London Ambulance Service NHS Trust

ST Elevation Myocardial Infarction Annual Report 2015/16

January 2017

Produced by:
Yvette Thomas, Gurkamal Virdi and Rachael Fothergill

✉ CARU.Enquiries@lond-amb.nhs.uk

Clinical Audit and Research Unit, Clinical and Quality Directorate, London Ambulance Service NHS Trust, 8-20 Pocock Street, London, SE1 0BW.

Contents

Key findings

- The LAS attended 3,488 STEMI patients in 2015/16. This is a 4% increase on the previous years' figure of 3,349.
- Almost three quarters of patients were male.
- Males tended to be younger than female patients at 59 versus 72 years of age respectively.
- The anterior region of the heart was the most common infarct site (44%), followed by the inferior aspect (35%).
- The median response time for STEMI patients was within 8 minutes.
- The median overall on-scene time remained at 40 minutes.
- The percentage of patients receiving a full care bundle decreased slightly to 72%, reflecting a downward trend that has been observed over the last few years (from 74% in 2014/15 and 76% in 2013/14). The key area of the care bundle requiring improvement remains the analgesia component.
- Pathway compliance remains excellent with over 99% of patients transported to an appropriate facility, which for the majority of patients (97%) 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 113 minutes – within the national target of 150 minutes.

1. Introduction

From 1st April 2015 to 31st March 2016, 3,488 patients were diagnosed by ambulance clinicians as suffering a ST-Elevation Myocardial Infarction (STEMI). This report presents information on the characteristics of these patients, plus the care provided by the London Ambulance Service NHS Trust (LAS) in terms of response times, provision of the clinical care bundle and compliance to the specialist pathway. Details of patient outcomes including reperfusion treatment at hospital, survival and length of stay in hospital are presented where data is available.

Once LAS clinicians confirm the presence of STEMI using a 12-Lead electrocardiogram (ECG), they provide a care bundle incorporating: aspirin and glyceryl tri-nitrate (GTN) administration; assessment of cardiac pain using numerical or qualitative techniques and, the provision of analgesic drugs (Entonox and morphine) where the patient is in pain. All elements of the care bundle should be offered, although there may be exceptions where the full care bundle cannot be provided (e.g. contraindications or patient refusals).

Where appropriate, patients experiencing a myocardial infarction are conveyed rapidly by LAS staff to a specialist Heart Attack Centre (HAC) where they can receive a reperfusion procedure to unblock the artery. Patients who have clinical features that do not meet the criteria for HAC admission or have a functioning pacemaker in place will be conveyed to an Emergency Department (ED).

Data in this report 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 demographics

Gender	
Male	2,606 (74.7%)
Female	882 (25.3%)

Age (mean and range)	
All patients	62 (16-108)
Males	59 (16-97)
Females	72 (23-108)

Race▪~	
White	1,864 (53.4%)
Mixed	18 (0.5%)
Asian/British Asian	391 (11.2%)
Black/Black British	266 (7.6%)
Other	185 (5.3%)
Unable/Refused	533 (15.3%)
Not documented	231 (6.6%)

- Three quarters of patients were male.
- The average age was 62, with male patients 13 years younger than females.
- Over half of patients attended were of a white race origin.

2.2. Infarct details

Location of infarct	
Anterior	1,529 (43.8%)
Anterior/Lateral	300 (8.6%)
Inferior	1,226 (35.2%)
Inferior/Lateral	108 (3.1%)
Inferior/Posterior	26 (0.7%)
Lateral	159 (4.6%)
Lateral/Posterior	2 (0.1%)
Posterior	54 (1.5%)
STEMI only documented	84 (2.4%)

- The most common location of the infarct was the anterior region of the heart, followed by the inferior region.

▪ 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.
~ Percentages may not equal 100% due to rounding.

2.3. Response information

- For almost half of patients, chest pain was identified as the patient's chief complaint from the 999 call.
- Calls from Health Care Professionals and 111 accounted for 18% of STEMI patients attended by the LAS.

