# DELAYS TO REPERFUSION: MULTIPLE FACTORS TO CONSIDER

There are many factors that can influence the time it takes for medical care to arrive onsite and the time it takes to transport the patient to the medical facility, such as:
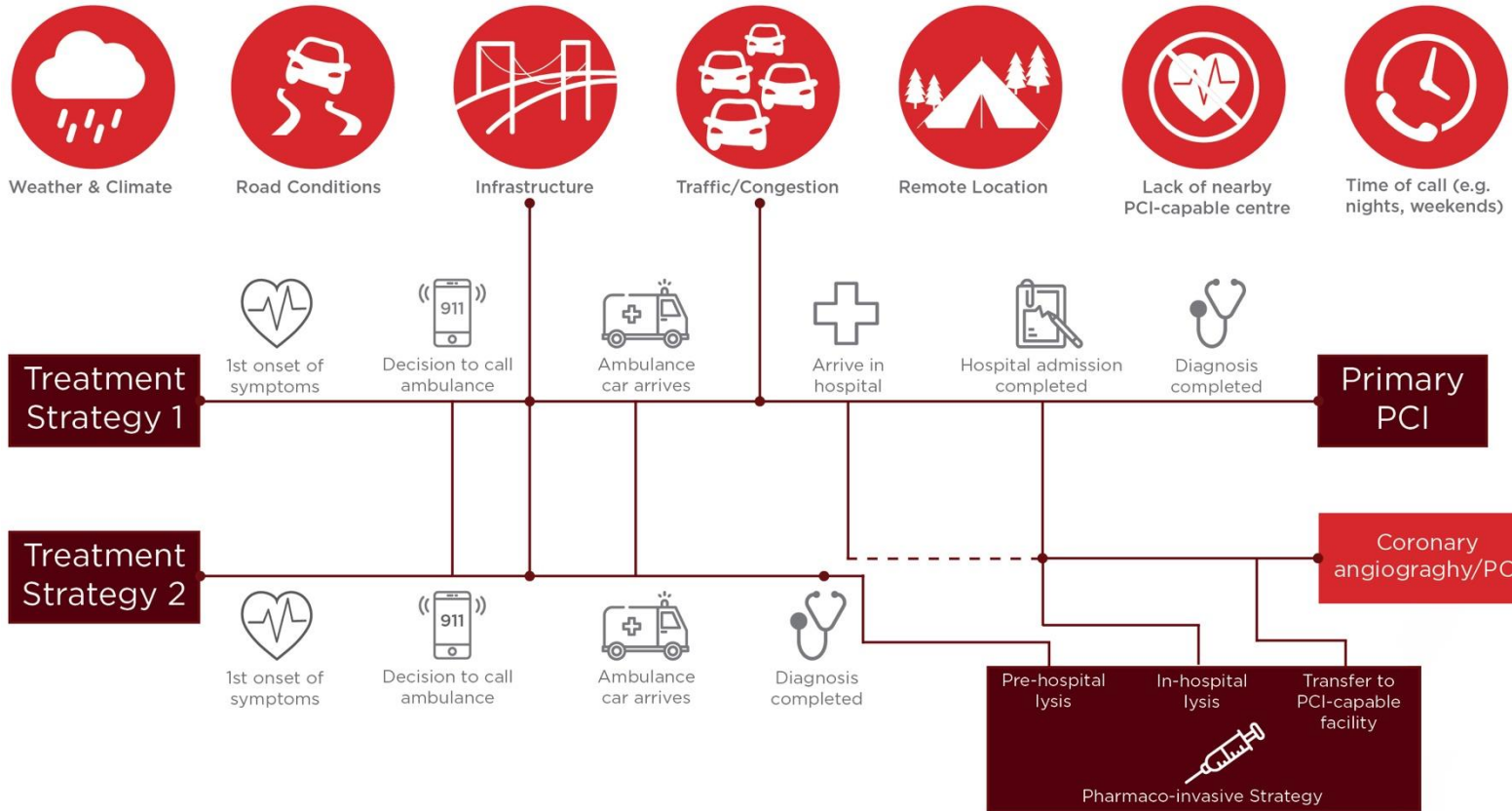
