Coronary Heart Disease

Association Between Prehospital Time Intervals and ST-Elevation Myocardial Infarction System Performance

Jonathan R. Studnek, PhD; Lee Garvey, MD; Tom Blackwell, MD; Steven Vandeventer; Steven R. Ward

Background—Among individuals experiencing an ST segment–elevation myocardial infarction, current guidelines recommend that the interval from first medical contact to percutaneous coronary intervention be ≤90 minutes. The objective of this study was to determine whether prehospital time intervals were associated with ST-elevation myocardial infarction system performance, defined as first medical contact to percutaneous coronary intervention.

Methods and Results—Study patients presented with an acute ST-elevation myocardial infarction diagnosed by prehospital ECG between May 2007 and March 2009. Prehospital time intervals were as follows: 9-1-1 call receipt to ambulance on scene ≤10 minutes, ambulance on scene to 12-lead ECG acquisition ≤8 minutes, on-scene time ≤15 minutes, prehospital ECG acquisition to ST-elevation myocardial infarction team notification ≤10 minutes, and scene departure to patient on cardiac catheterization laboratory table ≤30 minutes. Time intervals were derived and analyzed with descriptive statistics and logistic regression. There were 181 prehospital patients who received percutaneous coronary intervention, with 165 (91.1%) having complete data. Logistic regression indicated that table time, response time, and on-scene time were the benchmark time intervals with the greatest influence on the probability of achieving percutaneous coronary intervention in ≤90 minutes. Individuals with a time from scene departure to arrival on cardiac catheterization laboratory table of ≤30 minutes were 11.1 times (3.4 to 36.0) more likely to achieve percutaneous coronary intervention in ≤90 minutes than those with extended table times.

Conclusions—In this patient population, prehospital timing benchmarks were associated with system performance. Although meeting all 5 benchmarks may be an ideal goal, this model may be more useful for identifying areas for system improvement that will have the greatest clinical impact. (Circulation. 2010;122:1464-1469.)

Key Words: emergency medical services ■ epidemiology ■ myocardial infarction ■ reperfusion

Current guidelines from the American College of Cardiology and American Heart Association recommend that the interval from first medical contact to percutaneous coronary intervention (PCI) be ≤90 minutes among individuals experiencing an ST-elevation myocardial infarction (STEMI).1 2 Local, state, and national programs have aimed to reduce time to PCI by integrating the prehospital and in-hospital care of STEMI patients.3 6 The early acquisition of prehospital 12-lead ECGs and subsequent hospital notification in patients with symptoms of an acute coronary syndrome is a Class I recommendation and has been shown to reduce time to PCI.7 13 However, there is little additional guidance on how emergency medical services (EMS) should optimize their time before hospital arrival.

The aims of this study were to describe prehospital system time intervals from first medical contact to reperfusion by PCI among STEMI patients, to assess associations between time intervals and achieving PCI in ≤90 minutes, to derive theoretical benchmarks for system time intervals, and to estimate the probability of achieving PCI in ≤90 minutes based on proposed timing benchmarks.

Methods

Design and Setting

This was a retrospective analysis of prehospital patients presenting with an acute STEMI as diagnosed by prehospital ECG in Mecklenburg County, North Carolina. Since May 2007, the Mecklenburg EMS Agency (Medic) has maintained a registry of all prehospital STEMI activations within the county. Outcomes data for this registry were provided through a cooperative agreement with the 3 hospitals that perform PCI in the county. Each STEMI-receiving hospital is an accredited chest pain center with PCI by the Society of Chest Pain Centers14 and participates in the North Carolina statewide system of STEMI care. Reperfusion of Acute Myocardial Infarctions in Carolina Emergency Departments.15 This study was approved by the Carolinas Health-
Prehospital triage, treatment, and transport protocols are uniform providers possessing automatic external defibrillator capability. Paramedics communicated their findings and ECG information were not transmitted. Emergency physicians activated the PCI deployment as acceptable in patients with first medical contact to first device departure to patient on CCL table (table time). All variables were assessed, and the variable with the lowest Wald P value was added to the model. This process was repeated until variables failed to reach statistical significance at the 0.05 level. To adjust for important patient characteristics, age, gender, and race were forced into the final multivariable model.

