Part 2– EMS Core Measures Project
Reporting Capability of EMSA and LEMSA Data Systems

Introduction

The purpose of emergency medical services (EMS) is to provide timely and appropriate emergency medical care and transportation of the ill and injured, thereby reducing death and disability. EMS is an integral part of every community's total health care delivery system. Consistent evaluation of clinical and response performance indicators are crucial components in ensuring that first response services are operating at peak efficiency. To achieve this, continuous quality improvement (QI) practices must become an essential and seamless part of normal EMS routines. Data systems that are robust and agile, with the ability to report clinical indicators and performance measures, are a key tool in quality improvement activities.

In order to evaluate system impact on patients, the continuum of care from dispatch to pre-hospital to hospital disposition must be connected. This evaluation will help us to understand how care provided by EMS systems translates to improved outcomes and system effectiveness.

Background

California statute maintains that one of the required elements of an EMS system is data collection and evaluation, and mandates the establishment and development of quality improvement guidelines. Additionally, EMS system quality improvement regulations define the requirements for local EMS agencies (LEMSA), EMS service providers, and base hospitals in their role as part of the EMS system. These requirements include, but are not limited to the implementation of an EMSA approved EMS Quality Improvement program, and the use of defined indicators to assess the local EMS system.

In April 2012, the EMS Authority received a grant award from the California HealthCare Foundation (CHCF) to support data and quality management activities. As part of the work plan for this one-year grant period, the EMS Authority tested the ability of its current data assets to answer questions about EMS in California. The process of testing and analyzing the results were performed by the State in collaboration with local and regional EMS partners.

A task force was convened to assist in the development of the core measures. The task force consisted of key data and quality leaders from local EMS agencies, medical directors, hospitals, and pre-hospital EMS providers. The measures are based on scientific evidence about processes and treatments that are known to get the best results for a condition or illness. Core measures help EMS systems improve the quality of patient care by focusing on the actual results of care. The *California EMS System Core Quality Measures, EMSA 166, Appendix E* better defines the criteria and references the specific definitions and references that serve as the basis for each measure.

Reporting Capability

California EMS Information System (CEMSIS)

California does not have a single, statewide data system and variability exists between LEMSA data systems. EMSA engaged a contractor to evaluate the existing CEMSIS system. Unfortunately, the CEMSIS system in existence during this grant cycle was determined to be incompatible with effective EMS Core measure reporting.

The capacity of the existing California Emergency Medical Services Information System (CEMSIS) was assessed by the *Health Services Advisory Group* to determine its capability to deliver core performance measures through a contractor experienced in this review. Our review found that the existing CEMSIS system had a number of weaknesses that made validated EMS information difficult to collect and to report.

The Core Measures project provided a significant opportunity to test the ability of CEMSIS to deliver reports because the measure sets represent a wide range of EMS business processes. Prior to development of the Core Measures, the CEMSIS demonstration project had not been evaluated in such a comprehensive way. The evaluation consisted of two projects -- a system-wide data quality analysis performed by an experienced consultant, and generation of the Core Measure reports themselves. Both projects revealed complex problems across numerous segments of the CEMSIS system, including errors in the data dictionary, errors during local data transmission, and inconsistencies found inside the state system itself. Overall, CEMSIS was able to produce data for only nine (9) of the 28 core measure reports. For a single LEMSA, CEMSIS could generate, on average, six (6) of these nine (9) reports. Seventeen (17) of the 32 LEMSAs were represented to some degree. Only a fraction of these reports appeared to reflect actual EMS business processes as determined by EMSA. As a result, the CEMSIS reports are currently unsuited for the purpose of clinical quality management activities.

Local Emergency Medical Services Agency (LEMSA)

California is a large, diverse state with a two-tiered regulatory system consisting of State EMSA and 32 LEMSAs (during this grant period). Local EMS agencies are statutory required to plan, implement, and evaluate an EMS system. As such, they are charged with the responsibility for establishing a data collection system and setting standards at the local level. Overall, the local EMS agencies performed admirably given the difficult task of mining retrospective data to identify core measures.

The LEMSAs faced many challenges in reporting the core measures to EMSA. These are enumerated below. But, despite multiple barriers, the LEMSAs embraced the need for EMS quality core measures and understood the value in grappling with standardized metrics statewide. As such, despite looking at retrospective data, 16/32 (50%) of the LEMSAs had the ability to report more than half of the core measures. (see Table 3 - “Number of Core Measures With Data Submitted, By LEMSA, for 2011 and 2012”.