1. 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction: Executive Summary: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Catheterization and Cardiovascular Interventions. 2013;82(1):E1-E27.
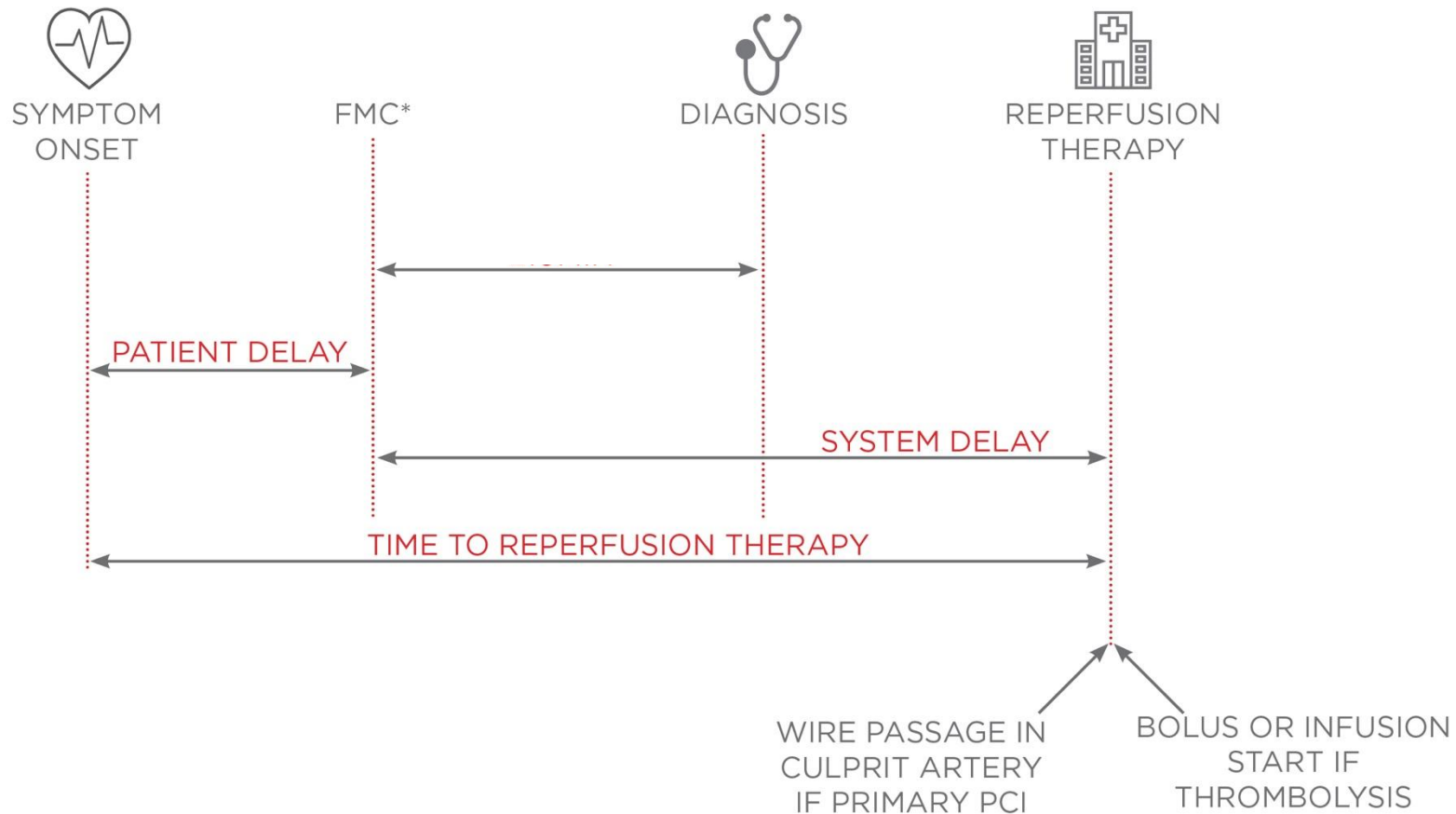
* All delays are related to FMC (First Medical Contact)

