The "Essential STEMI Subsystem" (ESS) & "Essential Elements of Reperfusion" (the 5R's)

Hospitals that treat STEMI patients must optimize three basic pathways whereby STEMI patients interact with that particular facility. This is true of both PCI and non-PCI centers. Each of these pathways shares common elements but (from a systems perspective) they also define somewhat distinct STEMI patient populations. These three overlapping patient populations are roughly defined by how they arrive and/or depart that facility:

1) STEMI patients presenting at "at the front door" without initial EMS involvement
2) STEMI patients brought in from the field via EMS transport
3) STEMI patients transferred to (or received from) another institution (inter-facility EMS transfers).

Classifying STEMI patient populations in this way allows us to define the key elements of the "Essential STEMI Subsystem" (ESS). As discussed in detail later, an ESS is defined as the smallest collection of hospitals and EMS agencies that can function together as a "stand-alone" STEMI system of care. Thus the ESS is the smallest "building block" of STEMI care; this suggests that careful "grass roots" optimization of care within each ESS is mandatory as a foundation for large scale improvements of care at the state, regional and national level.

The Essential STEMI Subsystem (ESS) is defined from the perspective of an individual facility. Each ESS consists of that individual STEMI facility plus all EMS agencies and other treatment facilities that either send or receive patients to or from that facility. For example, a PCI center ESS might typically include several non-PCI centers and a number of EMS agencies. Similarly a non-PCI center ESS may include a variable number of EMS agencies and one or more PCI centers-depending on that institution's inter-facility transfer and patient referral patterns, etc.

Defining a STEMI system of care at this level of detail has several important implications. First, the borders of each ESS can be fairly carefully defined since any facility or EMS agency that interacts with that particular facility is part of their ESS sphere. This establishment of boundaries helps clarify responsibilities within any given ESS and also suggest to each facility where they should focus their efforts.

Secondly, since each facility forms the core of an ESS, each system will (usually) overlap one or more neighboring systems. STEMI care providers, particularly EMS personnel, may thus be working within several separate ESS spheres. This linked distribution can facilitate cooperative effort, simplify geographical coverage and aid quality improvement efforts on a regional level.

Thirdly, this simple yet precise definition of an ESS serves to quantify and standardize the elements and structures s likely to be found within any local STEMI care system. This standardization lends itself to the application of systems engineering principals in an attempt to find standardize approaches to quality improvement that are likely to work within any ESS.

Careful examination of STEMI systems that have evolved independently have brought to light concepts and practices that appear to be inherent requirements for optimizing any local STEMI system of care. Refinement of these ideas has resulted in the concept of the "Five Essential Elements of Reperfusion," commonly referred to as the "5R's". Focusing efforts on optimizing each of these five elements appears to be the most efficient approach for rapid improvement of STEMI care within each ESS.

The "5R's" of Reperfusion are briefly discussed below.

(R1) Relationships: The establishment of solid relationships within the boundaries of an ESS is the single most important Essential Element. Forming relationships (of all sorts) within the STEMI care continuum of an ESS is an absolutely essential process and ultimately is the key to sustainable success. These relationships are numerous and can be classified as formal or informal. This includes regular STEMI-specific provider education.

(R2) Recognition: The first step towards reperfusion is recognition of a STEMI on an ECG. Therefore, each STEMI portal, whether fixed (hospital) or mobile (EMS vehicle) must carefully adhere to a standardized screening ECG protocol on a continuous basis. Lapses in this crucial action are often responsible for late or missed STEMI diagnosis.

(R3) Reperfusion: Each STEMI Portal, both fixed and mobile (EMS) must have a carefully developed reperfusion plan in place. This STEMI ALERT plan must be carefully adapted to that STEMI portal and must be instantly available to STEMI care providers when a STEMI is diagnosed.

(R4) Real-time data collection: Collecting accurate information on each STEMI ALERT (as it occurs) is necessary for continuing improvement. This data should be recorded by STEMI caregivers as the process occurs and recorded on a standardized data collection sheet that can be easily collected for quality improvement analysis.

(R5) Reassessment & Refinement: Constant process improvement is facilitated by accurate data collection followed by timely data analysis. Without a process in place to act on this data quality improvement can be limited, however. Therefore it is important that each institution and local system have a vigorous process in place for ongoing quality improvement.

Focusing effort on systematic improvement of each of these essential elements is the most efficient method of systematically improving STEMI care in any local system.