Confounding and effect measure modification were assessed with criteria set forth by Mickey et al. Confounding variables included age, gender, and race and were reported only if the adjusted odds ratios (ORs) for any main effect variable changed by 10%. On completion of the main effects model, plausible interaction terms were created and effect modification was assessed. Only those interaction terms with a value of Wald P≤0.01 were added to the model. Model fit and discrimination were assessed with the Hosmer-Lemeshow goodness-of-fit test and area under the receiver-operating characteristic curve. Results of this model are presented as β coefficients to facilitate the calculation of probabilities and as ORs to indicate the estimated measure of the effect that timing benchmarks have on the study outcome. All data in this analysis were abstracted from patient records and entered into Microssoft Excel (Redmond, Wash). All statistical analyses were conducted with Stata version 10 (College Station, Tex).

Study Population
Patients transported by Medic to 1 of the 3 PCI centers in Mecklenburg County were eligible for enrollment. Patients must have been ≥18 years of age, met the current protocol guidelines for prehospital cardiac catheterization laboratory (CCL) activation, and had a PCI performed between May 2007 and March 2009. Beginning in May 2007, Medic and the 3 PCI-capable hospitals instituted a “code STEMI” protocol allowing the prehospital diagnosis of STEMI, CCL activation, and bypass of hospitals not PCI capable. To be considered a code STEMI, patients must have signs and symptoms consistent with cardiac ischemia, computer interpretation of the prehospital 12-lead ECG must indicate acute MI, and paramedic overread must confirm this interpretation as ≥1-mm ST-segment elevation in ≥2 contiguous limb leads or ≥2 mm in ≥2 contiguous precordial leads. Paramedics communicated their findings and ECG information via radio to emergency physicians at the PCI centers. ECG images were not transmitted. Emergency physicians activated the PCI center and CCL and notified the interventional cardiologists of incoming patients via a paging system. The CCLs were staffed Monday through Friday from 7 AM to 6 PM, and on-call staff was required to be available within 30 minutes of notification at other times. During the course of the study period, ~16% of patients classified by EMS as having a STEMI were determined to be false-positive activations because paramedics incorrectly applied the above algorithm.

Variable Description
The outcome variable in this analysis was STEMI system performance, defined as first medical contact to reperfusion. First medical contact was defined as the time of 9-1-1 call receipt. Reperfusion time was defined as first device deployment. System performance was analyzed as a dichotomous variable and defined as acceptable in patients with first medical contact to first device deployment ≤90 minutes. The system time intervals analyzed were 9-1-1 call receipt to ambulance on scene (response time), ambulance on scene to 12-lead ECG acquisition (ECG time), and time to STEMI team notification (notification time). On arrival at the hospital, the time interval missing most often was prehospital CCL activation and received PCI. Complete patient records and entered into Microsoft Excel (Redmond, Wash). All statistical analyses were conducted with Stata version 10 (College Station, Tex).

Results
There were 181 patients during the study period who had prehospital CCL activation and received PCI. Complete system time intervals were available for 165 patients (91.2%). The time interval missing most often was prehospital ECG acquisition to STEMI team notification (15 patients, 8.3%). There was no indication that these data were missing because of some nonrandom pattern. The most likely reason for these missing data was a failure to record the time of STEMI team notification.

Of 165 patients with complete data, 110 (66.7%) received PCI ≤90 minutes after 9-1-1 call receipt. The median time to PCI in the study population was 82.9 minutes, with 90% of patients receiving PCI within 118.0 minutes after 9-1-1 call receipt. Briefly, patients had an average age of 60.3 years, 121 (73.3%) were white, and 119 (72.1%) were male.

A descriptive analysis of each system time interval is displayed in Table 1. Among STEMI patients, the shortest average time interval was ECG time at 6.6 minutes. On average, nearly half of the benchmark of 90 minutes was used to transport a patient from the scene to placement on the CCL table. Table 1 also displays the average system time interval for patients receiving PCI in ≤90 minutes compared with those receiving PCI in >90 minutes. Analysis indicated that all time intervals were
significantly associated with PCI time, with time intervals being shorter among the individuals who received PCI in ≤90 minutes. Table 2 presents frequencies of benchmark time intervals, unadjusted ORs, and 95% confidence intervals (CIs) for the occurrence of PCI in ≤90 minutes by each benchmark time interval. Results from these univariate analyses indicated that achieving each benchmark time interval, except notification time, was significantly associated with an increased frequency of having a PCI in ≤90 minutes.

