



# HeartRescue Global

## Policy Brief

STEMI: ST-Segment Elevation  
Myocardial Infarction

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## ACKNOWLEDGEMENTS

This analysis was produced by RTI International in partnership with the Medtronic Foundation. For over 50 years, RTI has been committed to improving the human condition by turning knowledge into practice. The Medtronic Foundation focuses on expanding access to quality health care among underserved populations worldwide, as well as supporting health initiatives in communities where Medtronic employees live and give.



STEMI, or ST-segment elevation myocardial infarction, is one form of cardiovascular disease (CVD) and is an enormous worldwide public health problem. For decades, STEMI has been a significant health problem in high-income countries, but now it has become an increasingly significant medical, social, and financial problem in low- and middle-income countries.



**CVD**

is a leading cause of mortality worldwide

In 2015, CVD was responsible for

**6x**

as many deaths as these three combined<sup>1</sup>



HIV



malaria



tuberculosis

**25–40%**  
of all heart attacks are caused by STEMI<sup>2</sup>



**MANY STEMI SURVIVORS SUFFER LONG-TERM ILLNESSES AFTERWARDS, SUCH AS HEART FAILURE**



In 2015, ischemic heart diseases, including STEMI, accounted for

**9 MILLION DEATHS<sup>1</sup>**

**THE ESTIMATED GLOBAL COST OF CARDIOVASCULAR DISEASE WAS \$863 BILLION IN 2010<sup>3</sup>**

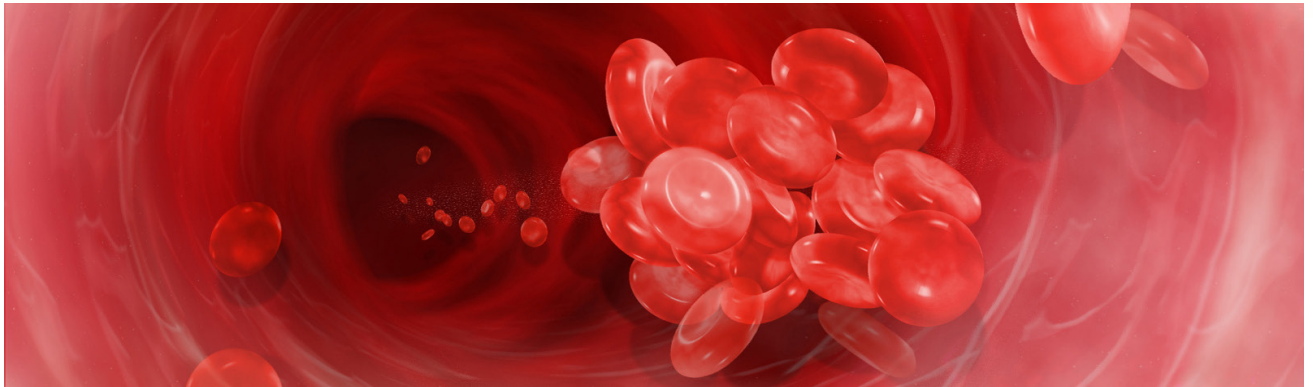


**AND IT IS ESTIMATED TO RISE TO \$1044 BILLION BY 2030<sup>3</sup>**



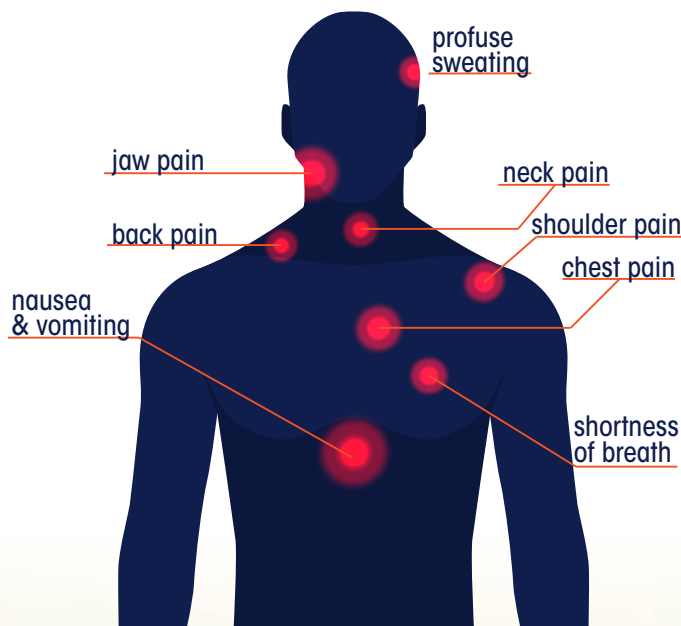
Timely treatment of STEMI is associated with significantly improved survival and other patient outcomes, and reduced costs. However, large socioeconomic, racial, and gender disparities in access to STEMI care and time to effective care exist worldwide.

