London Ambulance Service NHS Trust

ST Elevation Myocardial Infarction Annual Report 2016/17

October 2017

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London Ambulance Service NHS Trust

STEMI Overview

2016-2017

Patient demographics

3,540
Suspected STEMI patients

+1.5%

75% Male

25% Female

60
Years old

Consistent with 2015-16 data

71
Years old

Patient Care

73%

1%

Full care bundle

81%

1%

Analgesia provision

Analgesia remains the key care bundle component for improvement

Most common infarct site

45%
Anterior

Conveyance and outcomes

99%

Conveyed to an appropriate facility, **98%** to a specialist heart attack centre (HAC)

92%

Where STEMI was confirmed at hospital, **92%** received a pPCI at a HAC

Timings

00:08

'999' call to arrive scene

Remaining the same as 2015-16

00:40

Overall on-scene time

Remaining the same as 2015-16

00:17

Scene-to-HAC

Remaining the same as 2015-16

01:54
114 minutes

Average reperfusion time

36 minutes within the national target of 150 minutes (2:30).

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1 Introduction

From 1st April 2016 to 31st March 2017, the London Ambulance Service NHS Trust (LAS) attended 3,540 patients who had a suspected ST-Elevation Myocardial Infarction (STEMI) by LAS clinicians following a 12-Lead electrocardiogram (ECG).

When treating suspected STEMI patients, our clinicians undertake a range of assessments and interventions as necessary for the patient's condition. Of these, four key elements form a specific pre-hospital STEMI care bundle: use of aspirin, the administration of glyceryl tri-nitrate (GTN); two pain assessments (pre- and post-treatment), and the appropriate provision of analgesia.

STEMI patients are conveyed rapidly to an appropriate destination hospital for further treatment. Patients should be transported to a specialist Heart Attack Centre (HAC), where they will be taken directly to the catheter laboratory for angiography to assess whether they would benefit from a reperfusion procedure to unblock the artery.

Data for this report has been sourced from the Clinical Audit and Research Unit's (CARU) Acute Coronary Syndrome (ACS) registry. Information in the registry is captured from a range of LAS clinical and operational sources including: Patient Report Forms (PRFs) completed by attending clinicians, vehicle Mobile Data Terminals (MDTs), '999' call logs, and 12-Lead ECG rhythm strips. Patient outcome data is largely collected from the Myocardial Ischaemia National Audit Project (MINAP) database, with some additional data provided directly from hospitals.

This report presents information on our response, clinical care and conveyance for the 3,540 suspected STEMI patients treated by the LAS during 2016/17. Where data are available, patient outcomes and reperfusion treatment details are reported.

A glossary of terminology and abbreviations is included on page 15 for reference.

For a breakdown of STEMI patient care by the Clinical Commissioning Group of the incident location see Appendix 1, and by LAS Station Group see Appendix 2.

Please refer to the Cardiac Arrest Annual Report for details regarding 368 STEMI patients that were successfully resuscitated following a cardiac arrest and conveyed to a Heart Attack Centre as part of a specialist care pathway.

2 Findings

2.1 Patient demographics

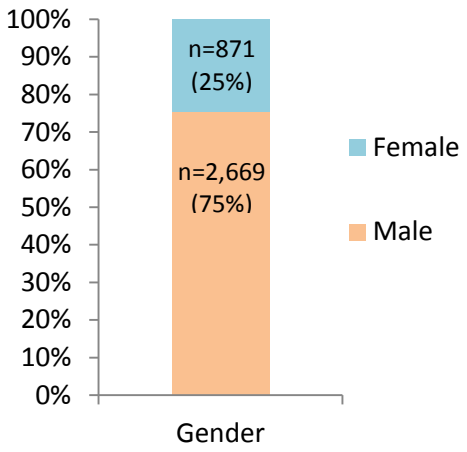


Figure 1: Gender distribution

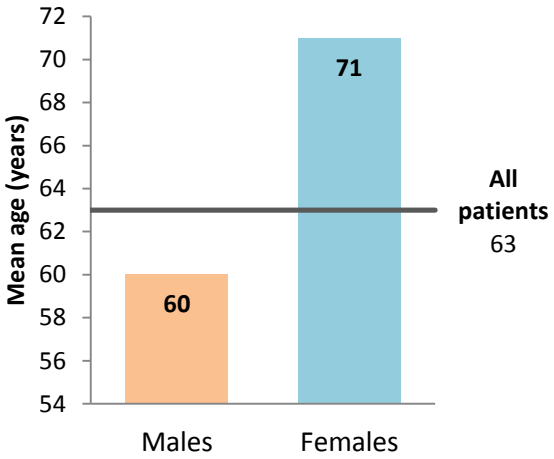


Figure 2: Mean age of STEMI patients by gender

- Three-quarters of patients were male.
- The average patient age was 63 years, with males being 11 years younger than females.

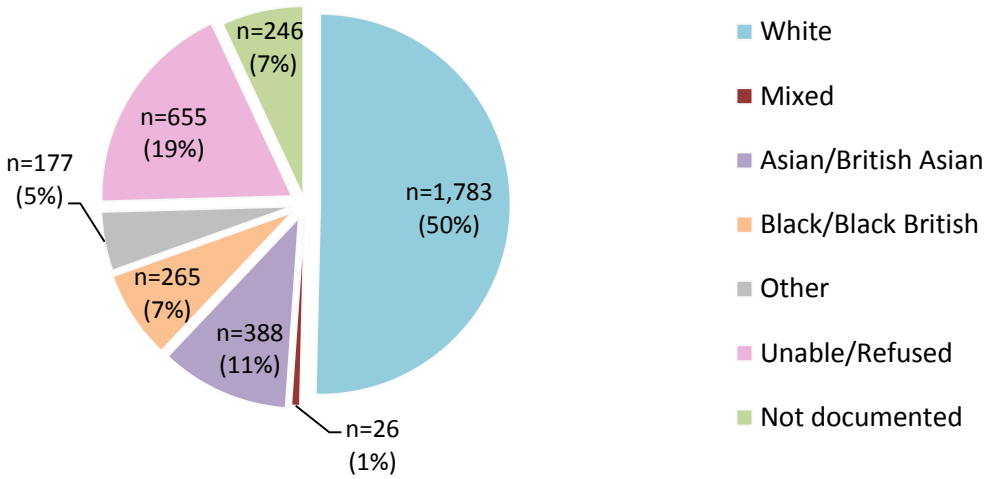


Figure 3: Breakdown of patient race

- Half of all patients were of a white race.
- Almost a fifth of patients either refused or were unable to provide information regarding their race. This has increased by 4% (from 15%) in 2015/16.