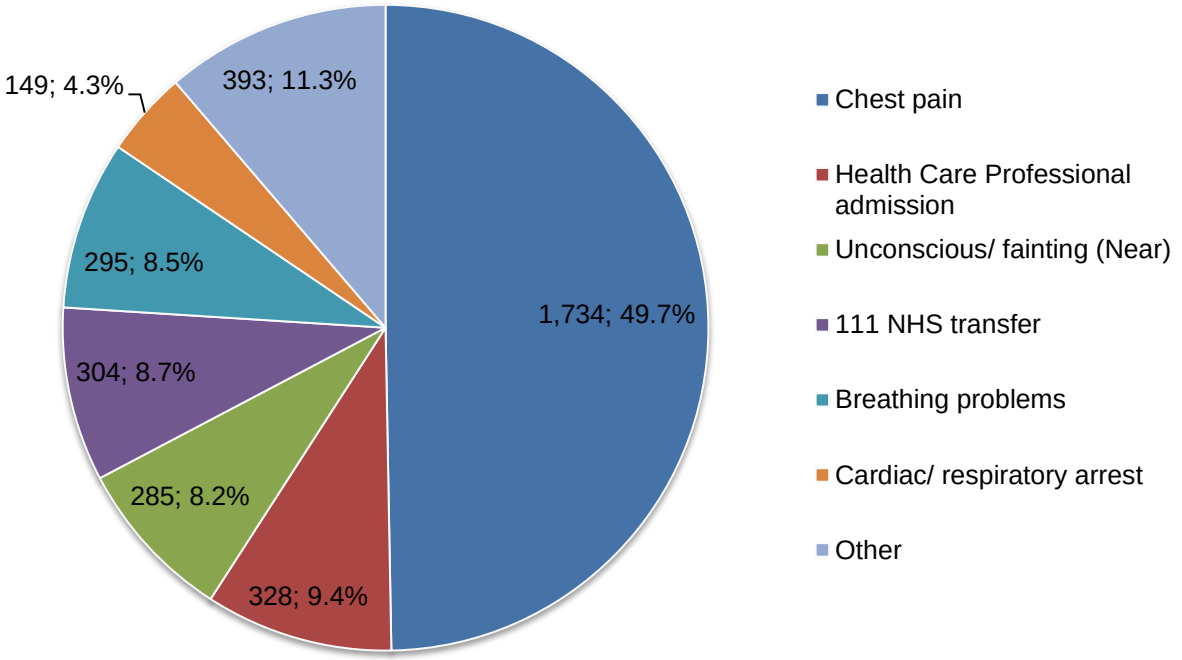


Figure 1 – Chief Complaint

Category by response time[+]			
Category	**No. (%)**	**Call Start response time**	**ORCON response time**
R1[◊]	217 (6.2%)	7 (8) Range 0-21	7 (7) Range 0-20
R2[◊]	2,959 (84.8%)	9 (11) Range 0-139	8 (9) Range 0-136
C1	55 (1.6%)	15 (29) Range 2-124	13 (27) Range 2-123
C2	175 (5.0%)	26 (41) Range 1-184	25 (39) Range 2-183
C3	35 (1.0%)	21 (38) Range 6-199	20 (36) Range 5-198
C4	46 (1.3%)	38 (57) Range 4-323	36 (54) Range 3-322
Overall*	3,488	9 (13) Range 0-323	8 (12) Range 0-322

[+] Medians are presented with means in brackets (in minutes).
[◊] Zero minute response times in the range are due to running calls where a patient/passerby has flagged an ambulance.
* Response category information not available for one case.

- The vast majority of calls (91%) were categorised as the highest priority Red response.
- The average response to patients allocated a Red 1 response category was 7 minutes. Over 60% of patients in the Red 1 group received a response within 8 minutes.
- The average overall response time was 9 minutes from the time the 999 call was connected to arrival on-scene, and 8 minutes using the ORCON definition.

2.4. Assessment and treatment of STEMI patients

Pain assessed	Pre and post treatment (or valid exceptions)	3,303 (94.7%)
	Not undertaken	185 (5.3%)
Aspirin	Administered or valid exception	3,329 (95.4%)
	Not administered	159 (4.6%)
GTN	Administered or valid exception	3,409 (97.7%)
	Not administered	79 (2.3%)
Entonox	Administered or valid exception	1,922 (55.1%)
	Not administered	1,566 (44.9%)
Morphine	Administered or valid exception	3,151 (90.3%)
	Not administered	337 (9.7%)
Analgesia	Administered or valid exception	2,787 (79.9%)
	Not administered	701 (20.1%)
Care bundle	Administered or valid exception	2,522 (72.3%)
	Not administered	966 (27.7%)

- In line with previous years, the delivery of aspirin and GTN has remained consistently high.
- The percentage of patients receiving two pain assessments has increased since the previous year by 1.9% to 95%.
- At least one form of analgesia was delivered to 80% of patients. However, this represents a decline of 2.7% from the previous year and reflects a decrease in both Entonox and Morphine administration (by 1.6% and 2.0% respectively). Of note, a paramedic was not on-scene to provide Morphine to 120 of the 337 cases where Morphine was not administered.

