at the population level for e.g., a quaternary care center expected to provide advanced services to a specific catchment area). If you are trying to build regional networks around readiness and using response to critical illness/injury as readiness examples, you might weigh response to large-scale events such as COVID surge or large mass casualties differently.

RESPONSE

The first step to creating a quality measurement attribution model is defining the goal or purpose of measurement. This was outlined in previous NQF attribution projects and remains an important component when designing attribution models for emergencies. A section on the goal of attribution methodology was added to the report discussion, and this element will be further expanded in the project's final report based on Committee discussion and input received during key informant interviews.

Editorial and Organizational

RELI Group Inc

COMMENT

Introduction p.3: In addition, suggest revising the statement in 3rd sentence as it's tautological. Can you restate to say that the model chosen for attribution can have large effects on providers shared savings and other incentives/penalties?

Aspirational Approaches p.18: This section might fit better within the background section as the content here provides important background/contextualization of the challenges of attribution in value-based systems.

Discussion: Types of Quality Measures p.19: This section may not be necessary for the reader of this paper. If the reader is able to follow the preceding sections they should be well versed on the different types of quality measures. If NQF feels this section is necessary, some of this material could serve as a footnote earlier in the paper, perhaps under background.

RESPONSE

NQF reviewed and updated these sentences and sections as deemed appropriate to clarify content and improve readability.

Manatt, Phelps & Phillips

COMMENT

A minor point: the direct contracting Geo model is on hold and I'm not sure whether it's moving forward. You might also want to reword the description of retrospective attribution; I'm not sure it's as much about the amount of planning providers are expected to do (you have to do a lot of planning if you could be accountable for anybody) and more about the type of risk they want to take on.

RESPONSE

NQF verified the status of the Geographic Direct Contracting Model and updated the report accordingly. We also refined the description of how retrospective attribution compares to a prospective approach.