



London Ambulance Service **NHS**  
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# ST Elevation Myocardial Infarction Annual Report 2014/15

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## Key findings

- The LAS attended 3,349 STEMI patients in 2014/15.
- Almost three quarters of patients were male, who tended to be younger than female patients.
- The anterior region of the heart was the most common infarct site (44%).
- STEMI patients received a response within 8 minutes (median), meeting the national target<sup>[1]</sup>.
- The median overall on scene time increased slightly to 40 minutes (from 39 minutes in 2013/14).
- The percentage of patients receiving a full care bundle decreased from 76% in 2013/14 to 74% in 2014/15. While aspirin and GTN were largely administered, provision of both the analgesia and two pain assessments elements were less routinely undertaken.
- Over 99% of patients were transported to an appropriate facility, which for the majority of patients (96%) was a specialist Heart Attack Centre.
- Where data were available, over half of all patients received primary Percutaneous Coronary Intervention (pPCI) treatment at a Heart Attack Centre. Reperfusion was achieved in an average of 111 minutes – within the national target of 150 minutes.

## 1. Introduction

In the period 1<sup>st</sup> April 2014 to 31<sup>st</sup> March 2015, 3,349 patients who were attended by the London Ambulance Service NHS Trust (LAS) following a 999 call for help were diagnosed by our clinicians as suffering a ST-Elevation Myocardial Infarction (STEMI).

LAS clinicians diagnose STEMI by considering the patient's presentation and their medical history alongside evidence from a 12-Lead electrocardiogram (ECG). Our clinical care of the STEMI patient focuses on four key areas comprising a care bundle: aspirin (an anti-platelet drug used to thin the blood); glyceryl tri-nitrate (GTN) - which allows blood to flow more easily by acting as a vasodilator; assessment of cardiac pain, and if the patient is in pain they should be offered either one or a combination of the analgesic drugs Entonox and morphine. While there may be circumstances where the full care bundle cannot be provided (e.g. contraindications or patient refusals), all elements should be offered wherever possible so that the patient gains the maximum potential benefit.

Patients experiencing a myocardial infarction can expect LAS staff to rapidly convey them to a specialist Heart Attack Centre (HAC) where the patient can receive a reperfusion procedure to unblock the artery.

This report presents information on our STEMI patients' characteristics, plus the care provided by the LAS in terms of response times, provision of the clinical care bundle, and compliance to the specialist HAC pathway. Reperfusion treatment and patient outcome details are also reported to illustrate the end-to-end nature of our care.

Data has been obtained from a number of sources: clinical information has been collected from the LAS Patient Report Forms (PRFs) and 12-Lead ECG rhythm strips, and response times have been taken from the Emergency Operations Centre (EOC) Call Log and the vehicle Mobile Data Terminals (MDTs). Data on reperfusion and patient outcomes has been primarily obtained from the Myocardial Ischaemia National Audit Project (MINAP) database, with some additional data obtained directly from hospitals.

A glossary of abbreviations and terms are included on page 11 for readers unfamiliar with the medical or operational terminology used in the ambulance service.

## 2. Findings

### 2.1. Patient characteristics

Characteristics		2014-2015
Gender	Male	2,475 (73.9%)
	Female	874 (26.1%)
Age (mean and range)	All patients	63 (12-105)
	Males	60 (12-102)
	Females	72 (24-105)
Race <sup>®</sup>	White	1,882 (56.2%)
	Mixed	22 (0.6%)
	Asian/British Asian	391 (11.7%)
	Black/Black British	233 (7.0%)
	Other	161 (4.8%)
	Unable/Refused	481 (14.4%)
	Not documented	179 (5.3%)
Location of infarct	Anterior	1,471 (43.9%)
	Anterior/Lateral	331 (9.9%)
	Inferior	1,126 (33.6%)
	Inferior/Lateral	111 (3.3%)
	Inferior/Posterior	29 (0.9%)
	Posterior	52 (1.6%)
	Lateral	149 (4.4%)
	STEMI only documented	80 (2.4%)

- Almost three quarters of patients were male.
- The average age was 63, with male patients 12 years younger than females.
- Over half of patients attended were of a white race origin.
- The most common location of the infarct was the anterior region of the heart, followed by the inferior region.