- Overall, delivery of the care bundle (pre- and post- treatment pain assessments, plus administration of GTN, aspirin and analgesia) has decreased from the last year by 1.9% to 72.3%.

2.4.1. Analgesia provision based on initial pain score given

Initial pain rating	No.	Administered / exception	Not administered
Mild pain	292	186 (63.7%)	106 (36.3%)
Moderate pain	646	463 (71.7%)	183 (28.3%)
Severe pain	1,335	1,068 (80.0%)	267 (20.0%)
Pain of unknown severity	275	176 (64.0%)	99 (36.0%)
TOTAL	2,548	1,893 (74.3%)	655 (25.7%)

- The majority of patients were in severe pain (i.e. reported a pain score of 7 or more on the numerical rating scale), but only 80% received analgesia (or had a valid exception for non-provision).
- Just over a quarter of patients reporting moderate pain (i.e. a pain score between 4 and 6) did not receive any form of pain relief.
- Patients with mild pain (i.e. a pain score of 3 or less) or reporting pain but the severity was not indicated, were the least likely to receive analgesia.

2.5. On-scene times

On-scene[+]	
From arrival of first attending vehicle	40 (44) Range 10-207
From arrival of first ambulance	32 (35) Range 5-207

- The average overall on-scene time has remained at 40 minutes this year.
- 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), the average on-scene time was 32 minutes.