The LEMSA reported limitations in reporting measures included the following:

New data systems - Some of the LEMSAs had migrated to new data systems and the data was no longer available or the LEMSA was unable to incur the costs of retrieving the data.

CEMSIS Data Dictionary - Not all LEMSA data systems utilized the existing CEMSIS data dictionary. This resulted in disparity between the methods by which measurements were derived. Some LEMSAs followed the measures exactly, while others had interpreted what the measure meant in an effort to yield a value. In the collection of data for future years, EMSA will limit this confusion to help LEMSAs derive their values in the same way, yielding standardized results.

Variability in data collection methodology - Many local EMS systems use paper prehospital care reports (PCR) while others use electronic patient care record (ePCR). Abstracting information from paper forms is difficult, time-consuming, and not necessarily accurate. In contrast, some software systems with ePCR have a high degree of technological sophistication that forces users to complete forms before closing the record. Moreover, without training in the specific core measure, users may not have understood the criticality of completing each data point.

Documentation by non-trained clinicians - EMS field personnel did not have the opportunity to receive advance training prior to data entry. Consequently, responders likely did not have had the necessary feedback provided to them so that all the data elements required for core measures were recorded.

Data sampling - Some LEMSAs reported measures using sampling and abstracting rather than conducting an analysis of all of their annual population data. While theoretically this should not make a difference, this was perceived as a source of concern regarding information reporting.

Lack of dedicated LEMSA resources - With diminishing funding available to LEMSAs, limitations with manpower, resources, and methodology to gather and consolidate data from all of their providers was significant.

Hospital outcome data - One of the clear challenges identified was the difficulty and inability by LEMSAs to obtain universal hospital outcome data on every ambulance transport. This was evidenced by the low response rate for specific cardiac arrest outcome measures (CAR- 3 and CAR-4). These measures relied upon the hospital to report survival to emergency department discharge and survival to hospital discharge. This is a key policy issue to address in the future in cooperation with the California Hospital Association.

Patient Records in Tiered EMS systems - One of the significant challenges of reporting EMS information is related to the nature of the “tiered” EMS system in place in most of California. Because there are EMS first responders and separate ambulance transport units that arrive at a later time, often two (2) records are initiated for each patient. In many cases, LEMSAs have not established a mechanism—either manually or technologically—to capture the full treatment provided to a single patient. This inability to aggregate first responder data with transport provider data could lead to a conclusion that care was not provided, when in fact, it may have been provided to the patient by a different provider. This observation serves as a critical policy issue and highlights the need for a “one patient, one record” system to allow for a complete picture of patient care.

Table 1

July 31, 2013

LEMSAs Reporting Data For Any Core Measure

	2009	2010	2011	2012	2013
Alameda County EMS		X	X		
Central California EMS	X	X	X	X	
Coastal Valleys EMS					
Contra Costa County EMS		X	X	X	X
El Dorado County EMS					
Imperial County EMS					
Inland Counties EMS	X	X	X	X	
Kern County EMS		X	X		
Los Angeles County EMS	X	X	X		
Marin County EMS		X	X		
Merced County EMS	X	X	X	X	
Monterey County EMS		X	X	X	
Mountain Valley EMS		X	X		
Napa County EMS					
North Coast EMS		X	X		
Northern California EMS	X	X	X	X	
Orange County EMS					
Riverside County EMS		X	X	X	
Sacramento County EMS		X	X		
San Benito County EMS					X
San Diego County EMS		X	X		
San Francisco EMS	X	X	X	X	
San Joaquin County EMS				X	
San Luis Obispo County EMS		X	X	X	
San Mateo County EMS		X	X	X	
Santa Barbara County EMS	X	X	X		
Santa Clara County EMS	X	X	X	X	
Santa Cruz County EMS	X	X	X		
Sierra-Sacramento Valley EMS	X	X	X		
Solano County EMS					
Tuolumne County EMS		X	X	X	
Ventura County EMS				X	
Totals Measure Responses (including RSTs and 2014 Measures)	10	23	23	14	2

Reported At Least 1 Measure
No Measures Submitted

Multiple factors impact the validity and analysis of these retrospective data, including but not limited to incomplete documentation, documentation not reflective of services provided prior to ambulance arrival, inconsistent data dictionary definitions between local jurisdictions, geographic resource disparities, and inability to collect hospital outcome data. This retrospective data has not been validated. These limitations caution against comparison between jurisdictions and limits the reliance of the aggregate values. As a result, the local EMS agency information has been blinded for this first trial year of data reporting.