<sup>®</sup> Due to the critical condition of patients, definitive race information is not always possible to obtain and therefore this data should be viewed with caution.

## 2.2. Response and on scene information

Response and on scene information		2014-2015
Chief Complaint	Chest pain	1,658 (49.5%)
	Health Care Professional admission	274 (8.2%)
	Unconscious/ fainting (Near)	272 (8.1%)
	111 NHS transfer	262 (7.8%)
	Breathing problems	253 (7.6%)
	Cardiac/ respiratory arrest	191 (5.7%)
	Other	439 (13.1%)
Calls by category	Category A	2,978 (88.9%)
	Category C	371 (11.1%)
999 Call to arrival on Scene <sup>+</sup>	Overall <sup>◇</sup>	8 (12) Range: 0 - 435
	Category A only <sup>◇</sup>	8 (9) Range: 0 - 83
	Category C only	19 (36) Range: 2 - 435
On scene <sup>+</sup>	From arrival of first attending vehicle	40 (43) Range: 7 - 330
	From arrival of first ambulance	32 (35) Range: 6 - 324

- Chest pain was recognised as the patient's chief complaint from the 999 call for almost half of patients.
- The majority of calls were categorised as Category A.
- The average overall response time was 8 minutes, meeting the national target.<sup>[1]</sup>
- Overall on-scene times have continued the upward trend seen in recent years and have increased to 40 minutes this year (from 39 and 38 minutes in 2013/14 and 2012/13 respectively).
- When calculated from arrival of an ambulance (therefore excluding the time that First Response Units were awaiting a vehicle to arrive on scene to convey the patient) on-scene times were 32 minutes - a 1 minute decrease on last year.

<sup>+</sup> Medians are presented with means in brackets (in minutes).

<sup>◇</sup> Zero minute times in the range are due to running calls where a patient/passersby has flagged an ambulance.

### 2.3. Assessment and treatment of STEMI patients

Assessment and treatment		2014-2015
Pain assessment	Pre and post treatment (or valid exceptions)	3,109 (92.8%)
	Not undertaken	240 (7.2%)
Aspirin	Administered or valid exception	3,192 (95.3%)
	Not administered	157 (4.7%)
GTN	Administered or valid exception	3,298 (98.5%)
	Not administered	51 (1.5%)
Entonox	Administered or valid exception	1,931 (57.7%)
	Not administered	1,418 (42.3)
Morphine	Administered or valid exception	3,089 (92.3%)
	Not administered <sup>∞</sup>	260 (7.7%)
Analgesia	Administered or valid exception	2,767 (82.6%)
	Not administered	582 (17.4%)
Care bundle	Administered or valid exception	2,486 (74.2%)
	Not administered	863 (25.8%)

- There was a slight (0.5%) increase in the administration of aspirin, while delivery of GTN remained consistently high with previous years.
- The percentage of patients receiving two pain assessments decreased by 1.7%, but has remained over 90%.
- The provision of Entonox increased slightly by 0.6% to 58%.

<sup>∞</sup> Includes 75 cases where the LAS did not dispatch a paramedic to the scene, and therefore morphine could not be given due to an inappropriate crew skill level in attendance.

- Morphine administration decreased slightly by 0.8% (but has remained over 90%).
- The overall delivery of analgesia decreased by 0.6%.
- Delivery of the care bundle (pre- and post-treatment pain assessments, plus administration of GTN, aspirin and analgesia) has decreased by 1.9% to 74.2%.

### 2.3.1. Analgesia provision based on initial pain score given

Initial pain rating	Patients	Given / exception	%	Not given	%
Mild pain	255	157	61.6%	98	38.4%
Moderate pain	607	443	73.0%	164	27.0%
Severe pain	1,180	996	84.4%	184	15.6%
Pain of unknown severity	288	210	72.9%	78	27.1%
<b>TOTAL</b>	2,330	1,806	77.5%	524	22.5%

- The majority of patients were in severe pain (i.e. a pain score of 7 or more on the numerical rating scale), but only 84.4% of patients received analgesia (or there is a valid exception for non-provision).
- Over a quarter of patients reporting moderate pain (i.e. a pain score between 4 and 6) do not receive any pain relief.
- Patients with mild pain (i.e. pain score is 3 or less) are less likely to receive analgesia, with just 61.6% patients receiving pain relief (or having a valid exception for non-provision).