2.2 Call information

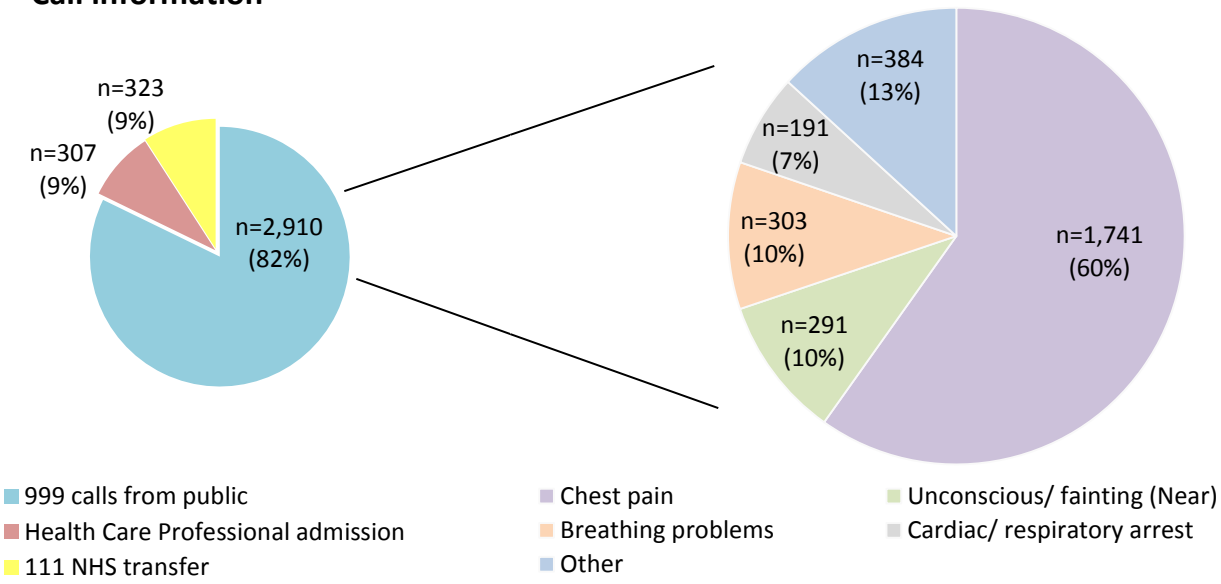


Figure 4: Chief complaint from 999 calls from members of the public

- 82% (n=2,910) of calls were from members of the public. Based on the information provided by caller, chest pain was identified from the 999 call as the chief complaint for 60% of patients, which is in line with previous years' findings.
- Calls received from '111' and other Health Care Professionals (e.g. GPs) accounted for 18% (n=630) of patients attended by the LAS.

2.3 Infarct details

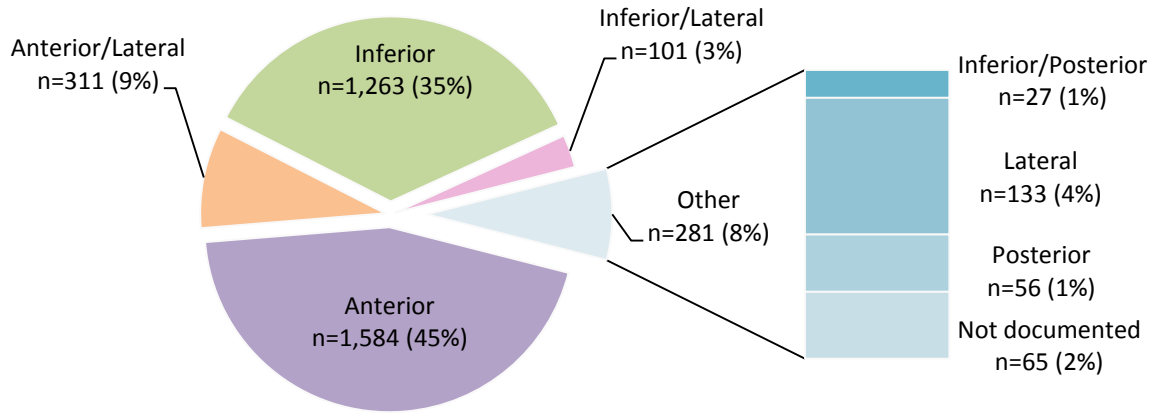


Figure 5: Location of infarct

- The most prevalent location of the infarct was the anterior region of the heart (45%), followed by the inferior region (35%).
- For 2% of cases, the infarct location was not documented.

2.4 Response information

Based on the information provided by the caller, 999 calls are triaged into response categories. The highest priority category, Red response, is sub-divided into Red 1 and Red 2 and has a national target whereby 75% of patients should receive a response within 8 minutes. Lower priority calls are allocated into one of four category C groups. Given that STEMI patients may not necessarily report chest pain at the point of the 999 call and may present with other symptoms, they can be prioritised into one of these categories and the response times will vary accordingly.

Response times are measured in different ways for each category. Red 1 responses start from the point the '999' call was connected by the operator. For Red 2 and Category C calls, a period of time prior to the clock starting is afforded in an attempt to establish the chief complaint. During 2016/17, the LAS was involved in an NHS England initiative to allow *up to* 240 seconds before the clock was started to help determine the chief complaint.

