

Obstacles to Measuring Emergency Medical Services Performance

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ABSTRACT

OBJECTIVES: Problems exist in the reporting of emergency medical services (EMS) performance. This is highlighted by differing results, found in numerous studies, examining survival from cardiac arrest. In response to some of these problems, the Utstein Template was endorsed by major medical groups in 1991 to permit apples-to-apples comparisons among EMS systems. Yet, a decade later EMS systems have failed to embrace a standardized reporting format, including the Utstein Template. This study sought to identify obstacles that inhibit the measuring of EMS performance.

METHODS: This study examined the self-reporting practices of 120 paramedic providers within the State of Florida. In this research, problems with definitional ambiguity and conscious errors are theorized to be obstacles in the measuring of EMS performance.

RESULTS: Using 'response time' as a key benchmark measure, the research found that paramedic agencies used nine (9) different definitions of response time. Further, the definitions used by agencies were significantly more favorable than those attributed to the general public and politicians - a finding suggestive of conscious errors.

CONCLUSIONS: Definitional ambiguity is a continuing obstacle in the ability to make inter-agency comparisons with performance data. The findings are also suggestive of conscious errors, an attempt to make agency performance look more favorable than may be deserved. Such organizational behavior may be a major obstacle to measuring EMS performance.

Keywords: performance, quality, measurement, assessment, emergency medical services

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INTRODUCTION

What are the obstacles to measuring performance in emergency medical services (EMS) systems? To explore that question, this research examined a widely used and simple performance measure - paramedic response time - that is considered highly valid and known to influence mortality and morbidity. However, studies on the reliability of response time as a performance measure are absent. Reliability can be affected by several factors. The first is definitional ambiguity, the use of varying definitions for important terms in performance measurement. The second factor in assessing reliability involves what has been described as conscious errors - problems in the collecting and reporting of data (Juran [1992]). Both of these challenges affect the ability to benchmark performance among organizations. Paramedic response time has been significantly researched and yet various studies provide divergent findings, in part because of problems with definitional ambiguity (Campbell [1997], Campbell [1991], Becker [1991], Braun [1993], Jurkovich [1987], Spaite [1993], Campbell [1993], Braun [1990], Hedges [1993], Gennis [1994], Campbell [1994], Killien [1996]). The ability to measure time to an accuracy of milliseconds often leads observers to believe that measurement of response time should be a simple exercise. This research identified some of the difficulties in conducting even relatively 'simple' performance measurement and the effects those difficulties have on making comparisons between organizations.

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DEFINITIONAL AMBIGUITY

In 1991, Cummins, et al. developed a template approach for reporting data from out-of-hospital cardiac arrest because of well-documented problems with standard data definitions (Cummins [1991a], Eisenberg [1980], Eisenberg [1990]). “The absence of uniform reporting has led to a tower of Babel in articles about cardiac arrest. Researchers have documented differences in survival rates in many different cities, differences that remain unexplained because of inconsistent and obscure terminology (Cummins [1991b]).” To combat this data definition and data collection problem, researchers developed the Utstein template. The Utstein template is an effort designed to improve reliability in performance measurement with a standardized approach to data collection. As such, the template attempts to address the inconsistent use of various definitions, including response time, used in many of the earlier cardiac arrest studies. Cummins, et al. refer to response time as one of the most frequently, yet inconsistently, used terms in resuscitation. The call-response interval is the period from receipt of call by the emergency response dispatchers to the moment the emergency response vehicle stops moving. Note that this interval does not begin when the emergency response vehicle begins to move. The call-response interval includes the time required to process the call, dispatch emergency personnel, move personnel from their quarters to the emergency vehicle, start the vehicle in motion, and travel to the scene (Cummins [1991b]).