Core Measures Analysis (Tables and Charts)

The first component of the core measures analyses that was examined as part of this project was the percentage of LEMSAs who were able to participate in core measure reporting of the 20 clinical, and response and transport measures, utilizing their current system methodology. At the conclusion of the contract period, we discovered that 81% of the LEMSAs were able to submit at least one core measure for any year (2009-2013).

Table 1 –LEMSAs Reporting Data For Any Core Measure

The GREEN areas on the chart correspond to LEMSAs that reported 1 or more measures for that data year. Areas in WHITE reflect the LEMSAs that did not submit any measures for that data year.

For data year, 2010 and 2011, 24 of the 32 (75%) LEMSAs were able to report information to EMSA. Data year 2012 was an optional year for reporting. Local emergency medical services agencies were not required to submit information for 2012. However, 14 of the 32 (44%) LEMSAs chose to submit information for this year, including 1 LEMSA that had not submitted previous years' information. It is likely that more LEMSAs would have been able to submit measures for this year had it been required rather than optional. One LEMSA, San Benito, was only able to submit partial year information for 2013. Twenty-six (26) of the 32 (81%) LEMSAs reported measures for at least one of the years 2009-2013.

Six (6) LEMSAs did not submit information capable of being included in this report. One LEMSA, Coastal Valleys, submitted unconsolidated information after the submission deadline and EMSA was unable to include it in the analysis. Two LEMSAs, Napa and Orange, had recently switched data systems which did not allow for information submission. The remaining three LEMSAs, El Dorado, Imperial, and Solano, were unable to submit information for the years requested.

With respect to the 17 clinical core measures, 24 of the 32 (75%) LEMSAs were able to report at least 1 clinical measure. Several LEMSAs reported that they had changed data systems during the past several years, which limited their ability to report either some of the clinical elements or some of the years requested.

Measure Ranking Based on Response Rate

Table 2

July 31, 2013

All (n=128)

Measure	Count	Response Rate
CAR-2	56	43.75%
RES-2	55	42.97%
PED-1	55	42.97%
SKL-1	53	41.41%
ACS-1	52	40.63%
ACS-2	51	39.84%
STR-2	51	39.84%
STR-3	51	39.84%
ACS-5	46	35.94%
SKL-2	46	35.94%
TRA-2	45	35.16%
ACS-3	44	34.38%
TRA-1	43	33.59%
PAI-1	41	32.03%
RST-1	40	31.25%
RST-3	38	29.69%
STR-5	35	27.34%
RST-2	28	21.88%
PED-2	24	18.75%
CAR-1	23	17.97%
CAR-4	23	17.97%
CAR-3	22	17.19%
ACS-4	21	16.41%
RES-1	21	16.41%
STR-1	18	14.06%
PUB-1	18	14.06%
STR-4	17	13.28%
PAI-2	15	11.72%

2009 (n=32)

Measure	Count	Response Rate
TRA-2	7	21.88%
CAR-2	7	21.88%
TRA-1	6	18.75%
ACS-1	6	18.75%
STR-3	6	18.75%
RES-2	6	18.75%
PED-1	6	18.75%
SKL-1	6	18.75%
SKL-2	6	18.75%
ACS-2	5	15.63%
ACS-3	5	15.63%
STR-2	5	15.63%
PAI-1	5	15.63%
RST-1	5	15.63%
RST-3	5	15.63%
ACS-5	4	12.50%
CAR-1	4	12.50%
PED-2	4	12.50%
RST-2	4	12.50%
PUB-1	4	12.50%
ACS-4	3	9.38%
CAR-3	2	6.25%
CAR-4	2	6.25%
STR-1	2	6.25%
STR-4	2	6.25%
STR-5	2	6.25%
RES-1	2	6.25%
PAI-2	1	3.13%

2010 (n=32)