# WHAT IS STEMI?



STEMI is one type of heart attack caused by a sudden blood clot in a major coronary artery. Because of a sudden interruption of blood supply to the heart, the full thickness of the heart muscle is damaged. STEMI is a more serious form of heart attack compared with other forms of heart attack in which only partial thickness damage of the heart muscle occurs.

STEMI symptoms typically include chest pain or chest tightness. Other symptoms include pain radiating to the neck, jaw, shoulder, back or arms; shortness of breath; nausea and vomiting; or profuse sweating. People in all communities need to learn about these symptoms so they, their family members, or others will know to call emergency telephone numbers quickly when these symptoms arise.



STEMI is diagnosed using clinical symptoms and electrocardiogram (ECG) findings, blood markers for heart damage, and coronary angiograms looking for blocked arteries.

In some cases, the patient also suffers out-of-hospital cardiac arrest (OHCA). This occurs when the heart completely stops pumping blood and people require immediate CPR and defibrillation (electric shock) to restore the heart's normal rhythm – or they will die.



## WHY IS TIME TO TREATMENT SO CRITICAL?

Time to treatment for someone suffering a STEMI event is a matter of life and death. The amount of a person's heart muscle that is lost from a lack of blood supply with STEMI is directly related to the length of time from symptom onset to definitive treatment. All STEMI care should focus on getting the patient to a hospital as fast as possible to get the blocked artery open and restore blood flow to the heart.

## HOW IS STEMI TREATED?

The treatment for STEMI is to open the blocked artery, which is called **reperfusion**. The preferred treatment is percutaneous coronary intervention (PCI).<sup>2</sup> Ideally, this is done within 90 minutes of the patient arriving at the emergency department (ED). This time is referred to as the **Door-to-Balloon** time.

If PCI is not available, then the patient receives a drug to dissolve the blood clot. The drug is given intravenously. These drugs are effective up to 12 hours after symptom onset, but they are most effective if given sooner. The goal is to administer the drug within 30 minutes of arrival at the ED. This time is called the **Door-to-Drug** or **Door-to-Needle** time.

# WHY IS IT SO IMPORTANT FOR PATIENTS AND THEIR FAMILY MEMBERS TO SEEK MEDICAL CARE FAST?

One of the most important factors that has an impact on STEMI treatment is **how soon** the patient decides to seek medical care after first feeling the symptoms. If patients or their family members delay too long in calling emergency medical services (EMS) or traveling to the hospital, then the speed of the hospital in performing PCI or administering drugs to dissolve the blood clot may be much less effective.

## WHO EXPERIENCES STEMI?

STEMI happens more frequently to:



Older people



Men (although women often have more complicated cases and less access to care)



People with previous CVD



People with diabetes



People who smoke



People with high blood pressure



People with high cholesterol



People with a family history of premature heart disease

# WHY DO WE NEED A STEMI SYSTEM OF CARE?

Because STEMI is such a time-sensitive medical emergency, a planned system of care must be established to rapidly diagnose STEMI and to quickly initiate treatment and deliver STEMI patients to hospitals ready to treat them. An effective STEMI system of care saves lives.

Four key steps comprise this STEMI system of care:

- **Step 1** involves the **community**
- **Step 2** involves the **EMS system**
- **Step 3** involves the **hospital**
- **Step 4** involves the system of care and a **data system** that include the community, EMS, and hospitals.

## STEP 1: Community Response to STEMI



The first step is for the patient, family member, or a bystander to call the emergency telephone number to activate the EMS system. A major challenge in countries around the world is to educate and motivate patients, family members, and bystanders about the urgency of calling EMS as quickly as possible when symptoms of a possible STEMI or another medical emergency occur.

Everyone needs to be trained to call the emergency telephone number (for example, 120 in China, 108 in India, 192 in Brazil, and 911 in the United States) as soon as they see someone suffering what looks like it could be STEMI or some other medical emergency. This will allow EMS to arrive and start treatment as soon as possible. Delays in calling EMS can result in needless suffering and unnecessary deaths of STEMI patients.

In most nations around the world, this step is usually delayed because of multiple factors. Some of the most common reasons for delays include:

- Lack of understanding of STEMI symptoms
- Lack of understanding of the time urgency for calling EMS for treatment
- Fears about financial burdens that EMS and medical treatment might mean for the family
- Lack of confidence in EMS response time or the quality of care
- Low social status of some historically-underserved patients in the community
- Cultural preferences for informal healers

## **STEP 2:** Rapid Emergency Medical Services



The second step is to organize a rapid response and high-quality EMS system that can identify, stabilize, and transport STEMI patients to an appropriate hospital. It is imperative that EMS transports the STEMI patient to a STEMI-ready hospital immediately as subsequent patient transfers are associated with significant delays in care. It is vital that the EMS dispatcher send the correct level of medical rescuers. Consequently, EMS dispatchers at emergency call centers need to have the necessary medical training, to use nationally developed protocols, and to have a quality-improvement system in place to ensure compliance with protocols.