Authors/Task Force Members, Steg PG, James SK, Atar D, Badano LP, Lundqvist CB, Borger MA, Di Mario C, Dickstein K, Ducrocq G, Fernandez-Aviles F. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force on the management of ST-segment elevation acute myocardial infarction of the European Society of Cardiology (ESC). European heart journal. 2012 Aug 24;33(20):2569-619.

MULTIPLE AREAS INVOLVED IN TIMEOUS TREATMENT
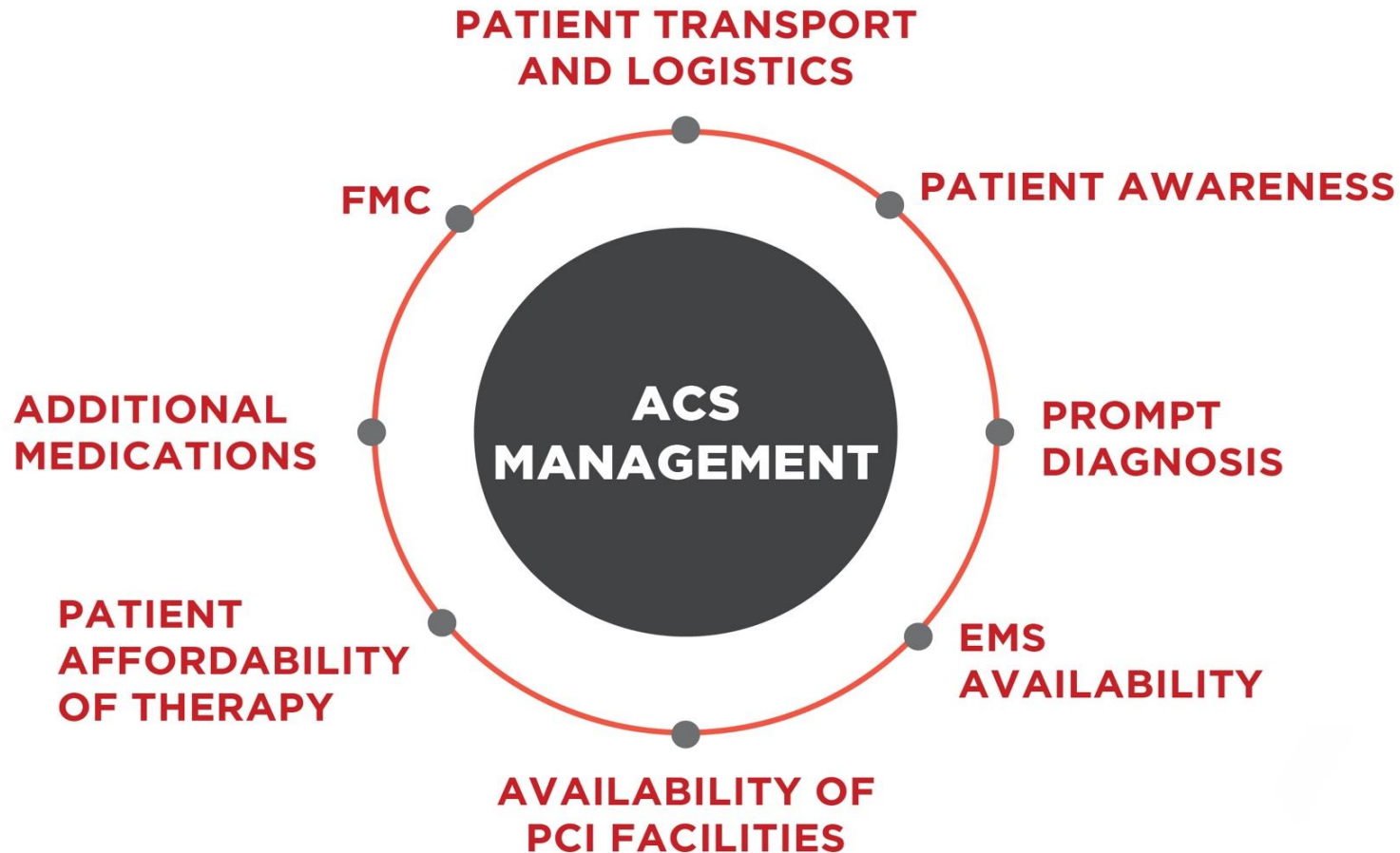
FMC: First medical contact; PCI: percutaneous coronary intervention;
ACS: Acute coronary syndrome; EMS: Emergency medical services

CURRENT BARRIERS & DELAYS IN ACS CARE

PATIENT EDUCATION

- Even though patients may realize that something is wrong, they do not always recognize the need for urgent intervention, where to go, and what to do

FIRST MEDICAL CONTACT

- Availability of ECGs* and interpretation of results
- Unnecessary delays by relying on blood test results
- Availability of appropriate support and infrastructure
- Recognizing the need for urgent ECG and decision making
- Availability of thrombolytics and lack of confidence in using these agents
- Not recognizing the need for additional medication
- Not recognizing that thrombolysis is not the final therapy and that referral to cath lab center should follow ASAP