Measure	Count	Response Rate
RES-2	18	56.25%
PED-1	18	56.25%
ACS-1	17	53.13%
ACS-2	17	53.13%
CAR-2	17	53.13%
STR-2	17	53.13%
STR-3	17	53.13%
SKL-1	16	50.00%
ACS-3	15	46.88%
ACS-5	14	43.75%
SKL-2	14	43.75%
RST-3	14	43.75%
TRA-1	13	40.63%
TRA-2	13	40.63%
RST-1	13	40.63%
PAI-1	12	37.50%
RST-2	12	37.50%
STR-5	11	34.38%
ACS-4	6	18.75%
CAR-1	6	18.75%
PED-2	6	18.75%
CAR-3	5	15.63%
CAR-4	5	15.63%
RES-1	5	15.63%
PAI-2	5	15.63%
PUB-1	5	15.63%
STR-1	4	12.50%
STR-4	4	12.50%

2011 (n=32)

Measure	Count	Response Rate
CAR-2	19	59.38%
RES-2	19	59.38%
PED-1	19	59.38%
SKL-1	18	56.25%
STR-3	17	53.13%
ACS-1	17	53.13%
ACS-2	17	53.13%
STR-2	16	50.00%
ACS-5	15	46.88%
TRA-2	14	43.75%
ACS-3	14	43.75%
STR-5	14	43.75%
PAI-1	14	43.75%
SKL-2	14	43.75%
TRA-1	13	40.63%
RST-1	13	40.63%
CAR-4	9	28.13%
RST-3	9	28.13%
CAR-3	8	25.00%
CAR-1	7	21.88%
RES-1	7	21.88%
PED-2	7	21.88%
ACS-4	6	18.75%
STR-1	6	18.75%
STR-4	5	15.63%
PAI-2	4	12.50%
PUB-1	4	12.50%
RST-2	3	9.38%

2012 (n=32)

Measure	Count	Response Rate
CAR-2	13	40.63%
SKL-1	13	40.63%
RES-2	12	37.50%
PED-1	12	37.50%
ACS-1	12	37.50%
ACS-2	12	37.50%
STR-2	12	37.50%
ACS-5	12	37.50%
SKL-2	12	37.50%
TRA-1	11	34.38%
TRA-2	11	34.38%
STR-3	10	31.25%
ACS-3	10	31.25%
PAI-1	10	31.25%
RST-3	10	31.25%
RST-1	9	28.13%
RST-2	9	28.13%
STR-5	8	25.00%
CAR-4	7	21.88%
CAR-3	7	21.88%
RES-1	7	21.88%
PED-2	7	21.88%
CAR-1	6	18.75%
ACS-4	6	18.75%
STR-1	6	18.75%
STR-4	6	18.75%
PAI-2	5	15.63%
PUB-1	5	15.63%

Response and Transport Measure

Indicator Developed to be Measured in 2014 (optional)

Multiple factors impact the validity and analysis of these retrospective data, including but not limited to incomplete documentation, documentation not reflective of services provided prior to ambulance arrival, inconsistent data dictionary definitions between local jurisdictions, geographic resource disparities, and inability to collect hospital outcome data. This retrospective data has not been validated. These limitations caution against comparison between jurisdictions and limits the reliance of the aggregate values. As a result, the local EMS agency information has been blinded for this first trial year of data re-

Table 2 - Measure Ranking Based on Response Rate

This table displays the response frequency to each of the measures ranked in descending order.

CAR-2, RES-2, PED-1, and SKL-1, are among the measures that yielded the highest response rate for all measures for any of the reporting years. At least eighteen (18) of 32 (59%) LEMSAs were able to report:

- CAR-2, Out of Hospital Cardiac arrest Return of spontaneous circulation (ROSC) in the field,
- RES-2, Beta2 agonist/bronchodilator administration to patients with bronchospasm
- PED-1, Pediatric Asthma patients receiving bronchodilators
- SKL-1, Endotracheal Intubation Success Rate

These measures are generally well established in medical literature. For example, CAR-2 is an outcome measure that demonstrates the ability of an EMS system to respond in a timely manner, provide time sensitive treatment, and evaluate the effectiveness of an EMS system. Additionally, SKL-1, which assesses airway management skill, has been identified in for decades as a skill to assist in evaluating individual performance.

The lowest response measures included RST-1, RST-3, CAR-3, and CAR-4. Obtaining a measurement for RST-1 and RST-3 was a challenge for many LEMSAs because of data dictionary issues and the inability to obtain meaningful information from 100% of EMS providers. CAR-3 and CAR-4 measurements were equally challenging due to the inability of LEMSAs to obtain hospital outcome data.