Even though attempts to clarify key performance indicators occurred beginning in 1991, there are still numerous agencies approaching the definition of response time from different perspectives. Data reported by the International City/County Management Association (ICMA) Performance Measurement Consortium uses a response time definition different than that advocated by the Utstein Template. The Consortium uses a performance measurement of response time that begins upon the dispatching of an appropriate unit (International City/County Management Association [1991]). The National Fire Incident Reporting System does not define response time as an interval, but researchers utilize data derived from the “alarm time” and “arrival time” data components. However, both data elements are interpreted differently by various agencies. The definition used by NFIRS simply states that alarm time as the “time of day that the alarm was received by the fire department (National Fire Protection Association [1976]).” If the police department dispatches the fire department, the definition is vague - does the definition mean receipt of call in the police department’s 9-1-1 center, or when the alarm is received by the fire department itself (i.e. dispatch time)? The Commission on Fire Accreditation International provides a clear definition of response time, one that was intentionally derived from the Utstein Template. It calculates response time from receipt of alarm in the dispatch center until arrival of emergency units on the scene of the incident (Commission on Fire Accreditation International, [1997]). The federal government has made numerous, and conflicting, attempts to clearly identify key terms. The US Department of Health’s recommendation for paramedic response time is nine (9) minutes or less in 90% of calls from the time of dispatch, which is not consistent with the Utstein definition (US Department of Health and Human Services [1993]).

However, even though Utstein was published in 1991, a study of EMS regulatory agencies in California counties found that few use standards that comply with state standards which mirror Utstein (Narad [1999]). What can explain low compliance with state standards? Research that has examined reporting practices in other situations may provide some context.

CONSCIOUS ERRORS

Juran characterized one of the more significant problems in performance measurement as conscious errors. Such conscious errors result in “a deliberate distortion of the sensed data, for a variety of (usually) self-serving human purposes: reduction of workload, avoidance of unpleasant tasks, self-aggrandizement, fear of being punished as the bearer of bad news (Juran [1992]).” At present, there is no research examining the impact of different methodologies and definitions on the reporting of paramedic response times. There is no understanding if variance in reported

response times is caused by differences in the definition used, or by various forms of conscious error. Therefore, this research attempts to provide context on the problems of reporting response times identified elsewhere in the literature.

METHODS

POPULATION AND SAMPLE

A survey instrument was mailed to all 211 paramedic agencies within the State of Florida. Fire-rescue agencies provide the majority of paramedic services within the state, a pattern reflective of urban and suburban areas across the nation. Within Florida, approximately 60% of paramedic providers are fire-rescue agencies. A total of 120 useable responses (56.9%) were received from a single mailing of the survey. Of these responses, approximately 72% were from fire-rescue agencies, while third service agencies represented 28% of all respondents.

INSTRUMENTATION

The survey's first three questions examined how response time was calculated, or defined, from three different perspectives. It has been suggested that the use of vignettes may be useful in eliciting judgments from survey respondents (Converse [1986]). For this study three such vignettes, modified by the variable of whose definition of response time the respondent was providing - the agency's, that attributed to a typical parent as perceived by the respondent, or that attributed to an elected official as perceived by the respondent, were used. Each vignette contained various time points, and the respondent was asked to define the point at which the clock started in calculating response time and when the clock stops. This was done for each of the three perspectives or vignettes. The responses from these three questions, regarding response time definitions, were coded to provide comparability across the three scenarios. The coding utilized is shown in Table 1. As can be seen, some scenarios did not have a comparable time point as other

CODE	AGENCY'S PERCEPTION	PARENT'S PERCEPTION	ELECTED OFFICIAL'S PERCEPTION
1	Man collapses.	Soccer player is injured.	
2		Parent dials 9-1-1	When the 9-1-1 call is made
3	Call received by 9-1-1 operator.	Call answered by 9-1-1 operator.	When the 9-1-1 call is answered
4	9-1-1 operator completes obtaining complaint type and location information – incident created in CAD system.	9-1-1 operator obtains information, advises paramedics are enroute, and parent hangs-up telephone.	When the 9-1-1 operator finishes obtaining information and completes the CAD intake form
5	Dispatcher alerts units and they are dispatched to the emergency.	Emergency unit is dispatched to the emergency.	When the dispatcher alerts the emergency units
6	Emergency units advise dispatcher they are enroute.	Emergency unit leaves the station.	When the emergency units actually leave the station
7		Parent hears siren of approaching ambulance.	
8	Emergency units advise dispatcher they are arrival at incident location.	Emergency unit has arrived at the soccer field.	When the emergency unit arrives at the emergency location
9	Emergency units advise they have made patient contact.	Paramedics make contact with the patient.	When the emergency personnel make patient contact or begin emergency operations
10	Other:	Other:	Other:

Table 1 – Mail Survey Codes for Response Time Definitions

scenarios. For example, the parent's perception was the only vignette that made use of the "siren approaching" time point. Differences between the responses to the three vignettes were then analyzed with crosstabulation statistics examined through use of Chi-square analysis.