On the basis of the univariate results presented above, a multivariable logistic regression model was constructed using the benchmark time intervals; it is also presented in Table 2. The ORs presented in this model were also adjusted for age, gender, and race. This model demonstrated good fit with the Hosmer-Lemeshow goodness-of-fit test and had good ability to discriminate between subjects who received PCI in ≤90 minutes and those who did not, with an area under the receiver-operating characteristic curve of 0.87.

Table time, response time, and on-scene time were the benchmark time intervals with the greatest measure of effect and influence on the probability of achieving a PCI in ≤90 minutes. Individuals with a time from scene departure to arrival on CCL table of ≤30 minutes were 11.1 times (95% CI, 3.4 to 36.0) more likely to achieve PCI in ≤90 minutes than those with extended table times. Furthermore, on-scene times of ≤15 minutes were also associated with an increased likelihood of achieving goal PCI time (OR, 9.6; 95% CI, 3.5 to 26.6).

Discussion
The need for establishing and implementing STEMI care systems has been well documented.18–21 To provide the best possible care to STEMI patients, process improvements must occur in both the prehospital and in-hospital settings.22 The American College of Cardiology/American Heart Association guidelines recommend that the interval from first medical contact to PCI be ≤90 minutes.2,8 However, there are no current recommendations on the time intervals that make up the prehospital portion of that 90-minute benchmark.

Describing prehospital system time intervals and deriving theoretical benchmarks for these intervals is one method that may assist in the evaluation of process improvement for STEMI care. This study identified prehospital benchmark time intervals in a STEMI care system and estimated their association with achieving PCI in ≤90 minutes. In addition, a statistical model was created to estimate the probability of receiving PCI in ≤90 minutes. Time to CCL table, scene time, and response time were the intervals most significantly associated with outcome. Yet, these variables have not been adequately studied as components of a STEMI care system. The utility of prehospital 12-lead ECG acquisitions and CCL notification has been associated with improved overall system performance and was included in the multivariable model presented.9,10,12 However, until this time, the complex interplay between these variables has not been analyzed.

The ability to rapidly transport patients off scene and arrive on the CCL table in ≤30 minutes was the variable most strongly associated with achieving PCI in ≤90 minutes. On average, approximately half of the guideline-recommended 90 minutes was consumed by transporting the patient to the hospital and specifically to the CCL table. Although transport times may vary greatly by region, it has been demonstrated that >40% of the US population lives in an area where a PCI-capable hospital is the closest destination facility.23 A 30-minute benchmark may not be feasible in the rural portions of the country but should be considered in areas with PCI-capable hospitals. It has also been shown that delay to the CCL table can be reduced if prehospital STEMI triage protocols incorporate

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Table 1. Descriptive Analysis of Prehospital Time Intervals for the Entire Study Population and by Performance Outcome

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Mean, min (90th Percentile)</th>
<th>Median, min (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response time</td>
<td>8.0 (7.5) (12.5)</td>
<td>7.4 (6.8–7.9)*</td>
</tr>
<tr>
<td>ECG time</td>
<td>6.6 (5.1) (12.0)</td>
<td>5.6 (5.0–6.1)*</td>
</tr>
<tr>
<td>Scene time</td>
<td>14.8 (14.5) (20.3)</td>
<td>13.5 (12.5–14.4)*</td>
</tr>
<tr>
<td>Notification time</td>
<td>12.8 (11.0) (24.2)</td>
<td>10.8 (9.8–11.9)*</td>
</tr>
<tr>
<td>Table time</td>
<td>42.6 (39.3) (62.9)</td>
<td>34.8 (32.8–36.7)*</td>
</tr>
</tbody>
</table>

PCI indicates percutaneous coronary intervention; ECG, electrocardiogram.

*P<0.05.