Table 3

July 31, 2013

Number of Core Measures With Data Submitted, By LEMSA, for 2011 and 2012

	2011	2012
Contra Costa County EMS	16	17
Los Angeles County EMS	17	0
Monterey County EMS	17	17
Riverside County EMS	15	16
Alameda County EMS	15	0
Central California EMS	15	15
Merced County EMS	15	15
North Coast EMS	15	0
San Mateo County EMS	15	15
Santa Clara County EMS	11	15
Sierra-Sacramento Valley EMS	15	0
Inland Counties EMS	14	14
San Diego County EMS	14	0
San Joaquin County EMS	0	14
Tuolumne County EMS	13	13
Northern California EMS	11	11
San Luis Obispo County EMS	7	8
Ventura County EMS	0	8
Mountain Valley EMS	7	0
Marin County EMS	7	0
Sacramento County EMS	6	0
San Francisco EMS	4	6
Santa Barbara County EMS	6	0
Kern County EMS	4	0
Solano County EMS	0	0
San Benito County EMS	0	0
Santa Cruz County EMS	0	0
Orange County EMS	0	0
Coastal Valleys EMS	0	0
El Dorado County EMS	0	0
Imperial County EMS	0	0
Napa County EMS	0	0

***Reporting of 2012 data was optional**

Multiple factors impact the validity and analysis of these retrospective data, including but not limited to incomplete documentation, documentation not reflective of services provided prior to ambulance arrival, inconsistent data dictionary definitions between local jurisdictions, geographic resource disparities, and inability to collect hospital outcome data. This retrospective data has not been validated. These limitations caution against comparison between jurisdictions and limits the reliance of the aggregate values. As a result, the local EMS agency information has been blinded for this first trial year of data reporting.

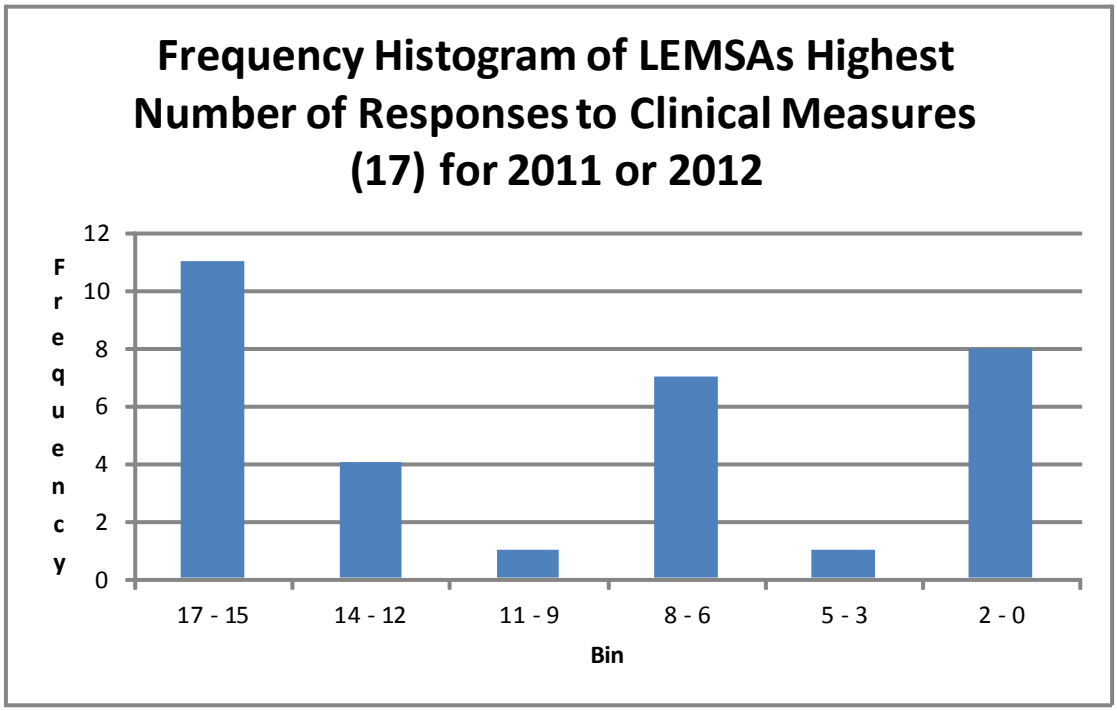
Table 3 and Charts 1 and 2 – LEMSA Response to Clinical Measures

Also of interest to EMSA, was which retrospective clinical measures had the most ability to be evaluated at the LEMSA level. Of the 17 clinical measures, 16 of 32 (50%) LEMSAs were able to report 9 or more (50%) measures.