## 2.4. Conveyance assessment and journey times

Conveyance		2014-2015
Destination	Patients conveyed to hospital	3,349
	Appropriate conveyance	Overall: 3,319 (99.1%) <i>HAC: 3,218 (96.1%)</i> <i>ED: 101 (3.0%)</i>
	Inappropriate conveyance	Overall: 30 (0.9%) <i>ED: 29 (0.9%)</i> <i>Unclear: 1 (0.0%)</i>
Conveyed to HAC <sup>+</sup> #	Leave scene to arrive hospital time	16 (17) Range: 1-63
	999 call to arrive hospital time	67 (71) Range: 25-481
Conveyed to ED <sup>+</sup> #	Leave scene to arrive hospital time	11 (13) Range: 3-57
	999 call to arrive hospital time	68 (77) Range: 29-209

- 99% of patients were transported to an appropriate destination, with 96% of patients conveyed to a HAC.
- Patients conveyed to a HAC had an average journey time of 16 minutes, which remains consistent with the previous year. However, the overall call to hospital time for these patients has increased by 4 minutes to 67 minutes.
- Journey time for those patients conveyed to an ED was 11 minutes, with a call to hospital time of 68 minutes.

<sup>+</sup> Medians are presented with means in brackets (in minutes).

<sup>#</sup> Does not include 1 patient where it was unclear whether the patient was conveyed to a HAC or ED.

## 2.5. Reperfusion and patient outcomes

Reperfusion		2014-2015
Patients with reperfusion information available		2,177
Reperfusion by type	Primary percutaneous coronary intervention (pPCI)	1,164 (53.5%)
	Thrombolysis	2 (0.1%)
	Reperused but method unknown	3 (0.1%)
	No reperfusion	1,008 (46.3%)
pPCI	Patients with pPCI time available	1,157
	'Call to Balloon' time <sup>+</sup>	111 (115) Range: 50-842
	pPCI within 150 minutes of 999 call	1,071 (92.6%)
	Patients with discharge data available	977
	Patients discharged alive	925 (94.7%)
	Average hospital stay	4 days

- Just over half of patients were confirmed as having received pPCI treatment.
- 93% of these patients had pPCI within the national target of 150 minutes from the time of the 999 call; a slight increase of 0.6% on figures for the previous year.
- 95% of patients that had pPCI were discharged from hospital alive, with an average hospital stay of 4 days. These figures remain consistent with previous years.

<sup>+</sup> Medians are presented with means in brackets (in minutes).

### 3. Discussion

This report demonstrates that the LAS continues to offer a very high standard of care to patients diagnosed with a STEMI, providing a prompt response and treatment followed by rapid transportation to the most appropriate centre (either a HAC for reperfusion treatment or the ED for further interventions).

Early identification of the need for a high priority Category A response to patients by Emergency Medical Dispatchers ensured that the average response time remains within the national target of 8 minutes for STEMI patients.

Clinical care for STEMI patients is centred around the provision of a care bundle comprising the administration of aspirin, GTN, analgesia and performing both pre and post treatment pain assessments. Our clinicians continue to deliver both GTN and aspirin to the majority of STEMI patients (99% and 95% respectively). When aspirin is not given, it is often in instances when patients are reporting to be pain free, suggesting a possible misunderstanding of its purpose as an anti-platelet to thin the blood and not as an analgesic.

The number of patients receiving two pain assessments (or having an exception to assessment such as being unconscious) has fallen, as too has analgesia provision. Pain assessments inform a step-wise approach to pain management. For pain scores of four and above, morphine should be the initial consideration, while for lesser scores the use of Entonox is currently advised. Our data indicates that whilst the majority of patients receive analgesia there are still patients who do not, with patients reporting a lower pain score less likely to receive an analgesic than those with higher scores. As with all other elements of the care bundle, exceptions to either or both forms of analgesia (such as contraindications and refusals) should be clearly documented.