The survey also examined the use of medical quality assurance in the agency, knowledge of the Utstein Template and the Utstein definition of response time. The Utstein Template defines the call-response interval (response time) as "the period from receipt of call by the emergency response dispatchers to the moment the emergency response vehicle stops moving (Cummins [1991b])". Questions were asked if the agency conducts medical quality assurance activities, if respondents had heard of the Utstein Template, were they aware of the Utstein definition of response time and did the agency use the Utstein definition in calculating their response time data.

HYPOTHESES

The research questions examined how response time was defined within the EMS agency and compared that agency definition to that which the respondent attributed to a typical parent or elected official. As a practical matter, the definition of response time can be determined by knowing when the response time clock starts and when the response time clock stops. Since these two elements comprise endpoints, they determine the definition of response time being used. To examine the definition being applied, two sets of hypotheses were used which take advantage of the ordinal nature of the data. Each set of hypotheses compared statistically when the response time clock started from various perspectives and when the response time clock stopped from the various perspectives.

The first hypotheses examined if the agency definition of response time was greater than that attributed to the typical parent perception. For the agency definition to have been greater, one would expect the agency to start their response time clock earlier in the process and / or stop their clock later in the process. Therefore, the first sets of hypotheses asked if the agency started the response time clock earlier than the time attributed to a typical parent and / or if the agency stopped the response time clock later than the time attributed to a typical parent. The second set of hypotheses examined the same concept outlined above, but compared the agency definition of response time with that attributed to an elected official.

RESULTS

When examining how agencies define response time, we look at when they start and stop the response time clock. Using responses from the vignettes that were designed to determine various definitions of response time, the data show that agencies start the response time clock later in the process than the perception those same agencies attribute to politicians. Further, both the agency definition and that attributed to politicians start the clock later than the perspective attributed to parents. The data in Table 2 summarizes the percentage of survey responses, from each of the three perspectives, that defines when the response time clock starts. This shows that almost half of the agencies responding indicated they start the clock when the 9-1-1 call was answered. In the parent perspective, as defined by the agency, over 75% of respondents believe the clock started earlier in the process, and almost half of respondents (47%) attributed an earlier start time to

	AGENCY	PARENT	POLITICIAN
Injury/Illness Occurs	1.7%	20.2%	0.0%
Dial 9-1-1	0.9%	57.1%	46.6%
9-1-1 Answered	47.9%	16.0%	31.9%
9-1-1 Call Completed	14.5%	6.7%	2.6%
Emergency Unit Dispatched	33.3%	0.0%	12.9%
Emergency Unit En-Route	1.7%	0.0%	6.0%
Total	100.00%	100.00%	100.00%

Table 2 – Perspectives of When Response Time Starts

politicians. Of agencies responding to the survey, one-third start the response time clock when the emergency unit is dispatched - however from the perspective attributed to the parent, the clock always starts earlier in the response time sequence. From the perspective that the agency attributed to a politician, only 12.9% of respondents would allow the clock to start as late as the dispatch of emergency units.

A similar set of questions examined when the clock stops in the response time calculation. Again, when examining the three perspectives, a review of Table 3 indicates that respondents believed that parents and politicians stop the clock later in the response scenario than do the agencies themselves. As shown, responses to this question fell into one of only two categories - the clock stopped when the emergency unit arrived at the incident location, or the clock stopped when emergency responders made patient contact. For 85.1% of respondents, the agency stopped the response time clock when they arrived at the incident location - this compares to 29.3% for the parent perspective. Respondents attributed patient contact time as the point at which 70.7% of parents would stop the response time clock. The politician's perspective favored stopping the response time clock when the unit arrived at the location.

	AGENCY	PARENT	POLITICIAN
Arrival At Location	85.1%	29.3%	66.1%
Patient Contact	14.9%	70.7%	33.9%

Table 3 – Perspectives of When Response Time Stops

Because of the ordinal nature of the data, a crosstabulation table was constructed and a Chi-square test of independence was calculated. These results are shown in Table 4. The data clearly demonstrated that the agency definition of response time resulted in a significant and more favorable impression of response time than that which would be attributed to a typical parent or to a politician.