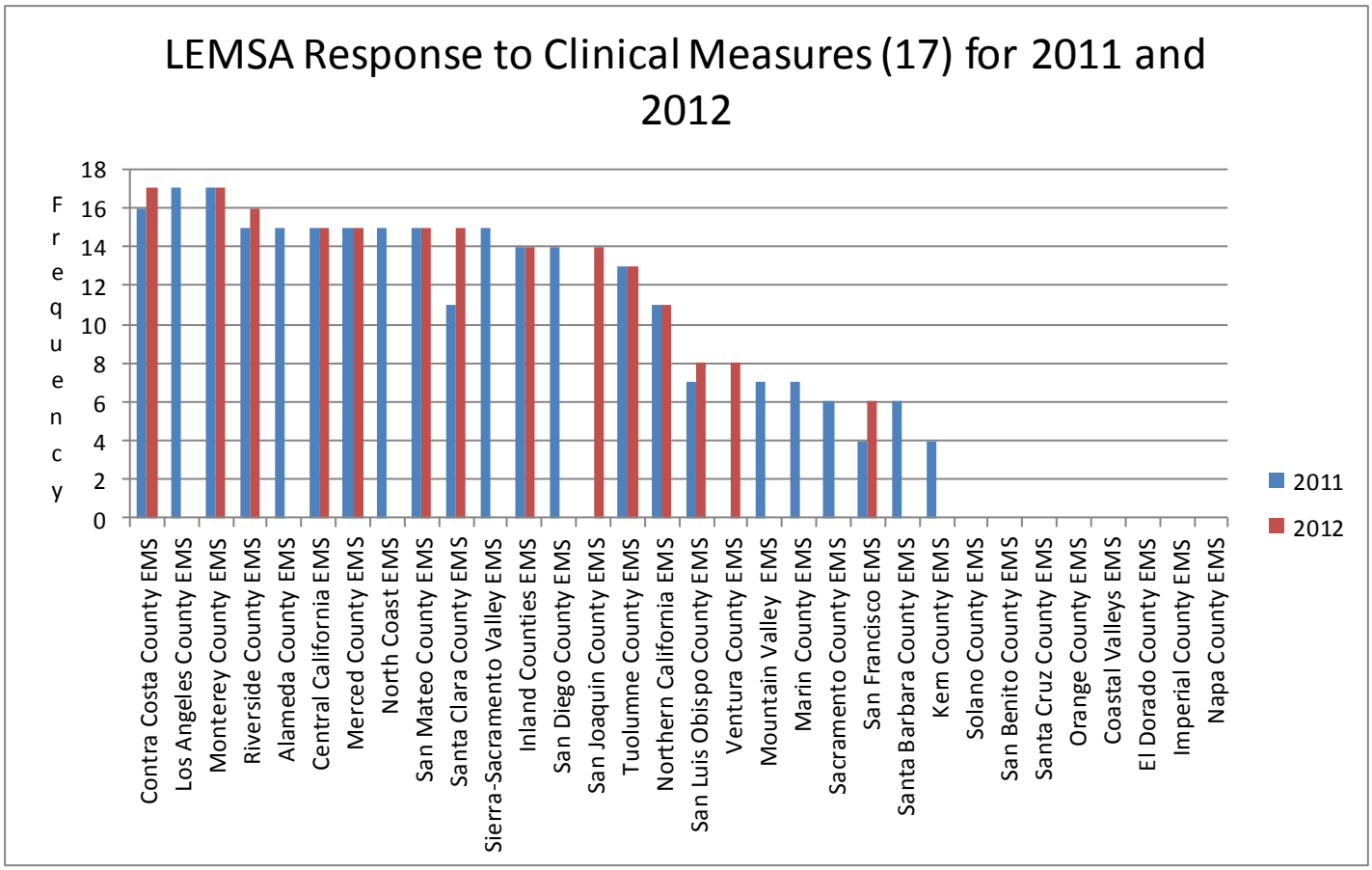
The ability (or inability) to report these measures is not indicative of their commitment to data collection or quality improvement. It is merely an indicator of the ability of the LEMSAs data systems to mine and report retrospective clinical data. The barriers previously mentioned impacted the ability of the LEMSAs to report this information.

Chart 1 and 2

July 31, 2013



Bin	*Frequency*
17 - 15	11
14 - 12	4
11 - 9	1
8 - 6	7
5 - 3	1
2 - 0	8



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