* ECG: electrocardiogram

1. Unpublished, personal communication Dr A Snyders

CURRENT BARRIERS & DELAYS IN ACS CARE

LYTIC AND OTHER DRUG AVAILABILITY
- Data within South Africa is limited
- Limited availability of lytics in general practitioner practices[1]
- Minimal antiplatelet administration[1]
- Delays in reperfusion results in an increase in morbidity and mortality[2]

TRANSPORT - REFERRAL CHALLENGES[1]
- Authorization from medical aids
- Ambulance availability
- Ambulance preference
- Referral pathway preference

TROPONINITIS[1]
- The condition that leads clinicians to falsely assign a diagnosis of AMI based only on the fact that a patient has an elevated cTn concentration. There are many causes of myocardial injury other than AMI.

1. Unpublished, personal communication Dr A Snyders
2. 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction: Executive Summary: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Catheterization and Cardiovascular Interventions. 2013;82(1):E1-E27.

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BARRIERS EXISTS IN ALL LEVELS OF CARE, EVEN PRIMARY CARDIAC HOSPITALS

- Not recognizing high risk patients

- Not recognizing an abnormal ECG*

- Relying on Troptonins - and the risk of Troptonitis

- ICU delays due to bed availability

- No or delay in notification of cardiac team once clinical diagnosis was made

* Electrocardiogram

1. Unpublished, personal communication Dr A Snyders

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SUMMARY OF COMMON BARRIERS

- Not obtaining a proper history of cardiac chest pain

- Not thoroughly examining the patient

- Not performing **IMMEDIATE ECG** on all patients triaged as chest pain/acute coronary syndrome

- Delay in repeating ECGs* or performing serial ECGs when appropriate

- Patients not familiar with EMS** contact details

- Lack of knowledge regarding closest PCI*** capable center

- Temporary staff unaware of protocol in place

- Thrombolytics not specified/requested or administered by non cathlab hospitals

- Bed availability at PCI capable center not confirmed prior to transfer

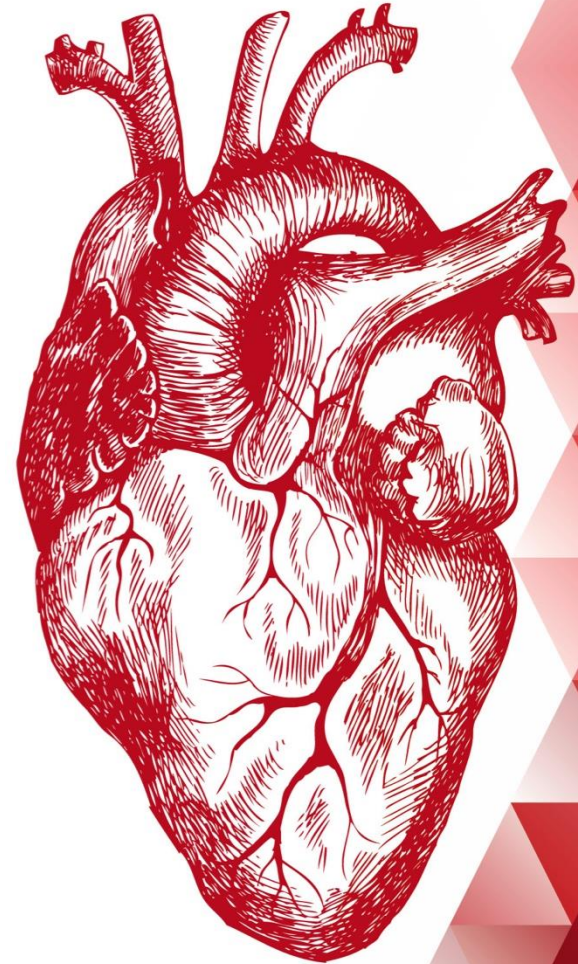- Possible medical aid authorization delays

1. Unpublished, personal communication Dr A Snyders

* ECG: Electrocardiogram ** Emergency medical services
*** Percutaneous coronary intervention

GOALS OF THERAPY IN MYOCARDIAL INFARCTION

➢ Restore coronary flow

➢ Limit size of infarct

➢ Preserve LV function

➢ Reduction of complications

➢ Improvement of clinical outcome

Authors/Task Force Members, Steg PG, James SK, Atar D, Badano LP, Lundqvist CB, Borger MA, Di Mario C, Dickstein K, Ducrocq G, Fernandez-Aviles F. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force on the management of ST-segment elevation acute myocardial infarction of the European Society of Cardiology (ESC). European heart journal. 2012 Aug 24;33(20):2569-619.