A further area of performance for crews to be aware of is the length of time spent on scene with patients. The overall time from arrival of the first vehicle to an ambulance leaving to convey a patient to hospital has risen (currently standing at a median of 40 minutes), continuing the upward trend seen over recent years. Although the first vehicle on scene is often a First Response Unit (and therefore unable to convey the patient), the time from the arrival of the first ambulance (that is able to convey) is still 32 minutes on average.

While the number of patients for whom reperfusion data was available has reduced this year, it can still be seen that over half the patients attended underwent a reperfusion procedure at hospital. When assessing the length of time from the 999 call to reperfusion ("call to balloon")<sup>[3]</sup>, the LAS average of 111 minutes is well within the national target of 150 minutes. The percentage of patients who met this target has also remained consistent with last year, at over 92%.

In order to drive improvements in our care, the LAS has provided teaching sessions for our staff to provide clinical messaging of the components of the care bundle and the need to reduce time spent on scene with STEMI patients. Additionally, in 2015/16, the Clinical Skills Refresher course will be updated with a renewed focus on STEMI care. We are also currently updating the pain tools released to staff and are exploring further options for providing feedback to staff on their performance with this group of patients.

In conclusion, the LAS has continued to ensure that STEMI patients receive a rapid response and an appropriate diagnosis enabling the utilisation of the specialist HAC pathway accordingly. There are areas where improvements should be made in order to meet the core value of providing the best possible care; however our staff and Londoners can be proud that we continue to see excellent outcomes for patients.

## **Acknowledgements**

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## **References**

1. Department of Health National Service Framework for Coronary Heart Disease (2000), HMSO, London.
2. National Institute for Clinical Excellence. Myocardial Infarction with ST-segment elevation. NICE Clinical Guideline 167. July 2013.
3. Treatment of Heart Attack National Guidance – Final Report of the National Infarct Angioplasty Project (NIAP), Crown, 2008.

## **Glossary for abbreviations and terms**

Aspirin – Aspirin thins the blood and improves its flow through the arteries.

Call to Balloon Time – The overall time taken from the initial 999 emergency call to the point of balloon inflation in a primary Percutaneous Coronary Intervention (pPCI) procedure performed at hospital.

Cardiac Catheter Laboratory (Cath Lab) – The area within a specialist Heart Attack Centre where patients receiving reperfusion will be treated.

Care Bundle – The optimum combination of observations and treatments that ambulance crews should perform so that the patient receives the best possible care.

Complex – Each of the LAS Clusters are subdivided into several smaller operational areas known as Complexes. Please note that these do not necessarily align with Clinical Commissioning Group areas. Some vehicles (such as special event vehicles, voluntary responders and private ambulance crews) are not assigned to a particular Complex; these are grouped under an overall heading of “No Complex”.

Entonox – A mix of 50% nitrous oxide and 50% oxygen (also known as “gas and air”), which is used for relief of mild to moderate pain, or while further analgesia is being prepared where pain is more severe.

First Response Unit – A resource dispatched to immediately life-threatening calls which can respond more rapidly than a full ambulance crew, ensuring that the patient begins to receive care as quickly as possible.

Glyceryl Tri-Nitrate (GTN) – A drug which allows blood vessels to relax and widen, thus allowing improved blood flow and reducing the workload of the heart.

Heart Attack Centre (HAC) – Specialist centres in London hospitals to which patients suffering a STEMI are taken directly for primary Percutaneous Coronary Intervention (pPCI).

Mobile Data Terminal (MDT) – The device used by clinical staff to receive incoming call information and navigate to the location.

Morphine – An analgesic which can be administered (usually intravenously) by a paramedic to patients in severe pain.

Myocardial Ischaemia National Audit Project (MINAP) – A large database maintained by hospitals containing details of patients who were taken to Heart Attack Centres, reperfusion treatment performed and patient outcomes.

Numerical rating scale – A method of rating a patient’s pain based on a score from zero (no pain) to 10 (the worst pain imaginable).

Pain assessment – An observation which should be taken both pre- and post-treatment to assess the patient’s level of pain.