	AGENCY VS. TYPICAL PARENT	AGENCY VS. POLITICIAN
When Response Time Starts	146.16 (p = 0.0000)	80.20 (p = 0.0000)
When Response Time Stops	72.96 (p = 0.0000)	11.19 (p = 0.0008)

Table 4: Chi-Square Values for Response Time Perceptions

An additional set of questions assessed the respondent's knowledge and / or agency use of quality assurance practices. Specifically, the questions asked if the agency conducted quality assurance activities, whether the respondent had heard of the Utstein template, whether the respondent was aware of the Utstein response time definition, and whether the agency followed Utstein in their definition of response time. The responses to these questions are contained in Table 5.

Not surprisingly, over 99% of agencies reported conducting some type of quality assurance activity. However, the data showed a decreasing number of respondents who acknowledged hearing of the Utstein template (34.2%) or even knowing the Utstein response time definition (26.8%). Only 10.8% of respondents claimed they used the Utstein response time definition, 71.7% claimed they did not, and 17.5% were unsure.

	YES	NO	DON'T KNOW	TOTAL
Does Agency Conduct Quality Assurance Activities?	99.2%	0.0%	0.8%	100.0%
Have You Heard Of Utstein?	34.2%	63.3%	2.5%	100.0%
Are You Aware Of Utstein Response Time Definition?	26.8%	71.4%	1.8%	100.0%
Do You Follow Utstein Definition?	10.8%	71.7%	17.5%	100.0%

Table 5: Knowledge and Use of Utstein Definition

The Utstein definition would be followed if the respondent had indicated they started the response time clock upon answering the 9-1-1 call and stopped the response time clock upon arrival at the incident location. Of all respondents, this practice of starting the clock and stopping the clock as defined by Utstein was found for 42 respondents (35%). Therefore, a number of respondents who answered they did not use, or were unsure if they followed the Utstein template, unknowingly made use of that definition.

DISCUSSION

One of the critical issues in measuring performance, and the benchmarking of performance among agencies, is the extent to which the definition of a given measure is clear, straightforward and generally agreed upon - if not, it suffers from definitional ambiguity.

DEFINITIONAL AMBIGUITY AS AN OBSTACLE

Definitional ambiguity was found to be a continuing problem in large part because of a failure by paramedic agencies to reach a generally agreed upon definition of response time. Agencies used six different points at which they might start the response time clock and two different points at which it could stop. In all, nine (9) different definitions of response time were identified.

When examining the different response time definitions used, two definitions were found to be most common. These definitions used a start time of either 9-1-1 answer or dispatch of emergency units, and both ended with arrival on-scene. However, a number of hybrid definitions were found as well. There was no discernable pattern to explain why certain agencies used certain definitions, but several possible explanations could be considered.

Some agencies seemed to use the data that was readily available. For example, for one respondent where time of dispatch was used to start the response time clock, the system was not designed to capture 9-1-1 answer times. Therefore, the definition of response time appeared related to what data was on-hand to perform the calculation. A second potential explanation appears related to the concept of conscious error. In a follow-up conversation with a respondent, the first time stamp captured by the CAD system was time of 9-1-1 answer, yet the agency made a conscious decision to use a more favorable definition - dispatch time until arrival on location. Managers stated that they believed it provided a more comparable assessment against other agencies in the area, but offered no specific information to indicate that such a definition was commonplace in their area. It was unclear, even to them, what definition other agencies in the area applied in calculating response time.

The problem of defining a relatively simple performance measure - response time - continues to plague paramedic providers a decade after the problem was first identified (Cummins [1991b]). While the manner in which response time was defined varied from agency to agency, there appeared to be little desire or effort to address this problem. The Utstein template refers to response time as starting the clock at 9-1-1 answer, and stopping the clock at arrival on location. Numerous regulatory and standards-making organizations have also provided definitions of response time, some of which agree and some of which conflict, with the Utstein definition. For purposes of benchmarking, it was less important which definition was used and more important that a consistent definition be applied by all paramedic agencies.

CONSCIOUS ERRORS AS AN OBSTACLE

A second dimension of definitional ambiguity existed, and it was caused by the failure of agencies to use a definition of response time that they believed would be used by parents and elected officials. It has been argued that politicians, and therefore public managers, are accountable to the public (Page [1993], Wholey [1993]) Yet, when public managers define key terms of performance in a manner more favorable than they believe others would define it, this raises ethical questions.

