London Ambulance Service NHS Trust

ST Elevation Myocardial Infarction

Annual Report: 2011-12

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Introduction

The London Ambulance Service NHS Trust (LAS) attended 2,963 patients who were diagnosed as suffering an ST-Elevation myocardial infarction (STEMI) by ambulance staff between April 2011 and March 2012.

This report presents information relating to the demographics of these patients, performance, the clinical assessments and treatment provided by the LAS, use of specialist pathways and patient outcomes. Data has been sourced from the LAS Patient Report Forms (PRFs) and 12 Lead electrocardiogram (ECG) rhythm strips, supplemented with further details from the Emergency Operations Centre (EOC) Call Log and vehicle Mobile Data Terminals (MDT). Patient outcome data has been obtained primarily from the Myocardial Ischaemia National Audit Project (MINAP) database, but also directly from hospitals where available.

This year the report introduces data related to the Department of Health (DH) Ambulance Clinical Quality Indicators (ACQIs) launched in April 2011[1]. The ACQI's are designed to measure the quality of care provided by ambulance services for key clinical conditions, and to enable ambulance services to be benchmarked against each other nationally to monitor progress. Two ACQI measures relate to the care of STEMI patients examining the proportion of patients receiving reperfusion within targets, and the provision of key elements of treatment referred to as a care bundle.

This report focuses on patients whose PRF and/or ECG indicated that they were diagnosed with a STEMI following an emergency 999 call and does not include patients were transported by the LAS via inter-hospital transfers. All figures within this report relate to the LAS as a whole.

Patient Information

Demographics

The average age of the 2,963 patients attended was 63 years, with a range of 16-101 years. The majority of patients were male (73%; n=2,170), with an average age of 59. Female patients were on average 14 years older at 73 years. These figures remain consistent with previous years.

Figure 1 below shows that over half of patients who provided their ethnicity were of a 'White' ethnic origin (57%, n=1,678).

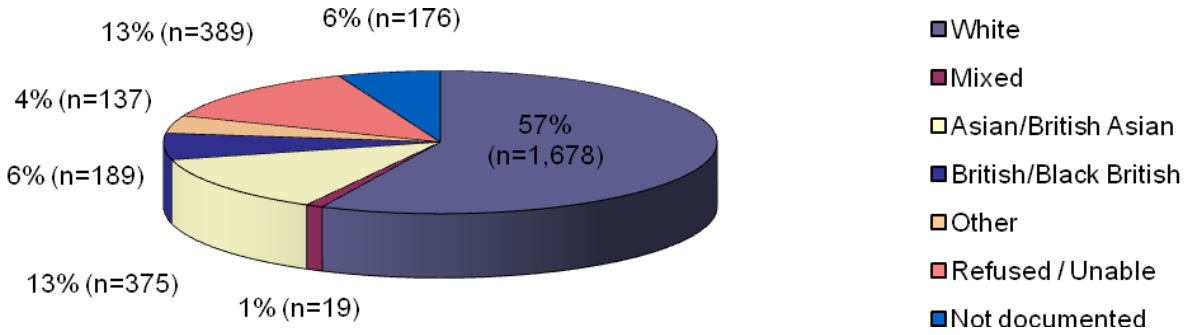

Figure 1. Ethnicity of patients attended

Type of infarct

Table 1 shows the breakdown of the area of the heart affected by the infarct. The most common type of infarct was in the anterior region of the heart (46%), followed by the inferior (35%).

Type of Infarct	Frequency
Anterior	46%; n=1,352
Inferior	35%; n=1,050
Lateral	4%; n=117
Antero-Lateral	10%; n=283
Infero-Lateral	3%; n=87
Only 'STEMI' documented	2%; n=74

Table 1. Type of infarct

Response Times [i]

Call to Scene

Table 2 below displays ambulance response times for STEMI patients during 2011-12.

Category	No. of Patients	Average Times in minutes~		Range (minutes)	% arriving within 8 minutes
		Median	Mean		
Call to Scene (All Calls)	2,963	7 (7)	8 (8)	0# - 171^	71%; n=2,090
Call to Scene (Category A Calls)	2,603	6 (6)	7 (7)	0# - 41	75%; n=1,965
Call to Scene (Non-Category A Calls)	360	11 (9)	18 (13)	0# - 171^	35%; n=125

~ 2010-11 data is provided in brackets to allow for comparisons.