For this step, each EMS system should maintain a standardized method, such as an algorithm, for evaluating and treating patients with symptoms that suggest a STEMI event. This includes rapidly acquiring and using a 12-lead ECG and communication of the ECG findings in advance to the receiving hospital. This can be done via direct EMS staff voice communication, automated computer algorithm interpretation, or wireless transmission and physician interpretation.



## **STEP 3:** High Quality Hospital Care



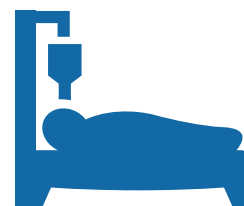
The third step is for the hospital to be prepared with a rapid STEMI response to deliver the appropriate reperfusion therapy, with PCI as the preferred treatment.<sup>2</sup> The hospital should have a streamlined STEMI treatment process to reduce the time required to open the affected artery. If patients arrive at a hospital that is not equipped to rapidly treat STEMI, there should be protocols to transport patients as fast as possible to the closest appropriate hospital equipped for STEMI treatment.

For this step, protocols for rapid diagnosis and cardiac catheterization laboratory activation for PCI should be established within hospitals and they should be identified as STEMI-Receiving Centers for EMS. These hospitals should be available 24 hours per day and 7 days per week to perform PCI or provide blood clot dissolving drugs.

## **STEP 4:** System of Care and Data System



The fourth step includes a system of care and a continuous data measurement system linking across the community, EMS, and hospitals. This system should include a STEMI patient registry or health information systems to collect and link EMS and hospital data on access to care, processes of care, speed of care at each of Steps 1 through 3, and outcomes for all STEMI patients. These data should be reviewed regularly and shared with EMS and hospital staff to track progress in improving access, response time, and quality of care for STEMI events. These data will also help to identify barriers to improvements.



## Community Level

## EMS Level

## Hospital Level

## Health System and Data System Level

### Common Barriers

### Potential Solutions

Low community knowledge of STEMI symptoms and the importance of rapid treatment

Inadequate recognition of STEMI symptoms and when to call EMS

Inadequate awareness of the life-saving benefits of rapid reperfusion treatment and the importance of time to PCI or clot-dissolving drug intervention

Increase public information and communications about STEMI signs and symptoms and actions required

Lack of confidence and use of EMS services

Increase public training on the benefits of using EMS system for suspected STEMI

Inadequate access to primary prevention treatment for heart disease in general

Enhance heart disease screening and prevention

### Common Barriers

### Potential Solutions

Inadequate mobile phone coverage and/or lack of EMS dispatch centers

Improve telecommunication and dispatch center infrastructure

EMS system limitations, such as availability of services, response times, costs to patients or family members, and quality of care, equipment, and services

Increase public and private funding and support for high-quality EMS care

Lack of EMS providers

Increase public and private funding for EMS, recruit and train EMS providers

Lack of STEMI protocols

Develop STEMI protocols and conduct training

Lack of EMS routing algorithm

Develop EMS routing algorithm and conduct training

Lack of 12-lead ECGs

Increase public and private funding for EMS, purchase 12-lead ECGs and conduct training

### Common Barriers

### Potential Solutions

Variable quality and speed of STEMI care delivered by hospital staff

Use existing, established performance measures for hospital STEMI care

Challenges in patient involvement in consent and decision-making

Increase public awareness about the need for rapid STEMI treatment

Delays in diagnosis and treatment in the emergency department and in activation of the hospital's PCI team

Establish treatment protocols

Delays in transfers between hospitals, if the initial hospital is not PCI-capable

Establish hospital transfer agreements between hospitals

Inadequate coordination of care and post-discharge instructions for secondary prevention

Abide by existing guidelines for post-STEMI care and secondary prevention

Cost of hospital treatment to the patients and their family members

Increase public and private funding and support for high-quality STEMI care

### Common Barriers

### Potential Solutions

Conflicting interests of hospitals, EMS, and government agencies

Establish cooperative agreements between hospitals and EMS systems

No data collection or reporting system for STEMI

Implement continuous data collection and evaluation of STEMI incidence, process of care, and outcomes

## REFERENCES

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- <sup>2</sup>O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, Ettinger SM, Fang JC, Fesmire FM, Franklin BA, Granger CB, Krumholz HM, Linderbaum JA, Morrow DA, Newby LK, Ornato JP, Ou N, Radford MJ, Tamis-Holland JE, Tommaso CL, Tracy CM, Woo YJ, Zhao DX. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2013;127
- <sup>3</sup>Bloom, D.E., Cafiero, E.T., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L.R., Fathima, S., Feigl, A.B., Gaziano, T., Mowafi, M., Pandya, A., Prettner, K., Rosenberg, L., Seligman, B., Stein, A.Z., & Weinstein, C. (2011). *The Global Economic Burden of Noncommunicable Diseases*. Geneva: World Economic Forum.

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