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Table 2. Frequencies, Unadjusted ORs, and 95% CIs for the Occurrence of PCI in <90 Minutes by Each Benchmark Time Interval

<table>
<thead>
<tr>
<th>Variable</th>
<th>PCI in ≤90 min, n (%)</th>
<th>PCI in &gt;90 min, n (%)</th>
<th>Unadjusted OR (95% CI)</th>
<th>Multivariable OR* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response time</td>
<td>&gt;11 14 (12.7)</td>
<td>15 (27.3)</td>
<td>1.0 (1.0–1.0)</td>
<td>1.0 (1.0–1.0)</td>
</tr>
<tr>
<td></td>
<td>≤11 96 (87.3)</td>
<td>40 (72.7)</td>
<td>2.6 (1.1–5.8)</td>
<td>9.2 (2.8–29.8)</td>
</tr>
<tr>
<td>ECG time</td>
<td>&gt;8 18 (16.4)</td>
<td>26 (47.3)</td>
<td>1.0 (1.0–1.0)</td>
<td>1.0 (1.0–1.0)</td>
</tr>
<tr>
<td></td>
<td>≤8 92 (83.6)</td>
<td>29 (52.7)</td>
<td>4.6 (2.2–9.5)</td>
<td>3.4 (1.2–9.3)</td>
</tr>
<tr>
<td>Scene time</td>
<td>&gt;15 32 (29.1)</td>
<td>40 (72.7)</td>
<td>1.0 (1.0–1.0)</td>
<td>1.0 (1.0–1.0)</td>
</tr>
<tr>
<td></td>
<td>≤15 78 (70.9)</td>
<td>15 (27.3)</td>
<td>6.5 (3.2–13.4)</td>
<td>9.6 (3.5–26.6)</td>
</tr>
<tr>
<td>Table time</td>
<td>&gt;30 64 (58.2)</td>
<td>50 (90.9)</td>
<td>1.0 (1.0–1.0)</td>
<td>1.0 (1.0–1.0)</td>
</tr>
<tr>
<td></td>
<td>≤30 46 (41.8)</td>
<td>5 (9.1)</td>
<td>7.2 (2.6–19.4)</td>
<td>11.1 (3.4–36.0)</td>
</tr>
</tbody>
</table>

*Adjusted for age, gender, and race.
bypassing non-PCI facilities and emergency departments within PCI facilities.24–27

Prehospital scene times of ≤15 minutes were associated with a higher probability of achieving PCI in ≤90 minutes in the present analysis. Early recognition of the signs and symptoms associated with a STEMI is critical for both prehospital and in-hospital providers to reduce the time to reperfusion. Current research on prehospital scene times has focused primarily on the treatment and transport of trauma patients.28–30 Further research on expediting scene times while allowing for appropriate patient assessment should be conducted among STEMI patients.

Prolonged response times resulted in a decreased probability of achieving rapid PCI. Although it may seem intuitive that short response times would translate to improved outcomes, this is not always the case. Several studies have evaluated the effect of response time on outcomes among prehospital patients.31,32 These studies demonstrated that after the first 4 minutes, patient outcome was not associated with further delays in prehospital response time. Although all prehospital patients may not require the same EMS response, it appears as though STEMI patients may benefit from early EMS arrival.

Although 12-lead ECG acquisition and hospital notification have previously been studied, there are no current guidelines for prehospital providers on the timeliness of these interventions. Results from this study indicated a significant association between achieving PCI in ≤90 minutes and obtaining a 12-lead ECG in ≤8 minutes. In the statistical model built from the derived timing benchmarks, notification time was not associated with an increased likelihood of early PCI. However, this term remained in the model because previous research has indicated the importance of bundling ECG acquisition and hospital notification together.6

It is important to recognize that not all of these individual components may be feasible for implementation in any 1 EMS system. Focusing on individual components with an overall design for implementation may prove beneficial for EMS systems attempting to improve STEMI care. Although a STEMI care system includes many more components than the benchmarks included in this study, these benchmarks may serve as plausible starting points for EMS systems process improvement in STEMI care.

Limitations
This study has several limitations resulting from the nature of the study design. Limitations included threats to generalizability and the potential for unrecognized confounding and nondifferential misclassification.

The benchmarks derived in this study were produced using data from within a single EMS agency that has integrated STEMI care with all local PCI-capable hospitals. The generalizability of these results to systems with multiple EMS agencies delivering patients to STEMI-receiving centers operating with various treatment algorithms remains to be seen. This study also used an uncommon definition for first medical contact, the time of 9-1-1 call receipt. This time was specifically chosen to include the entirety of EMS patient contact time. Other definitions of first medical contact are not as aggressive or comprehensive and focus on processes subsequent to paramedic arrival at the scene or at the patient’s side. Therefore, these results may not generalize to systems with varying definitions of first medical contact. Future research should incorporate data from multiple STEMI care systems to validate these findings.