** Call start times are based on Call Connect, which is the time the call was connected to the ambulance service.*

 # Calls with a zero response time refer to running calls.

^ The extended time of 171 minutes from call to scene was caused by an incident where the call was not reported as a cardiac problem and did not receive a Category A response.

Table 2. Call to Scene times

Overall, the median response time from 999 call to arrival on scene for all patients was 7 minutes. The DH requires UK Ambulance Services to respond to the highest priority (Category A) calls within 8 minutes. Based on the information given at the time of the call, 88% (n=2,603) of all calls were assigned a Category A response. For those calls assigned a Category A response, the median time from the 999 call to arrival on scene was 6 minutes, which is well within the Department of Health target. Furthermore, 75% of Category A calls received a response within the 8 minute target.

On Scene Time

The median time spent on scene with patients was 37 minutes. While in some cases valid reasons exist for extended time on scene (including patients refusing to travel, difficult removals, patients in cardiac arrest and consultation with the Clinical Support Desk for advice), there were many incidents where no reasons were

[ii] Please note that, as mean times can potentially be skewed by extended time ranges, median figures are used in this section as the median is a more accurate representation of the average.

evident. As can be seen in Figure 2, on scene times have been gradually increasing across the past seven years.

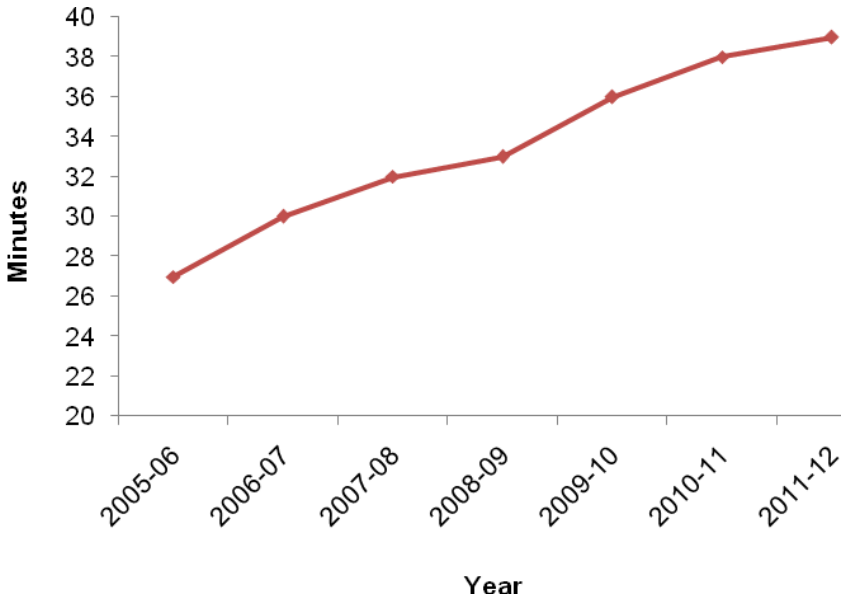

Figure 2. On scene times by year

Patient Care

Pain assessment

Table 3 shows that 90% (n=2,653) of patients received an initial (pre-treatment) pain assessment. Post-treatment pain assessment levels were lower than those undertaken pre-treatment (84% vs 90%), and 82% (n=2,436) of patients had both pre- and post-treatment pain assessments recorded.

Of note, valid exceptions to both assessments have increased since 2010-11 by 6%.

	Pre-Treatment	Post-Treatment	Both Assessments
Pain Assessment	90%; n=2,653	84%; n=2,487	82%; n=2,436
Valid Exceptions	8%; n=246	9%; n=262	9%; n=272
No Pain Assessment	2%; n=64	7%; n=214	9%; n=255

Table 3. Pain Assessment

Aspirin and GTN

Table 4 below shows the rates of aspirin and GTN administration to STEMI patients.

	Aspirin	GTN
Administered*	83%; n=2,473	69%; n=2,031
Valid Exceptions	12%; n=341	28%; n=841
Not Administered	5%; n=149	3%; n=91

**Administration figures include those patients who received aspirin prior to the arrival of LAS crews.*

Table 4. Aspirin and GTN administration

Overall, 83% (n=2,473) of patients were given aspirin. LAS staff were responsible for the majority (87%; n=2,158) of administrations, with 13% (n=315) of patients taking aspirin prior to the arrival of the LAS. A further 12% (n=341) of patients were not eligible to receive aspirin, either due to valid contraindications (such as allergy), which accounted for 92% (n=315) of all exceptions, or patient refusal (8%; n=26). In comparison to figures reported in 2010-11, there has been a decrease in administration of aspirin by 5% and an increase in exceptions reported of 6%.