IMPORTANCE OF RAPID REPERFUSION IN STEMI

30-MINUTE DELAY = 7.5% INCREASE IN 1-YEAR MORTALITY[3]

FIBRINOLYTIC THERAPY[2]

DOOR-TO-DRUG TIME (MIN)
- 0-30: 7.0
- 31-60: 9.3
- 61-90: 11.9
- >90: 16

IN-HOSP MORTALITY (%)
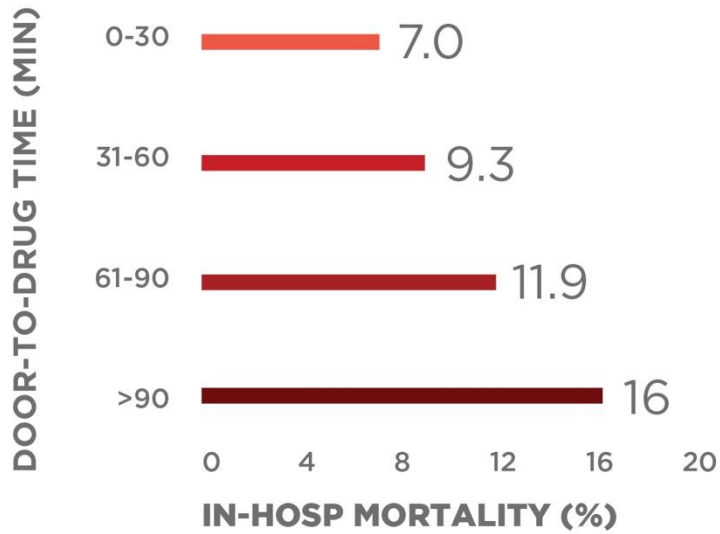
N = 85,589; P < 0.0001

PRIMARY PCI[1]

MORTALITY (%) vs DOOR-TO-BALLOON TIME (MIN)
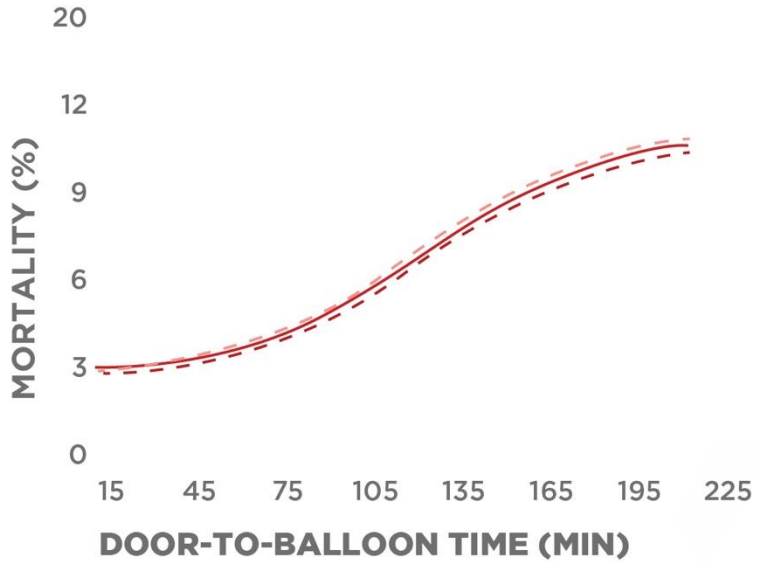
N = 43,801

1. Rathore S, Curtis J, Chen J, Wang Y, Nallamothu B, Epstein A et al. Association of door-to-balloon time and mortality in patients admitted to hospital with ST elevation myocardial infarction: national cohort study. BMJ. 2009;338(may19 1):b1807-b1807.
2. Canon C. Longer thrombolysis door-to-needle times are associated with increased mortality in acute myocardial infarction: An analysis of 85,589 patients in the National Registry of Myocardial Infarction 2 &3. Journal of the American College of Cardiology. 2000;35 (Suppl A):376A.
3. De Luca G, Suryapranata H, Ottervanger J, Antman E. Time Delay to Treatment and Mortality in Primary Angioplasty for Acute Myocardial Infarction. Circulation. 2004;109(10):1223-1225.