Both elected officials and citizens are intended recipients of performance measurement information. For accountability to exist, measures of performance must not only be used internally, but must also be shared outside the organization. In the design of performance measurement systems, it is surprising that so little attention has been given to obtaining the input of intended recipients as to what to measure and how to define key terms. Often these tasks are left to the very managers whose systems are being evaluated (Poister [1999]). Without such external input, it was not surprising there was an inability to reach agreement on the definitions of key performance terms. However, even in the absence of input into the design of the performance measurement system, managers must consider who will be the recipients of performance measurement information. In this study, it appears no such effort was made. It was particularly troubling to identify a pattern where paramedic agencies used a definition of response time that they believed was different than that attributed to intended recipients. A related issue is also troubling. When reporting response time information, agencies rarely if ever, identified how that term was defined and how their response time was calculated. Some agencies have argued they only report those components of response time over which the agency exerts direct control. Therefore, agencies may decide not to include the time from call receipt until dispatch. Such explanations neither absolve the agency from both monitoring and seeking to improve call processing times - regardless of who controls the 9-1-1 center - nor from clearly noting this limitation when reporting their response time. It has been noted that press releases, government information distributed to citizens and government web sites often report fire-rescue or paramedic response times, yet the definition used by the agency was rarely stated.

Managers of paramedic systems use significantly different definitions of response time than that which they attribute to the public. Their definition also differs significantly from the definition they attribute to their own elected officials. Consequently, paramedic agencies may not be communicating their performance clearly to key stakeholders. Agencies should assure that in their reporting and benchmarking activities that response time is clearly defined and the context for a particular definition is explained.

CONCLUSION

This research has shown that paramedic agencies continue to use various definitions of response time. More importantly, the response time definition employed by agencies provided a more favorable image of agency performance than may otherwise be deserved. There was no effort being made by agencies to establish a shared meaning with others or to communicate their definition of this key performance measure. These obstacles, therefore, limit the ability of providers to benchmark their performance against other systems and to engage in meaningful outcomes based research.

Obstacles to measuring performance in EMS systems were hypothesized to include both definitional ambiguity and conscious errors. The data clearly demonstrated that definitional ambiguity remains an obstacle for benchmarking among EMS systems. The problem with conscious errors, while not directly measured in this study, is suggested both from a theoretical perspective and the practice of agencies reporting their response times in a manner more favorable than may otherwise be justified. This obstacle with conscious errors can be minimized if agency directors assure that clear definitions are used for key terms, or that appropriate justifications are provided should a more favorable definition is used.

EMS managers must consider organizational obstacles to measuring system performance and should assure that benchmarking activities provide a true apples-to-apples comparison.

BIBLIOGRAPHY

- Becker, L., Ostrander, M., Barrett, J., & Kondos, G. (1991). Outcome of CPR in a large metropolitan area - where are the survivors? *Annals of Emergency Medicine*, 20(4):355-360. [Link to abstract]
- Braun, O. (1993). EMS system performance: The use of cardiac arrest timelines. *Annals of Emergency Medicine*, 22(1):52-60. [Link to abstract]