Category	**No. (%)**	**Response time**	
		Median (mean) in minutes	Range
R1*	256 (7%)	7 (8)	0-70
R2*	2,977 (84%)	7 (8)	0-119
Red*	3,233 (91%)	7 (8)	0-119
C1	53 (2%)	21 (30)	2-169
C2*	153 (4%)	17 (34)	0-404
C3	60 (2%)	16 (25)	1-127
C4	41 (1%)	23 (44)	2-204
Category C*	307 (9%)	20 (33)	0-404
Overall*	**3,540**	**8 (11)**	**0-404**

** Zero minute response times in the range are due to running calls.*

Table 1: Category by response time

- 91% of calls were allocated a Red response, with the vast majority (84%) being Red 2.
- 58% of patients allocated a Red category received a response within 8 minutes. When split by Red 1 and Red 2, a resource arrived on scene within 8 minutes for 63% and 57% of calls respectively.
- Overall, the median response time was 8 minutes, which remains consistent with 2015/16.

2.5 On-scene times

Based on the response category, the LAS will dispatch different types of vehicles to patients. This can be a solo responder (i.e. a car, motorbike, cycles) to initially assess and treat the patient and/or a double-crewed ambulance that can also convey the patient to hospital.

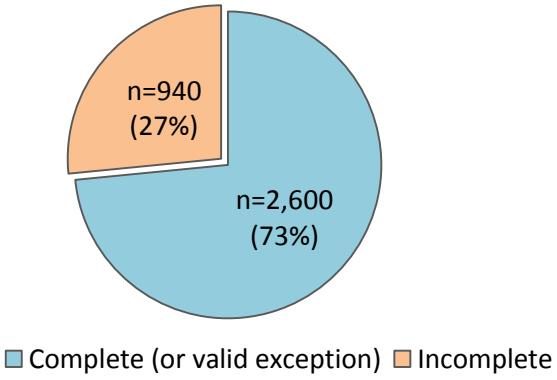
From the arrival of:	On-scene time	
	Median (mean) in minutes	Range in minutes
First attending vehicle	40 (43)	0-172
First conveying ambulance	31 (34)	0-157

Table 2: On-scene times

- The median on-scene time from the first attending vehicle arriving on-scene to the transporting ambulance leaving scene remains the same as last year (40 minutes).
- When measuring on-scene time from the first conveying vehicle arriving to the transporting ambulance leaving scene, the median was 31 minutes (1 minute faster than 32 minutes reported in 2015/16).

2.6 STEMI patient care

2.6.1 Care bundle compliance



Full care bundle components:

- ✓ Aspirin
- ✓ GTN
- ✓ Two pain assessments (pre- and post-treatment)
- ✓ Analgesia

Figure 6: Full care bundle administration

- 73% of patients received a complete care bundle or had a valid exception, representing an increase of 1% from 2015/16 (72%). Further details are provided in section 2.6.2 and 2.6.3.

2.6.2 Aspirin and glyceryl trinitrate (GTN)

Patients presenting with a STEMI should be administered aspirin and GTN as soon as possible to increase the blood flow to the heart.

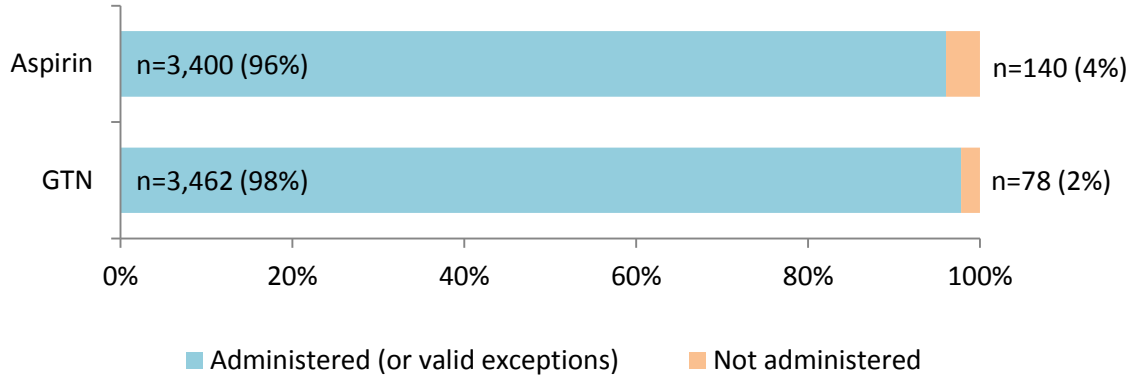


Figure 7: Aspirin and GTN administration

- Both aspirin and GTN administration remained at a high level similar to previous years.
- 96% of STEMI patients received aspirin, representing a 1% increase from 2015/16.
- GTN was administered to 98% of patients.

2.6.3 Pain assessment and management

LAS clinicians should assess the patient's level of pain prior to treatment to ensure that appropriate analgesia is given. Pain is assessed using either a numerical rating scale (where the patient scores their pain from 0 to 10) or a qualitative assessment that describes the pain experienced. The level of pain is grouped as mild (score 1 to 3), moderate (score 4 to 6) or severe (score 7 to 10). For mild pain, Entonox is advised and can be administered by all LAS clinicians. Morphine should be given for moderate to severe pain by LAS paramedics. Entonox is also indicated for patients with moderate to severe pain where it is not possible to administer morphine or as a precursor to morphine administration. Following treatment, the patient's pain is re-assessed to determine the effectiveness of the analgesia and further treatment requirements. Where the patient is pain-free either as a result of GTN and aspirin treatment or due to an atypical presentation, analgesia is not required and is exempted.

2.6.3.1 Pain assessment

- Overall, 95% of patients (n= 3,371) received a pre- and post-treatment pain assessment (or had a valid exception), which is consistent with 2015/16.
- 5% of patients (n=169) did not receive the two pain assessments and there were no valid reasons documented for this.