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RELATIONSHIP BETWEEN MORTALITY REDUCTION AND EXTENT OF SALVAGE
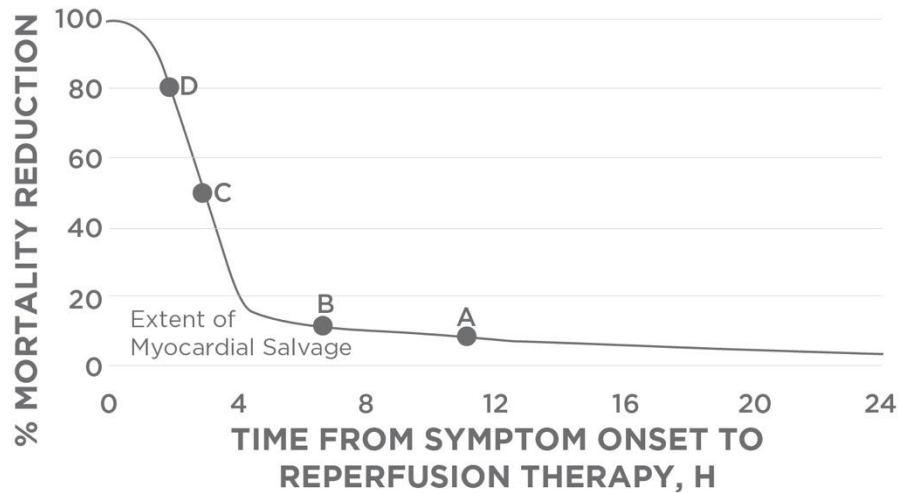
MODIFYING FACTORS

- Collaterals
- Ischemic preconditioning
- MVO_2
- Duration of sustained ischemia

TREATMENT OBJECTIVES

- Time to treatment is critical
- Opening the infarct related artery (PCI and/or lysis)

SHIFTS IN POTENTIAL OUTCOMES WITH DIFFERENT TREATMENT STRATEGIES

- A to B: No Benefit
- A to C: Benefit
- B to C: Benefit
- D to B: Harm
- D to C: Harm

1. Gersh B, Stone G, White H, Holmes D. Pharmacological Facilitation of Primary Percutaneous Coronary Intervention for Acute Myocardial Infarction. JAMA. 2005;293(8):979.

APPROACHES TO IMPROVE THERAPY OUTCOMES[1]

EARLIER TREATMENT

Education of physicians, paramedical personnel, and the public

CORRECT THROMBOLYTIC AGENTS

Plasminogen activators with higher thrombolytic potency and/or specific thrombolytic activity

IMPROVED CO-THERAPY WITH ANTITHROMBOTIC AGENTS

Anticoagulants, specific thrombin inhibitors
Antiplatelet agents, GP 118/IIIA inhibitors

1. Collen D. Towards improved thrombolytic therapy. The Lancet. 1993;342(8862):34-36.

IMPROVING TIME TO TREATMENT

- Public education and AMI awareness
  → Reduce symptom onset-to-call times

- Medical professionals
  → Reduce first medical contact (FMC)-to-treatment times

NETWORKS

- Foster strong communication among medical professionals involved in the treatment of ACS within hub and spoke networks

- Facilitate pre-hospital diagnosis and thrombolysis or a referral to PCI-capable facility within guideline specific timeframes

Adapted from: Ibanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, Caforio AL, Crea F, Goudevenos JA, Halvorsen S, Hindricks G. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). European heart journal. 2017 Aug 26;39(2):119-77.