The benchmark table time includes EMS transportation time from the scene to the PCI center, any time spent in the emergency department, and time required for transportation from the emergency department to the CCL. These times were grouped together as an expression of the integration of prehospital and in-hospital services, one of the key elements of successful chest pain evaluation centers.9 With prearrival notification of STEMI patients, the PCI centers in this study prepared the CCL and admitted patients directly to the CCL when possible. In some cases, the CCL was not prepared for patient admission by the time of EMS arrival at the hospital. Therefore, some patients were delivered to the emergency department for a short period of time. Not all hospitals admit EMS patients directly to the CCL from the field; however, the benchmark interval of 30 minutes should allow brief evaluation in the emergency department for those institutions, if that is the preferred method.

Unfortunately, the analytic data set used in this analysis did not include extensive patient demographics and prior medical history. Therefore, there may be some level of unrecognized confounding of the presented results. Further descriptions of patient characteristics may provide opportunities for greater insight into STEMI systems of care. In addition, the impact of first responders was not considered in this evaluation. The contribution of first responders to symptom assessment and patient preparation may influence several of the benchmark times evaluated. The proportion of cases in which first responders participated in this series was not recorded.

Finally, because of the nature of the study design, the potential for misclassification of exposure and outcome variables was present. All variables were initially continuous in nature but were transformed into dichotomous variables. The process of transforming and analyzing continuous data as dichotomous may lead to misclassification bias. However, it is likely that this bias is nondifferential, with misclassification of exposures not related to the outcome and vice versa. Therefore, any bias present in these results would likely be toward the null, indicating that the presented measures of effect may be smaller.

Conclusions
This study was able to describe prehospital system time intervals and to assess their relationship with STEMI system performance. Five theoretical benchmarks were derived from these time intervals that enabled the estimation of the probability of achieving PCI in ≤90 minutes. Although meeting all 5 benchmarks may be an ideal goal, this model may be more useful for identifying areas for system improvement that will have the greatest clinical impact.
Acknowledgments

We would like to thank Michelle Correll for her efforts with data acquisition and the EMS professionals at Mecklenburg EMS Agency for their dedication and cooperation in supporting prehospital research.

Disclosures

None.

References


Currently, there is little guidance on how emergency medical services should optimize their time before hospital arrival when caring for ST-elevation myocardial infarction patients. This study analyzed the association between 5 prehospital system time intervals and achieving a goal time to percutaneous coronary intervention of ≤90 minutes. Our findings imply that developing prehospital time benchmarks for important patient care–related variables may further enhance quality improvement for ST-elevation myocardial infarction care systems. It is important to recognize that not all of the individual prehospital time components may be feasible for implementation in any 1 emergency medical service system. Focusing on individual components with an overall design for implementation may prove beneficial for emergency medical service systems attempting to improve ST-elevation myocardial infarction care. Although an ST-elevation myocardial infarction care system includes many more components than the benchmarks included in this study, these benchmarks may serve as plausible starting points for emergency medical service systems process improvement in ST-elevation myocardial infarction care.
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급성 심근경색증의 신속한 치료를 위해 치료 전 소요되는 시간간격들에 대한 분석이 필요하다

권준 교수 결과대병원 심장내과

Summary

배경

5F분절 상부 급성 심근경색증 환자의 최고 병원 홂시에 서는 최초 의료진 접촉 후 30분 이내에 환자 처치를 시작할 수 있도록 하는 것이 중요하다. 본 연구의 목적은 환자가 병원에 도착하기 전까지 소요되는 시간인 30분이내의 시간간격들로 나누어 보고하고, 이러한 시간간격들이 최초 의료진 접촉에서 환자 사망률과 제한적 치료가 실시되는 시간간격들로 정의되는 5F분절 상부 급성 심근경색증 치료 시스템 성능에 어떠한 영향을 미치는지 알아보기 위함이다.