2.6.3.2 Drugs administered

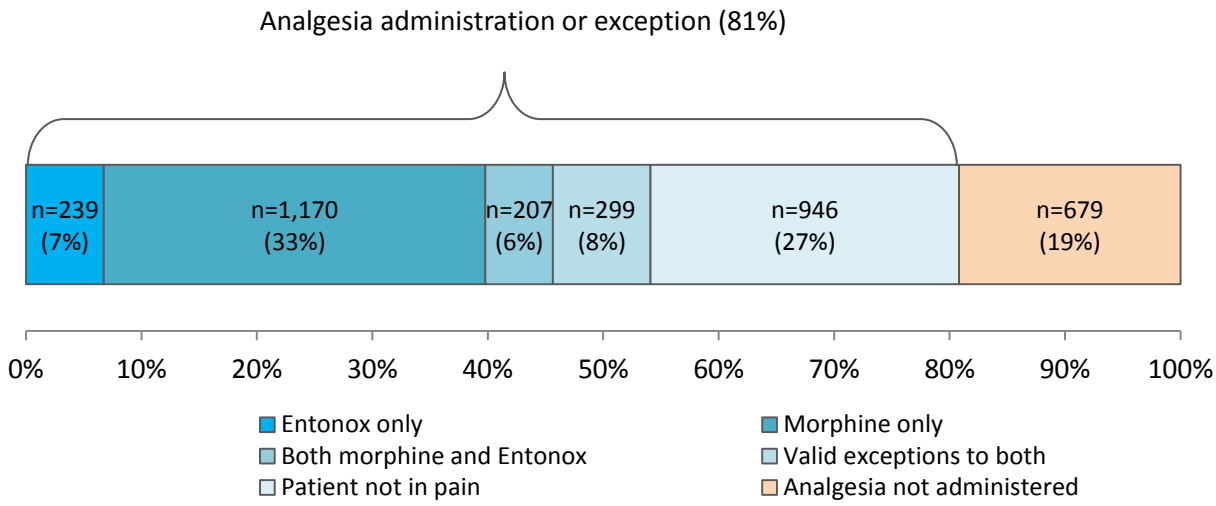
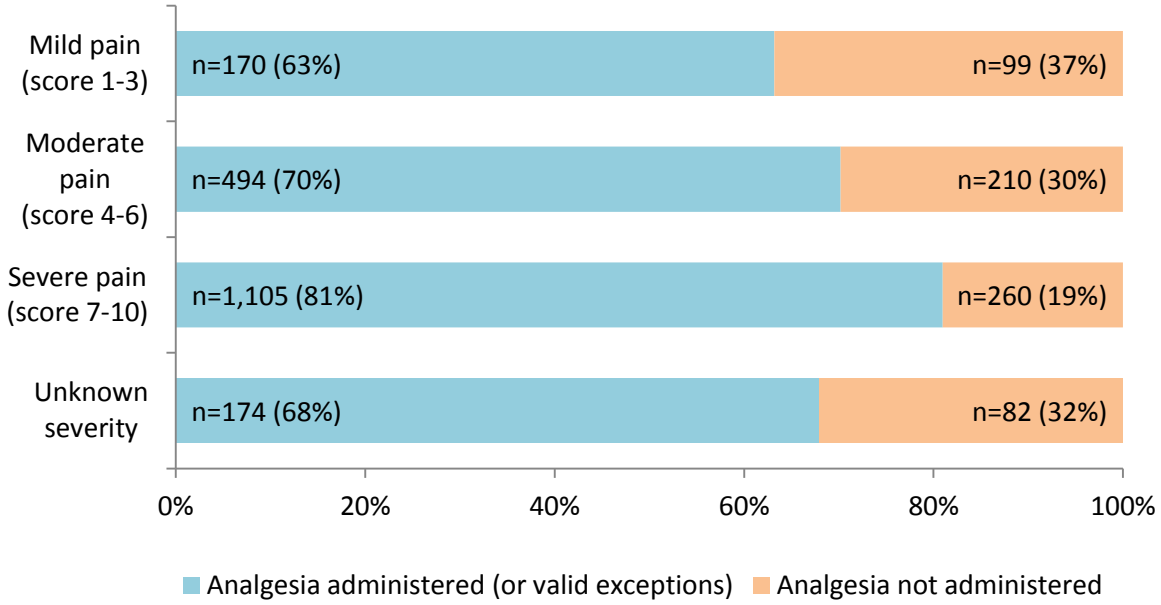


Figure 8: Administration of analgesia

- Overall, 81% of patients received at least one form of analgesia or had valid exceptions; an increase of 1% from 2015/16 (80%). A fifth of patients did not receive any analgesia.
- When analgesia was administered (n=1,616): 72% of patients received morphine only, 15% received Entonox alone and 13% of patients received both forms of analgesia.
- 35% of patients had a valid exception as to why analgesia could not be administered, which included the patient not being in pain (27%) or other exceptions, such as contraindications, being present for both Entonox and morphine (8%).

2.6.3.3 Provision of analgesia according to pain level



Patients not in pain or where pain was not assessed are excluded from this figure.

Figure 9: Appropriate analgesia provision based on pain severity

- 73% (n=2,594) of patients reported that they were in pain following a pain assessment.
- Over half of patients (53%, n=1,365) reported severe pain. Of these, only 81% received analgesia, which was an increase of 1% since 2015/16.
- 19% of patients in severe pain did not receive analgesia, and no reasons were provided.
- For patients in moderate (n=704) or mild pain (n=269), the proportion of analgesia administered decreased by 2% and 1% from last year to 70% and 63% respectively in 2016/17.
- Where pain was reported, but it was not possible for LAS clinicians to establish the severity of the symptoms (n=256), analgesia was administered to 68% of patients. This is a 4% decrease from last year.