IDEAL STRUCTURE OF HUB AND SPOKE MODEL FOR STEMI CARE
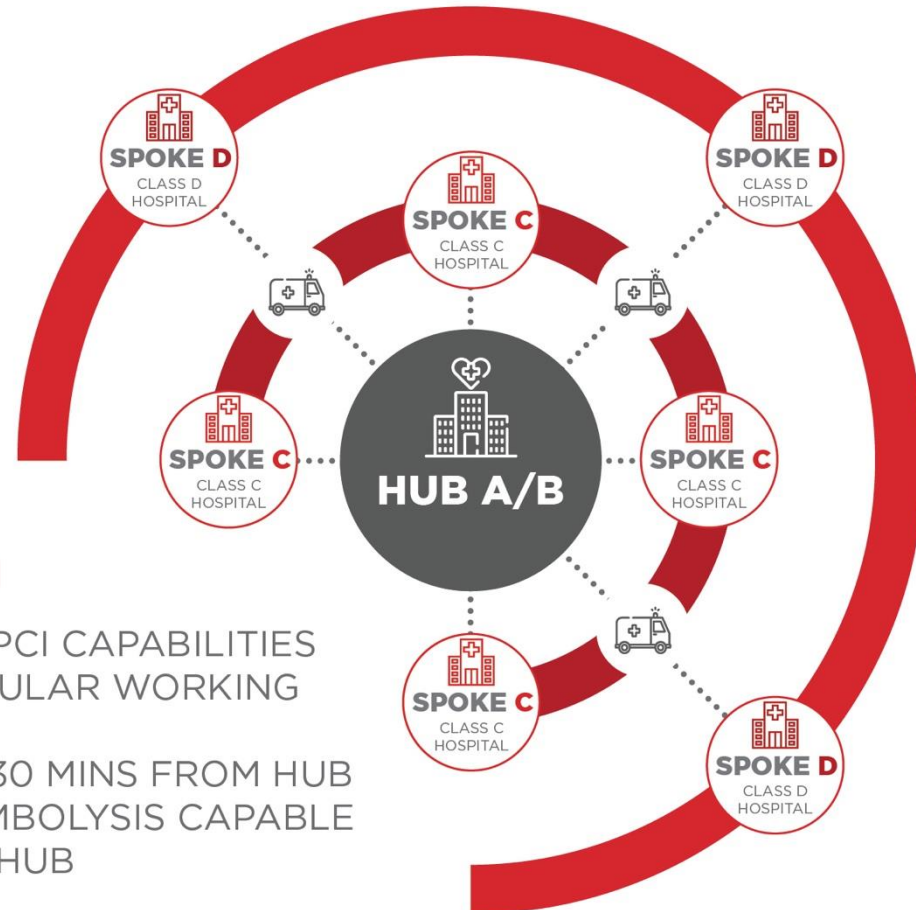
HOSPITAL CLASSIFICATION

HUB A :   24 HR PRIMARY PCI CAPABILITIES
HUB B: PCI DURING REGULAR WORKING HOURS
SPOKE C : ECG CAPABLE <30 MINS FROM HUB
SPOKE D : ECG AND THROMBOLYSIS CAPABLE <30 MINS FROM HUB

PCI: percutaneous coronary intervention; ECG: electrocardiogram;
STEMI: ST-elevation myocardial infarction

Alexander T, Mullasari A, Kaifoszova Z, Khot U, Nallamothu B, Ramana R et al. Framework for a National STEMI Program: Consensus document developed by STEMI INDIA, Cardiological Society of India and Association Physicians of India. Indian Heart Journal. 2015;67(5):497-502.

CONCLUSION

- Time is critical in the treatment of ACS, including ST-elevation myocardial infarction

- The diagnosis is based on the clinical presentation and an ECG

  Reperfusion is the most important intervention:

  – 1st prize: **PRIMARY PCI**

  – Close 2nd: **EARLY ADMINISTRATION OF THROMBOLYTIC FOLLOWED BY PCI**

EARLIEST REPERFUSION IS THE BEST OPTION FOR PATIENT OUTCOMES

PCI: percutaneous coronary intervention;

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THE RESPONSIBILITY IS OURS

- Know where all your local/referral PCI/Cath lab centers are

- Establish networks between non-cath lab hospitals and cath lab hospitals

- Perform an ECG without delay

- Take a picture of the ECG and forward to the cardiologist/ED if required

- If possible (or if remote location) - consider keeping and administrating thrombolysis according to guidelines

- Consult and ask questions ·if you are unsure of diagnosis etc.