병법 및 결과

2007년 3월부터 2009년 3월까지 병원 도착 이전에 서 행한 심진도에서 5F분절 상부 급성 심근경색증으로 진단 받은 환자를 대상으로 하였다. 환자 사망률과 제한적 치료를 받은 환자는 총 182명(9.1%)이었다. 병원 도착 전 시간간격들로는 평균 30분 이내로 소요되는 3가지 시간, 3가지의 시간간격들이 환자 사망률과 제한적 치료를 받은 환자 비율의 영향을 미치는 것으로 나타났다. 또한, 병원 도착 후 도착이 시간군간에 대한 기준시간을 모두 만족시키는 것이 이상적이지만, 문헌을 통하여 가장 영향을 미친 시간간격들로 접촉하는 것이 효과적일 수 있다.
급성 심근경색증 환자에서 지표의 성능 여부는 흔들 범 생 후 환상동맥 재관류를 위한 환상동맥 재관류 시시각지의 과정이 얼마나 신속하게 이루어졌는가를 말한다. 특히 5분내 향상 급성 심근경색증 환자에서 합병증의 가능성을 낮추는 것은 신속한 치료를 유도하고, 결과적으로 재 관류 치료까지의 시간을 단축시키는 데 도움을 준다. 미국 심장학회에서는 급성 심근경색증 환자에서 최초 의료진 접촉 후 환상동맥 재관류 치료까지의 시간을 30분 이내로 할 것을 권장하고 있다.

본 연구는 5분 내 상승 급성 심근경색증 환자에서 최초 의료진 접촉 후 90분 이내에 환상동맥 재관류 치료 목표가 이루어지는 것과 관하여 치료 전 소요되는 전체 시간을 5개의 시간관련 민감도시간(목표시간, ECG 시간, on scene time, notification time, table time)로 나누어 분석하였다. 본 연구에서는 최초 의료진 접촉 시간을 911에 신고가 접수되는 시간으로, 그리고 환상동맥 재관류 차질로 시간은 환상동맥 내 주입 또는 스테너가 삽입되는 시간으로 정의하였다. 연구 결과, 5개 시간관련 민감도시간 중 10분 이내의 response time, 15분 이내의 on scene time, 그리고 30분 이내의 table time의 90분 이내의 환상동맥 재관류 치료 목표를 달성하는 데 있어 가장 큰 영향을 미치는 것으로 나타났다.

급성 심근경색증 환자 치료에 있어 90분 이내의 치료 목표를 위해 본 연구에서는 갑상 신관동맥 재관류 치료 전까지 소요되는 전체 시간을 5개의 시간관련 민감도시간으로 나누며 각각의 기준을 개발하는 것은 치료 시스템을 향상시키는데 있어 매우 중요할 것으로 판단된다. 전체 소요시간을 여러 개의 시간관련 민감도시간으로 나누며 분석함으로써 그 중 어떤 시간관련성이 전체 시간을 좌우하는 그동안 영향을 미치는지를 알 수 있으며, 그 중 교정 가능한 시간관련성을 고유나 환원 또는 시스템 변수를 통하여 단축시킬 수 있다면 치료 전 소요되는 전체 시간을 효과적으로 줄이기로 할 수 있을 것이다.

본 연구에서는 3개의 시간관련성이 목표 시간 단축에 가장 큰 영향을 미치는 것으로 나타났는데, 그 중 외부 이 내 치료 목표에 가장 많은 영향을 미치는 것으로 확인된 table time은 병원까지의 환자 운송시간뿐만 아니라 병원 도착 후 응급실에서의 대기시간 그리고 응급실에서 환 상동맥 재관류시의 환자 이동시간도 포함하였다. 병 원까지의 환자 운송시간은 교통문제와 관련하여 있어 현실적으로 해결이 쉽지 않았지만, 병원 도착 후 환상동맥 재관류까지 소요되는 시간은 환자 전 방출 성공의 급성 심근 경색질환의 사전 예방 및 협조를 통해서 응급실을 거치지 않고 관방 검사와 환상동맥 재관류가 가능하도록 해야 하며 응급실에서의 대기시간을 최소화하는 방법으로 해결이 가능하다. 반면에, response time과 on scene time은 구급대원들을 대상으로 한 환자나 세포로 기발을 통해 서 줄이기 어렵다. 이렇게 급성 심근경색증 치료 시스템 장상에 가장 영향을 미치는 중요한 것이 중 하나지만 확 인하고 교정해 나가는 데 있어서 90분 이내의 치료 목표를 현실적으로 달성할 수 있다.

결론 심장 전문의 합병 소요시간을 줄이는 데 있어 본 연구에서 보고된 5개 시간관련 시간에 대한 기준도 과적해야 할 부분들이 있겠지만, 이와 같은 여러 시간관련 시간에 대한 기준을 분석해 본 이론 시로는 응급 사례 시스템 과정을 향상시키는 중요한 시범이 될 것으로 평가된다.