2.6.3.4 Outcome of pain management

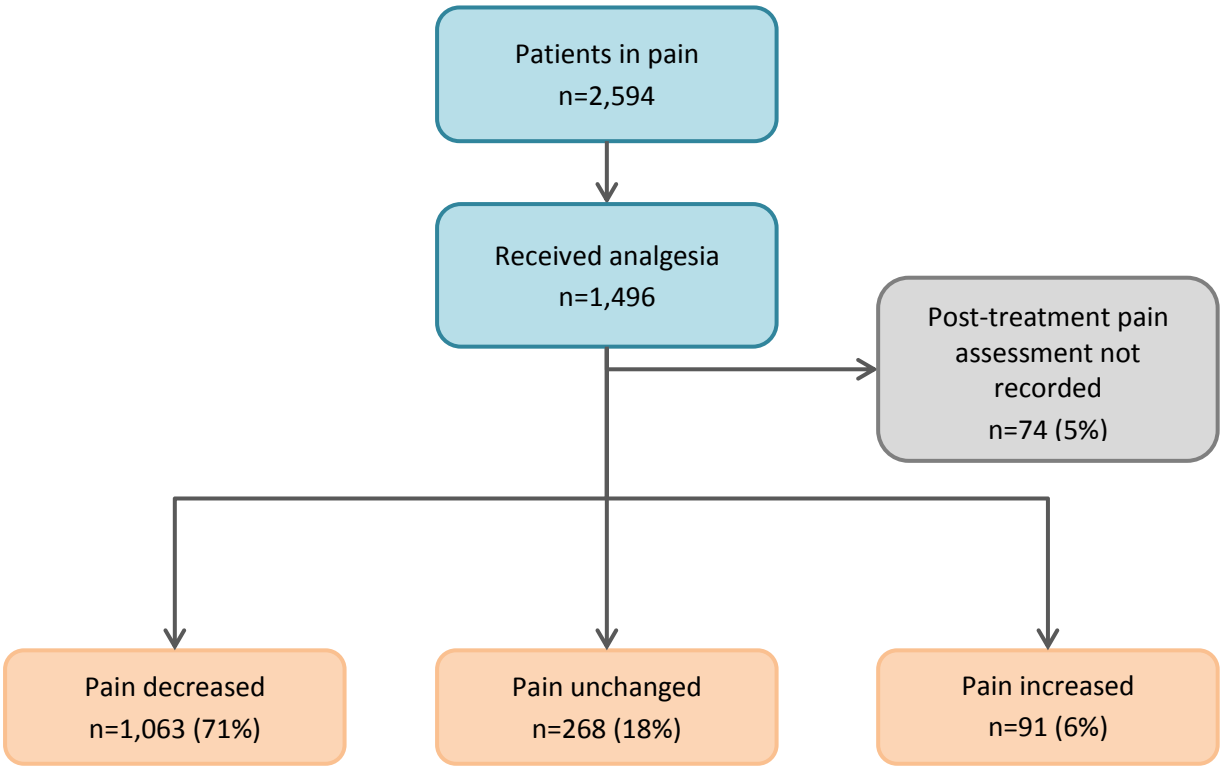


Figure 10: Outcome of pain management

- Of the 1,496 patients who reported that they were in pain upon initial assessment and received analgesia, 71% reported a decrease in pain following administration of analgesia (either a decrease of at least one point on the numerical rating scale or reported decrease in qualitative description).
- 24% (n=359) of patients reported their pain had remained the same or increased despite analgesia administration. Of these, 66% (n=233) received morphine, 22% (n=78) received Entonox and 13% (n=48) received both forms.

2.7 Conveyance

Heart Attack Centres (HAC) will accept STEMI patients directly from the LAS 24 hours a day, 7 days a week. In certain instances, conveyance to an Emergency Department (ED) may be more appropriate for the patient, if for example, the patient is asymptomatic, the patient's condition is not sufficiently stable, the HAC is not able to accept patients due to capacity issues, or patients refused conveyance to a HAC.