Paramedic – A majority of clinical staff are paramedics and are able to perform advanced skills such as cannulation. Morphine may only be given by staff with a skill level of paramedic or higher.

Patient Report Form (PRF) – The document used by the LAS to record all aspects of patient care and treatment.

Primary Percutaneous Coronary Intervention (pPCI) – A surgical procedure performed at a Heart Attack Centre which seeks to unblock arteries by means of insertion of a catheter into the affected artery and inflating a small balloon to re-open it. The opened artery is then held in place with a small stent.

Response Category A – Category A calls are those classed as immediately life-threatening and should receive a response within 8 minutes of the initial 999 emergency call. The vast majority of patients diagnosed with a STEMI receive a response of Category A.

Response Category C – Calls which are not deemed immediately life-threatening (based on the information given by the caller regarding the patient's condition) are classed as Category C. Some patients subsequently diagnosed with a STEMI receive this response, primarily where the patient has not reported chest pain or any other typical symptoms of a heart attack.

ST-Elevation Myocardial Infarction (STEMI) – A type of myocardial infarction. ST-Elevation refers to a particular pattern seen on a 12-Lead ECG which indicates a complete blockage in a coronary artery.

Step-wise Pain Management – The process of using an appropriate form of analgesia to the patient's level of pain throughout an acute event.

Thrombolysis – A form of reperfusion which breaks down blood clots by pharmacological means (also known as "clot busting"). It is now generally only used in a small number of patients who are not suitable for primary Percutaneous Coronary Intervention treatment and is undertaken at hospital.

Wong-Baker faces – A scale used for pain assessment based on a series of faces ranging from a happy face for no pain to a crying face for the worst pain imaginable. Patients select the face which best describes their level of pain. While primarily used for children, it can also be used for STEMI patients who are unable to describe pain in another manner (e.g. due to language barriers or being non-verbal).

## Appendix 1 – Median on scene times and Care Bundle Provision by Complex

Cluster	Complex	Median (mean) on scene times (in mins)		Care Bundle			
		From arrival of first vehicle on scene	From arrival of first ambulance on scene	Yes/ Exception		No	
				%	n	%	n
North West	Hillingdon	44 (46)	33 (35)	73.6%	92	26.4%	33
	Kenton	38 (41)	31 (33)	79.7%	145	20.3%	37
	Brent	41 (44)	33 (36)	81.1%	142	18.9%	33
West	Hanwell	43 (47)	35 (38)	75.7%	112	24.3%	36
	Isleworth	39 (41)	29 (33)	82.0%	100	18.0%	22
	Fulham	40 (43)	34 (36)	78.2%	97	21.8%	27
North Central	Friern Barnet	40 (43)	32 (35)	69.2%	101	30.8%	45
	Chase Farm	43 (46)	31 (37)	80.0%	28	20.0%	7
	Edmonton	41 (44)	32 (36)	77.0%	141	23.0%	42
	Camden	39 (42)	31 (34)	77.6%	118	22.4%	34
East Central	City & Hackney	38 (40)	31 (32)	69.4%	100	30.6%	44
	Newham	41 (42)	30 (32)	74.6%	91	25.4%	31
	Tower Hamlets	37 (39)	31 (32)	76.1%	67	23.9%	21
	Whipps Cross	40 (43)	30 (33)	77.1%	158	22.9%	47
North East	Romford	40 (44)	31 (34)	77.4%	106	22.6%	31
South East	Greenwich	41 (44)	31 (35)	78.6%	114	21.4%	31
	Bromley	45 (46)	36 (39)	76.6%	105	23.4%	32
	Barnehurst	48 (49)	36 (39)	77.6%	90	22.4%	26
	Deptford	39 (41)	32 (34)	72.0%	152	28.0%	59
South West	New Malden	40 (42)	34 (36)	72.3%	86	27.7%	33
	St Helier	38 (43)	31 (35)	62.8%	98	37.2%	58
	Wimbledon	37 (41)	31 (34)	75.0%	69	25.0%	23
	Croydon	41 (43)	33 (36)	59.6%	81	40.4%	55
No Complex		40 (44)	31 (35)	62.4%	93	37.6%	56