- Braun, O., McCallion, R., & Fazackerley, J. (1990). Characteristics of midsized urban EMS systems. *Annals of Emergency Medicine*, 19(5):536-546. [Link to abstract]
- Campbell, J. P., Gratton, M. C., Robinson, W. (1991). Meaningful response time interval: Is it an elusive dream? *Annals of Emergency Medicine*, 20(4):433. [Link to abstract]
- Campbell, J. P., Gratton, M. C., Salomone, J. A., & Watson, W. A. (1993). Ambulance arrival to patient contact: The hidden component of prehospital response time intervals. *Annals of Emergency Medicine*, 22(8):1254-1257. [Link to Abstract]
- Campbell, J. P., Gratton, M. C., Salomone, J. A., Lindholm, D. J., & Watson, W. A. (1994). System implications of the ambulance arrival-to-patient contact interval on response interval compliance. *Prehospital and Disaster Medicine*, 9(4):230-233. [Link to abstract]
- Campbell, J. P., Gridley, T. S., & Muelleman, R. L. (1997). Measuring response interval in a system with a 911 primary and an Emergency Medical Services secondary public safety answering point. *Annals of Emergency Medicine*, 29(4):492-496. [Link to abstract]
- Commission on Fire Accreditation International. (1997). *Fire and Emergency Service Self-Assessment Manual* (4th ed.). Fairfax, VA [Link to bookseller]
- Converse, J. & Presser, S. (1986). *Survey Questions: Handcrafting the Standardized Questionnaire*. Newbury Park: Sage. [Link to bookseller]
- Cummins, R. O., Chamberlain, D. A., Abramson, N., Allen, M., Baskett, P., Becker, L., Bossaert, L., Delooz, H., Dick, W., Eisenberg, M., Evans, T., Holmberg, S., Kerber, R., Mullie, A., Ornato, J., Sandoe, E., Skulberg, A., Tunstall-Pedoe, H., Swanson, R., & Thies, W. (1991a) Recommended guidelines for uniform reporting of data from out-of-hospital cardiac arrest: The Utstein style. *Annals of Emergency Medicine*, 20(8), 861-74. [Link to abstract]
- Cummins, R. O., Chamberlain, D. A., Abramson, N., Allen, M., Baskett, P., Becker, L., Bossaert, L., Delooz, H., Dick, W., Eisenberg, M., Evans, T., Holmberg, S., Kerber, R., Mullie, A., Ornato, J., Sandoe, E., Skulberg, A., Tunstall-Pedoe, H., Swanson, R., & Thies, W. (1991b) Recommended guidelines for uniform reporting of data from out-of-hospital cardiac arrest: The Utstein style. *Circulation*, 84(2), pp 972. [Link to abstract]
- Eisenberg, M. S., Bergner, L., & Hearne, T. (1980). Out-of-hospital cardiac arrest: A review of major studies and a proposed uniform reporting system. *American Journal of Public Health*, 70(3):236-239. [Link to abstract]
- Eisenberg, M. S., Cummins, D. O., Damon, S., Larsen, M., & Hearne, T. (1990). Survival rates from out-of-hospital cardiac arrest: Recommendation for uniform definitions and data to report. *Annals of Emergency Medicine*, 19(11):1249-1259. [Link to abstract]
- Gennis, P., Lombardi, G., & Gallagher, E.J. (1994). Methodology for data collection to study prehospital cardiac arrest in New York City: The PHASE methodology. *Annals of Emergency Medicine*, 24(2):194-201. [Link to abstract]
- Hedges, J. (1993). Beyond Utstein: Implementation of a multisource uniform data base for prehospital cardiac arrest research. *Annals of Emergency Medicine*, 22(1):41-46. [Link to abstract]
- International City/County Management Association. (1999). *Comparative Performance Measurement: FY 1998 Data Report*. Washington, D.C. [Link to publisher]
- Juran, J. M. (1992). *Juran on Quality by Design: The New Steps for Planning Quality into Good and Services*. New York: The Free Press. [Link to bookseller]
- Jurkovich, G., Campbell, D., Padrta, J., & Luterman A. (1987). Paramedic perception of elapsed field time. *Journal of Trauma*, 27(8):892-897. [Link to abstract]
- Killien, S., Geyman, J., Gossman, J., & Gimlett, D. (1996). Out-of hospital cardiac arrest in a rural area: A 16-year experience with lessons learned and national comparisons. *Annals of Emergency Medicine*, 28, 294-300. [Link to abstract]
- Narad, R. & Driesbock, K. (1999). Regulation of ambulance response times in California. *Prehospital Emergency Care*, 3(2):131-135. [Link to abstract]
- National Fire Protection Association. (1976). *Standard 901: Uniform Coding for Fire Protection*. Boston. [Link to bookseller]
- Page, B. & Shapiro, R. (1993). The rational public and democracy. In G. Marcus & R. Hanson (Eds.), *Reconsidering the Democratic Public*. University Park, PA: Pennsylvania State University Press. [Link to bookseller]
- Poister, T. & Streib, G. (1999). Performance measurement in municipal government: Assessing the state of the practice. *Public Administration Review*, 59, 325-335. [Link to publication]
- Spaite, D., Valenzula, T., Meislin, H., Criss, E., and Hinsberg, P. (1993). Prospective validation of a new model for evaluating emergency medical services by in-field observation of specific time intervals in prehospital care. *Annals of Emergency Medicine*, 22, 730-1. [Link to abstract]
- US Department of Health and Human Services. (1993). *Staffing and Equipping Emergency Medical Services Systems: Rapid Identification and Treatment of Acute Myocardial Infarction*. (NIH Publication No. 93-3304). Rockville, MD [Link to document]
- Wholey J. & Hatry H. (1992). The case for performance monitoring. *Public Administration Review*, 52, 604-610. [Link to publication]