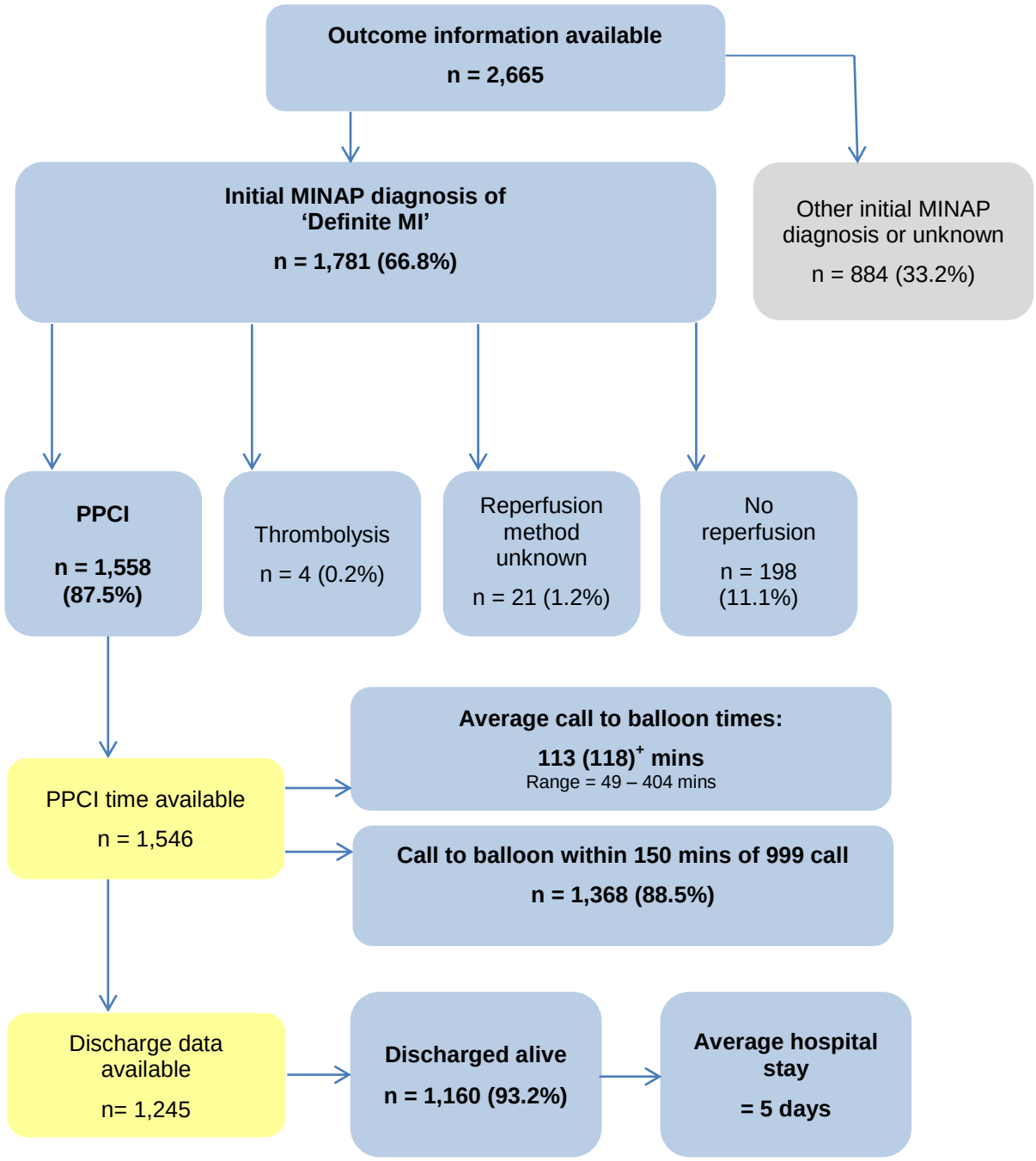
2.6. Conveyance and journey times

Destination #	Appropriate conveyance	HAC: 3,380 (97.0%) ED: 79 (2.3%)
	Inappropriate conveyance	24 (0.7%)
Conveyed to HAC +	Leave scene to arrive hospital time	17 (18) Range 2-64
	999 call to arrive hospital time	68 (73) Range 26-312
Conveyed to ED +	Leave scene to arrive hospital time	10 (12) Range 2-43
	999 call to arrive hospital time	76 (84) Range 48-387

- Over 99% of patients were transported to an appropriate destination, with 97% conveyed to a HAC.
- Patients conveyed directly to a HAC had an average journey time of 17 minutes, and an overall call to hospital time of 68 minutes.
- Journey time for those patients conveyed to an ED was 10 minutes, with a call to hospital time of 76 minutes.

+ Medians are presented with means in brackets (in minutes).
# 5 patients refused to travel to hospital against the advice of LAS clinicians; these patients have been excluded from these totals.

2.7. Reperfusion and patient outcomes



- Of the 3,488 STEMI patients that the LAS attended, outcome information was available in the Myocardial Ischaemia National Audit Project (MINAP) registry for 2,665 cases.
- 1,781 cases were classified within MINAP as having an initial diagnosis of 'definite' myocardial infarctions (MI). Of these, 87.5% of patients were confirmed as having received pPCI treatment.
- 88.5% of patients had pPCI within the national target of 150 minutes[1] from the time of the 999 call; a decrease of 4.1% on figures for the previous year.
- 93% of patients that had pPCI were discharged from hospital alive, with an average hospital stay of 5 days. These figures remain consistent with previous years.

+ Medians are presented with means in brackets (in minutes).

3. Discussion

The LAS has continued to deliver a high quality service to patients who are experiencing a STEMI. Our patients have continued to receive a prompt response overall, with patients in the highest priority category receiving an attendance by LAS clinicians within 8 minutes – a consistent achievement over the last 10 years. We have also maintained our excellent compliance to the specialist HAC pathway with over 99% of patients conveyed to the most appropriate destination and journey times being within 20 minutes.

Our on-scene times have been maintained from the previous year at 40 minutes overall and 32 minutes for the conveying ambulance. Whilst this stable performance is reassuring, it is still acknowledged that on-scene times could be reduced to minimise the risk of damage to the myocardium and deterioration in the patient's condition. It is therefore imperative that upon diagnosis of a STEMI the patient is expedited to the conveying vehicle as quickly as possible and any necessary secondary assessment and treatments (including the care bundle) are conducted en-route to hospital. Moving forward, the LAS will continue to explore STEMI on-scene times within a wider review of job cycle times, and communicate the need to reduce on-scene times at clinical skills refresher training courses and through Clinical Updates and bulletins. Furthermore, extended on-scene times will continue to be a focus for direct feedback to staff by local sector teams when reviewing their clinical and operational performance.

The assessment and treatment of patients, as measured by the care bundle, have seen improvement over the years. Although aspirin and GTN have continued to be delivered to the majority of patients and there is an improvement in pain assessments, performance against the care bundle has unfortunately decreased. This is a due to a reduction in the delivery of analgesia with both Entonox and Morphine administration falling by 2%. It is evident that of the 655 patients that did not receive any analgesia (or have exceptions documented), 41% (n=267) reported severe pain, with moderate and mild pain described by 28% (n=183) and 16% (n=106) respectively. Therefore, the majority of these patients were in pain and, as such, eligible to potentially receive Morphine or at the very least Entonox. To help improve care bundle delivery, instances where analgesia has not been considered will be highlighted to Quality, Governance and Assurance Managers by the Clinical Audit and Research Unit for feedback to staff.