2.7.1 Destination of STEMI patients

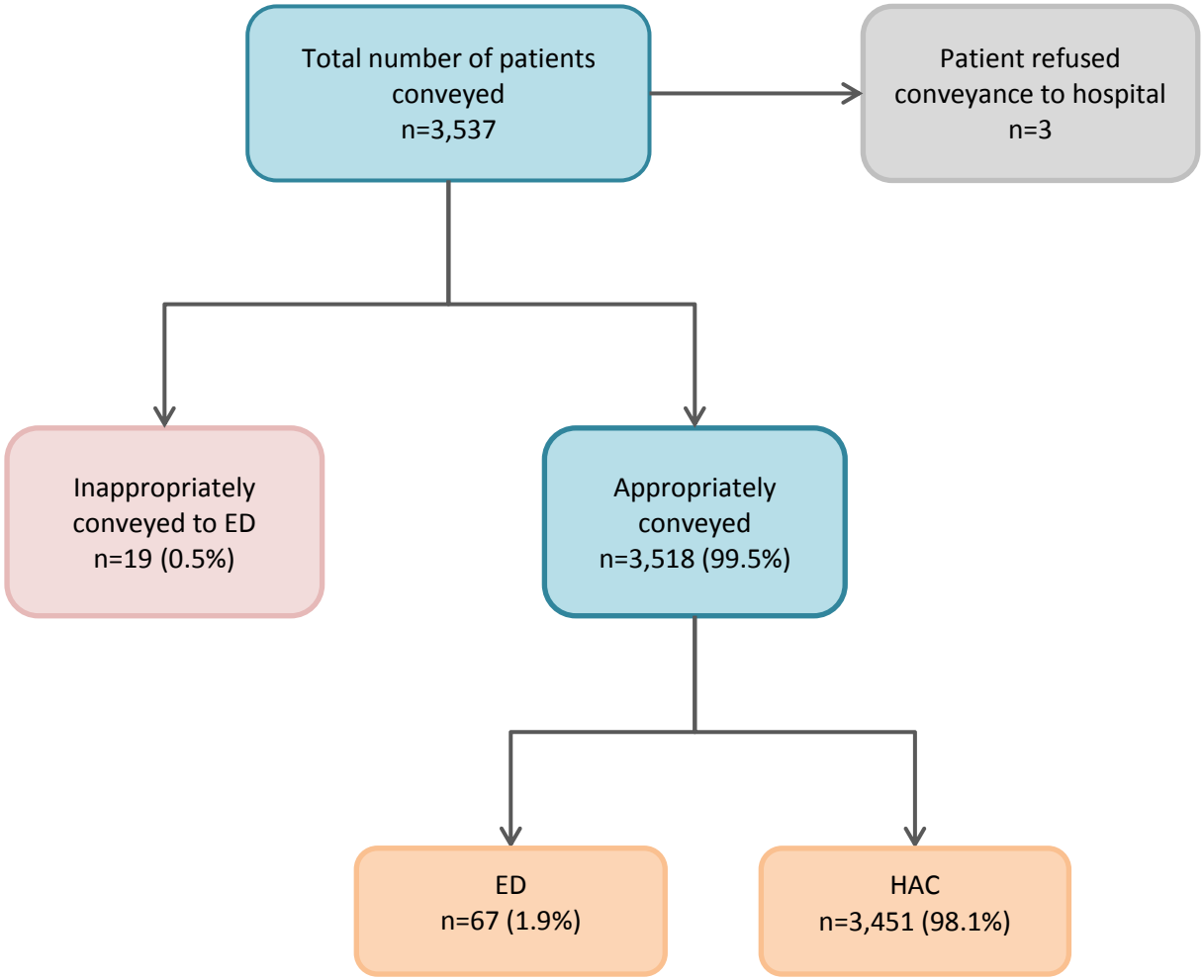


Figure 11: Patient destination

- Over 99% of patients were conveyed to an appropriate destination, which is consistent with 2015/16.
- 98% of patients were transported to a HAC, a 1% rise from last year (97%).

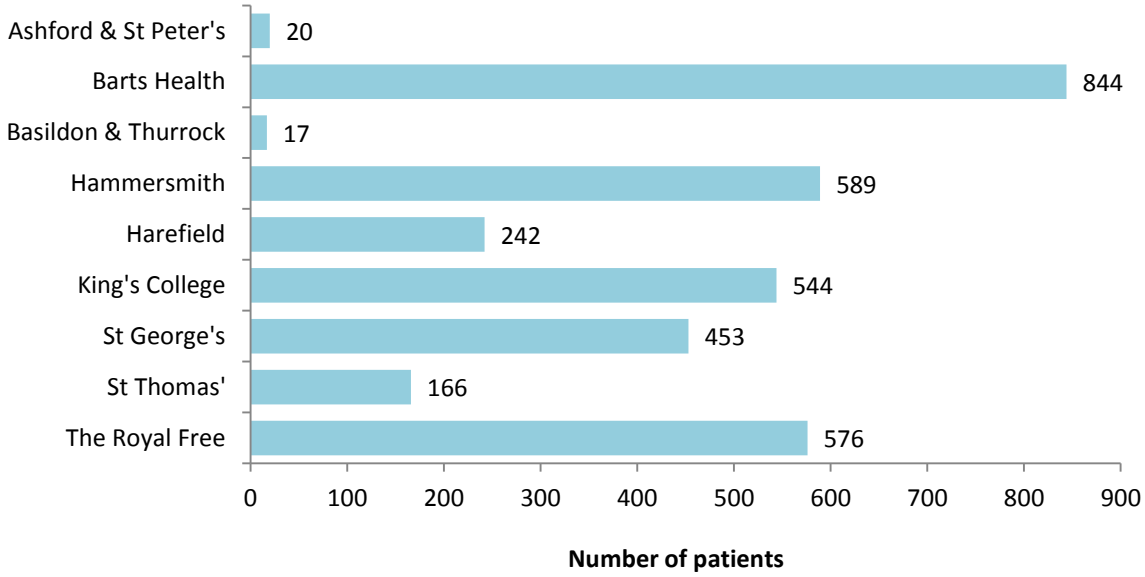


Figure 12: Number of patients conveyed to each HAC

- The majority of patients were conveyed to the Heart Centre at Barts Health.
- Ashford and St Peter's began accepting patients from 1st June 2016 at its site at St Peter's Hospital Chertsey. Furthermore, from 24th January 2017, Essex Cardiothoracic Centre at Basildon Hospital extended their catchment to patients from the Hornchurch and Harold Wood area.