- Do not delay getting your patient to a PCI/Cath Lab facility

PCI: percutaneous coronary intervention; ECG: electrocardiogram;
ED: emergency department

THE RESPONSIBILITY IS OURS

PCI/HUB HOSPITAL DRIVEN PROGRAMS

- Referral center education

- Transfer Arrangements

- Establish Contact Numbers

- Referral Sheet

IMPORTANT FACTORS TO FOCUS ON FOR IMPROVED ACS MANAGEMENT

- Education campaign[1]

- Community organisation[1]

- Standardized written ACS and STEMI management protocols[1]

- Ambulances (vehicles, helicopters, planes) equipped with defibrillators, 12-lead ECG, trained professionals capable of basic and advanced life support or initiation of fibrinolysis in case of delays[1]

- ECG transmission/teleconsultation[1]

- Hub and Spoke networks, implementing pharmaco-invasive therapy strategy

- Single number to activate catheterization laboratory[1]

- Experienced cardiologist or intensive care specialist to lead the network[1]

- 24/7 accessible tertiary care centres[1]

* Procedures and treatment should be agreed between network members and   put in writing. PCI: percutaneous coronary intervention; ECG: electrocardiogram

1. Huber K, Gersh BJ, Goldstein P, Granger CB, Armstrong PW. The organization, function, and outcomes of ST-elevation myocardial infarction networks worldwide: current state, unmet needs and future directions. European heart journal. 2014 Apr 16;35(23):1526-32.

TAKE HOME MESSAGES

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- If performed, **PPCI remains the gold standard of care** for STEMI patients, but only with 120 min of first medical contact[1]

- **Pharmaco-invasive strategy is recommended** when and where PPCI is not achievable within the recommended time frame[1]

- The pharmaco-invasive strategy delivers clinical outcomes suggesting **non-inferiority to PPCI,** with a similar risk profile[2]
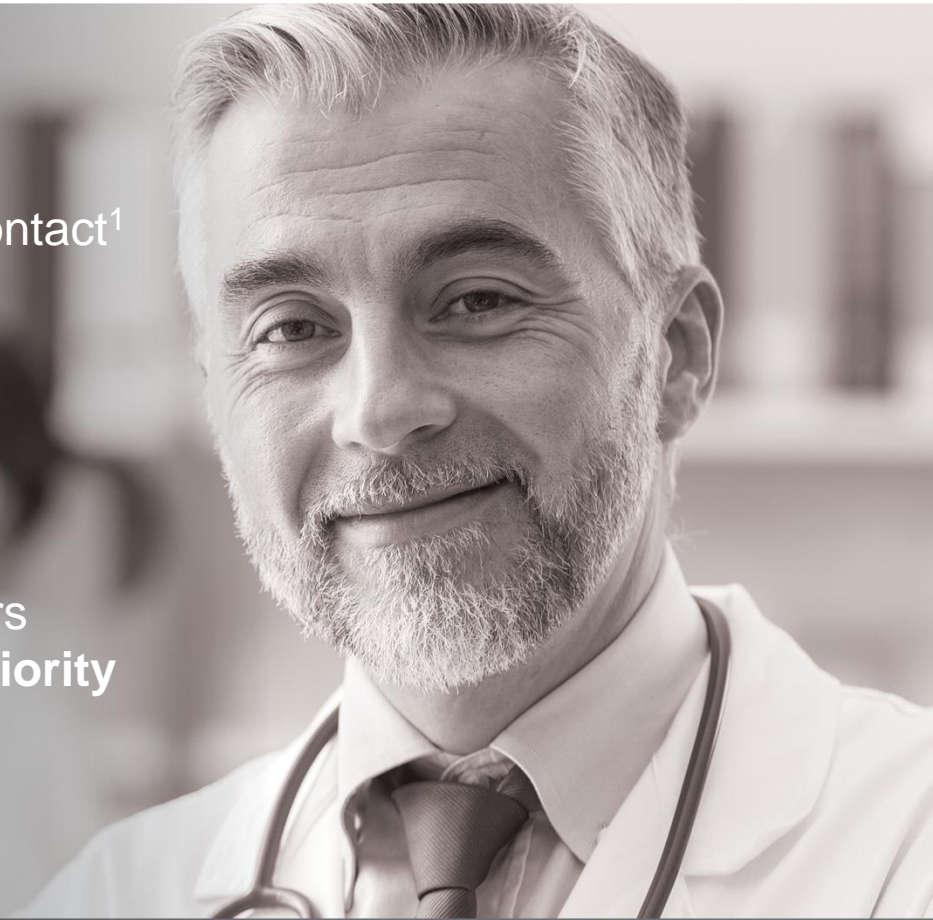
1. Banez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, Caforio AL, Crea F, Goudevenos JA, Halvorsen S, Hindricks G. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). European heart journal. 2017 Aug 26;39(2):119-77.
2. Sinnaeve PR, Van de Werf F. Primary PCI Not Always the Best Reperfusion Strategy?. Circulation. 2014 Mar 21:CIRCULATIONAHA-114.