Where outcome data was available, two-thirds of patients were confirmed at hospital as 'definite' MI's, with 87.5% receiving pPCI. The average call to balloon time for these patients remained well within the 150 minute target at 113 minutes. However, the proportion of patients who received pPCI within the 150 minute target has fallen by 4% from 92.6% to 88.5%. It should be recognised that the factors affecting timely reperfusion treatment will be influenced by expedited care from both the LAS and the HAC's and, as such, the LAS will continue to explore efficiencies with the HACs.

In conclusion, this report shows that the LAS continues to provide a good standard of care with a rapid response to STEMI patients, a thorough patient assessment and excellent decision making when selecting the appropriate care pathway.

Acknowledgements

The authors wish to acknowledge and thank Philip Ogden for his efforts in helping collect data.

References

1. 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 Start – the time the 999 call is connected to the ambulance service.

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.

Clinical Commissioning Group – NHS organisations that govern the delivery of services within areas of England.

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).

Job Cycle – the time from the 999 call to the point at which a clinician is available to respond to the next 999 call.

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 Infarction (MI) – Commonly known as a 'heart attack'. A myocardial infarction refers to a blockage of the coronary artery that limits blood flow to the heart.

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).

ORCON – A set of national definitions to determine response times. The standard definition allows a maximum of 60 seconds to triage the patient before the clock starts to measure the response times for R2 and Category C calls. In 2015/16, the LAS participated in the Ambulance Response Programme pilot, which allowed an additional 60 seconds.

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 area (based on the Clinical Commissioning Group location)

Incident CCG^	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
Barking & Dagenham	37 (41)	31 (34)	77.8%	56	22.2%	16
Barnet	39 (43)	30 (33)	68.0%	121	32.0%	57
Bexley	44 (45)	33 (36)	81.8%	81	18.2%	18
Brent	37 (40)	31 (33)	72.3%	120	27.7%	46
Bromley	42 (47)	32 (37)	76.3%	103	23.7%	32
Camden	45 (48)	35 (38)	63.6%	42	36.4%	24
Central London (Westminster)	43 (46)	33 (38)	67.8%	78	32.2%	37
City & Hackney	39 (45)	31 (35)	72.3%	81	27.7%	31
Croydon	39 (42)	32 (34)	77.0%	114	23.0%	34
Ealing	39 (43)	33 (36)	75.1%	127	24.9%	42
Enfield	41 (46)	31 (37)	72.5%	95	27.5%	36
Greenwich	45 (49)	35 (40)	81.3%	74	18.7%	17
Hammersmith & Fulham	45 (47)	34 (39)	68.7%	57	31.3%	26
Haringey	43 (44)	31 (35)	73.8%	62	26.2%	22
Harrow	37 (40)	30 (32)	71.1%	81	28.9%	33
Havering	38 (41)	33 (35)	70.7%	87	29.3%	36
Hillingdon	42 (45)	31 (34)	74.5%	123	25.5%	42
Hounslow	39 (41)	30 (32)	71.2%	79	28.8%	32
Islington	45 (46)	35 (38)	64.9%	61	35.1	33
Kingston	40 (45)	33 (37)	66.7%	38	33.3%	19
Lambeth	43 (44)	35 (35)	72.1%	62	27.9%	24
Lewisham	42 (47)	36 (39)	81.1%	90	18.9%	21
Merton	37 (40)	31 (35)	70.4%	50	29.6%	21
Newham	39 (45)	30 (37)	65.5%	78	34.5%	41
Redbridge	40 (43)	29 (33)	75.8%	97	24.2%	31
Richmond	43 (44)	31 (34)	80.3%	57	19.7%	14
Southwark	40 (42)	35 (37)	70.4%	76	29.6%	32
Sutton	36 (39)	31 (34)	68.2%	60	31.8%	28
Tower Hamlets	43 (45)	36 (37)	67.3%	70	32.7%	34
Waltham Forest	39 (43)	28 (33)	68.0%	68	32.0%	32
Wandsworth	41 (46)	36 (38)	66.7%	68	33.3%	34
West London (Kensington & Chelsea, Queens Park)	40 (43)	34 (38)	75.6%	65	24.4%	21

^ One incident attended at a non-London CCG is excluded from the table.