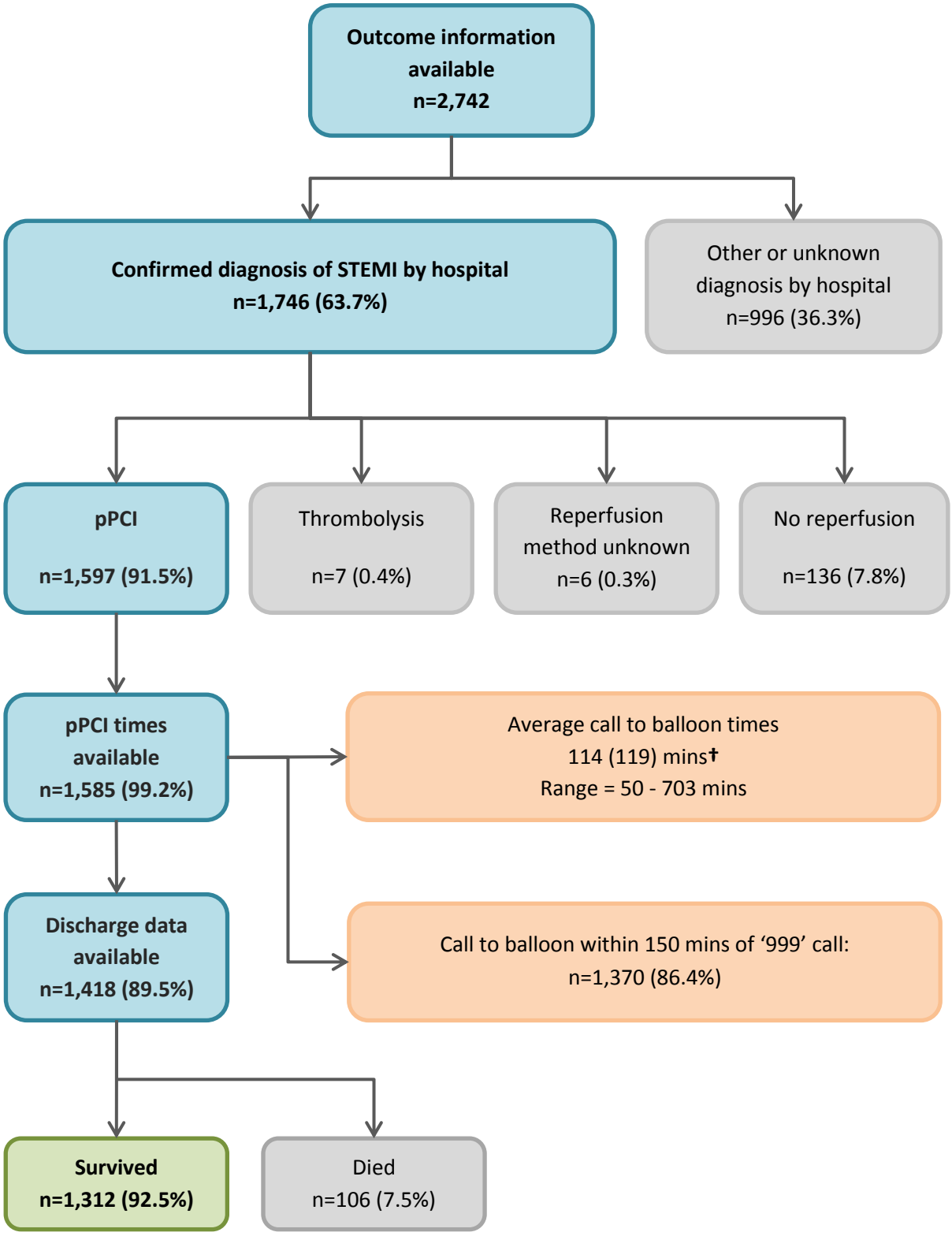
2.7.2 Journey and call to hospital times

Destination	**Leave scene – arrive hospital** Median (mean) in minutes	**999 call – arrive hospital** Median (mean) in minutes
HAC	17 (18) Range 1-68	67 (71) Range 18-520
ED	10 (12) Range 2-38	66 (72) Range 32-188

Table 3: Journey and call to hospital times

- Patients conveyed directly to a HAC had an average journey time (leave scene to arrival at hospital) of 17 minutes.
- The 999 call to hospital arrival time to a HAC was 67 minutes.

2.8 Reperfusion and patient outcomes



† Median (mean); pPCI, primary percutaneous coronary intervention.

Data sourced primarily from the MINAP registry (see glossary on page 16 for details).

Figure 13: Outcomes for patients who received reperfusion at a HAC

- LAS STEMI diagnoses were confirmed at hospital for 64%, a 3% decline from 2015/16 (67%).
- 92% of hospital-confirmed STEMI patients received pPCI treatment, up 4% from last year.
- The average call-to-balloon time was 114 minutes, which is well within the national target of 150 minutes[1].
- Overall, 86% of patients had their pPCI procedure within the national target of 150 minutes, a decrease of over 3% from the previous year's figure (89%).
- Similar to last year, 93% of patients were discharged from hospital alive and the average length of hospital stay was 5 days.

3 Quality improvement initiatives

During 2016/17, the LAS undertook a range of initiatives aimed at improving STEMI care, which included:

- We launched our 5-year Clinical Strategy 2016-2021 and committed to a number of actions, including reducing on-scene times and improving the management of pain.
- The LAS has continued to provide educational updates to staff via Core Skills Refreshers, internal bulletins and publications in the Clinical Update and the learning from experience Insight magazine.
- An 'Improving Patient Care' poster[2] emphasising the key assessments, interventions and triage was released to all staff to help support decision making in an effort to reduce time on-scene.
- Monthly care packs and under-triage reports have been disseminated across the Trust to improve clinical care at a local level.
- We amended the criteria for direct admission to the Heart Attack Centres to include patients with functioning pacemakers.
- We continued to work with the cardiac networks in London to monitor activity and enhance the STEMI pathway, including supporting developments for extending Heart Attack Centre catchments.

[1] Treatment of Heart Attack National Guidance – Final Report of the National Infarct Angioplasty Project (NIAP), Crown, 2008.
[2] https://thepulseweb.lond-amb.nhs.uk/operational/job-cycle-time/job-cycle-time-project-updates/

4 Summary

The LAS has maintained a high standard of care in 2016/17 as evidenced by our rapid response, comprehensive on-scene assessment and diagnosis of patients, treatment of symptoms and appropriate conveyance of patients. Our outcomes show reperfusion rates have improved and our patients receive an average call to balloon that is well within the national target of 150 minutes. There are some areas in need of improvement as detailed in the next section.

5 Messages for improvement

The LAS's 5-year clinical strategy (2016-2021), published earlier this year, commits to high quality care for suspected STEMI patients. Our report has highlighted two key areas for improvement to ensure our STEMI patients receive the level of care we aim to achieve:

Pain management

Nearly a fifth of patients did not receive analgesia, making pain management an essential component of patient care to improve.

Following treatment with one type of analgesia, there is potential to utilise additional forms in instances where patients report that their pain has not improved.

On scene

The Clinical Strategy has highlighted on-scene times as a key area for improvement for time critical conditions such as STEMI.

On-scene times have remained stable at 40 minutes, but must be improved to ensure that patients receive prompt continuing care at hospital and limit any further damage to their heart.

6 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.

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 pain, or while further analgesia is being prepared where pain is more severe.

First arriving vehicle – A resource dispatched to immediately life-threatening calls which can include a solo responder (such as a car, motorcycle, bicycle response) or an ambulance.

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 moderate to 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 an area of 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).

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.

Red Response Category – Red 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 Red response.

Response Categories C1-C4 – 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 C1-C4. 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.

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.

Acknowledgements

CARU wishes to thank colleagues in the Medical Directorate for their ongoing support, particularly, Mark Whitbread, Jo Nevett and Fenella Wrigley. We are also grateful to colleagues at London hospitals who help provide outcomes data.

Appendix 1: On-scene times and care bundle provision by Clinical Commissioning Group of incident location

Incident CCG	Median (mean) on-scene times, minutes		Care Bundle			
	Arrival of first vehicle	Arrival of first conveying vehicle	Yes/ Exception		No	
			n	%	n	%
Barking & Dagenham	40 (42)	30 (32)	67	71.3%	27	28.7%
Barnet	39 (42)	31 (33)	123	79.4%	32	20.6%
Bexley	44 (45)	33 (26)	75	79.8%	19	20.2%
Brent	37 (41)	30 (33)	140	80.5%	34	19.5%
Bromley	45 (48)	35 (40)	101	75.9%	32	24.1%
Camden	37 (43)	32 (36)	66	76.7%	20	23.3%
Central London	39 (41)	31 (34)	84	72.4%	32	27.6%
City & Hackney	37 (41)	32 (33)	68	73.9%	24	26.1%
Croydon	40 (44)	31 (33)	108	65.1%	58	34.9%
Ealing	41 (43)	32 (34)	129	73.3%	47	26.7%
Enfield	39 (44)	29 (31)	97	73.5%	35	26.5%
Greenwich	44 (47)	39 (42)	81	76.4%	25	23.6%
Hammersmith & Fulham	40 (43)	33 (36)	61	80.3%	15	19.7%
Haringey	40 (45)	27 (32)	70	67.3%	34	32.7%
Harrow	40 (43)	28 (31)	78	77.2%	23	22.8%
Havering	40 (43)	29 (34)	81	68.6%	37	31.4%
Hillingdon	41 (43)	28 (31)	111	73.0%	41	27.0%
Hounslow	39 (42)	30 (33)	107	76.4%	33	23.6%
Islington	43 (46)	32 (35)	48	66.7%	24	33.3%
Kingston	38 (45)	33 (38)	37	74.0%	13	26.0%
Lambeth	36 (41)	32 (35)	64	68.1%	30	31.9%
Lewisham	42 (45)	32 (38)	68	69.4%	30	30.6%
Merton	35 (39)	30 (32)	41	70.7%	17	29.3%
Newham	38 (41)	32 (33)	83	67.5%	40	32.5%
Redbridge	40 (44)	30 (33)	126	78.8%	34	21.3%
Richmond	41 (45)	31 (36)	63	75.9%	20	24.1%
Southwark	42 (45)	37 (39)	82	75.2%	27	24.8%
Sutton	40 (45)	33 (36)	55	72.4%	21	27.6%
Tower Hamlets	39 (42)	32 (32)	83	74.1%	29	25.9%
Waltham Forest	40 (43)	31 (32)	75	73.5%	27	26.5%
Wandsworth	35 (38)	30 (33)	52	61.2%	33	38.8%
West London	35 (43)	35 (37)	76	73.8%	27	26.2%

Appendix 2: On-scene times and care bundle provision by LAS Group Station

LAS Group Station	Median (mean) on-scene times, minutes		Care Bundle			
	Arrival of first vehicle	Arrival of first conveying vehicle	Yes/ Exception		No	
			n	%	n	%
Homerton	38 (42)	31 (33)	165	75.7%	53	24.3%
Newham	39 (42)	31 (32)	199	71.1%	81	28.9%
Romford	40 (44)	30 (34)	203	74.1%	71	25.9%
North East	39 (43)	31 (33)	567	73.4%	205	26.6%
Camden	40 (43)	31 (34)	111	68.1%	52	31.9%
Edmonton	40 (45)	28 (32)	123	70.7%	51	29.3%
Friern Barnet	39 (44)	31 (35)	115	78.8%	31	21.2%
North Central	40 (44)	30 (34)	349	72.3%	134	27.7%
Brent	38 (40)	30 (31)	225	79.8%	57	20.2%
Fulham	39 (41)	31 (34)	146	77.7%	42	22.3%
Hanwell	38 (42)	30 (34)	169	74.8%	57	25.2%
Hillingdon	41 (44)	30 (32)	94	73.4%	34	26.6%
Westminster	40 (43)	35 (36)	70	73.7%	25	26.3%
North West	39 (42)	30 (33)	704	76.6%	215	23.4%
Bromley	43 (46)	35 (38)	149	70.3%	63	29.7%
Deptford	41 (44)	34 (37)	227	76.2%	71	23.8%
Greenwich	43 (46)	36 (39)	143	76.1%	45	23.9%
South East	42 (45)	35 (38)	519	74.4%	179	25.6%
Croydon	39 (45)	31 (34)	82	65.6%	43	34.4%
New Malden	39 (44)	32 (36)	77	71.3%	31	28.7%
St Helier	37 (41)	30 (33)	87	69.6%	38	30.4%
Wimbledon	36 (40)	33 (34)	77	68.8%	35	31.3%
South West	38 (43)	32 (34)	323	68.7%	147	31.3%
PAS & VAS	41 (45)	32 (34)	94	68.1%	44	31.9%
Other LAS†	38 (42)	29 (36)	44	73.3%	16	26.7%

† *Includes Hazardous Area Response, Special Events, Tactical Response Units and Training.*