GTN was administered to 69% (n=2,031) of patients by LAS staff. A further 28% (n=841) of patients had valid reasons documented as to why they did not receive GTN: 6% (n=176) had taken it prior to the arrival of the LAS, 14% (n=433) had valid contraindications (such as hypotension and no cardiac chest pain), 7% (n=216) had a reduced level of consciousness and could not be given the drug and a final 1% (n=16) of patients refused it. As observed with aspirin administration, when compared to last year, the percentage of patients who received GTN has decreased by 6% and valid exceptions to the drug have increased by 6%.

Analgesia

Overall, 45% (n=1,345) of patients received at least one form of analgesia, with 185 of these patients receiving both Entonox and morphine. 31% (n=913) had documented valid exceptions relating to both drugs. The remaining 24% (n=705) of patients received no analgesia; 11% (n=324) had an exception to one analgesic but offered no reasons for non-administration of the other, while the remaining 13% (n=381) received neither form of analgesia with no reasons provided. Appendix 1 provides further details regarding analgesia administration.

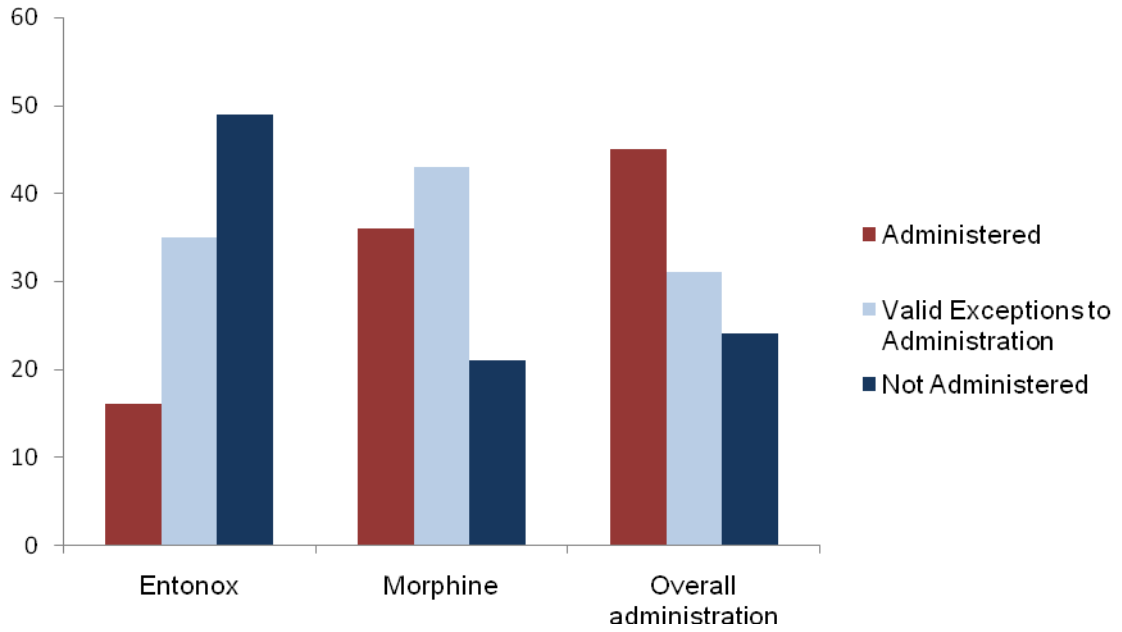

Figure 3. Percentage of patients receiving analgesia

The percentage of patients either receiving at least one form of analgesia has increased by 2% since 2010-11. In addition, there has been a 5% rise in reporting of valid exceptions.

Care Bundle

The key elements of care that staff should provide to STEMI patients are pre- and post-treatment pain assessments and administration of aspirin, GTN and analgesia. Where indicated, patients should receive all four of these elements in combination (a "care bundle") to receive optimum care. Should one or more pre-determined clinical exceptions apply for at least one element, but the patient receives all other elements correctly, it will be deemed that there is a valid exception to the provision of the care bundle. However, if one or more elements are not provided, and there are no valid exceptions for this, the care bundle is considered incomplete.

Due to the differences in the criteria used, there are two forms of calculation undertaken for the care bundle: one is reported internally by the LAS and the other externally for the DH ACQI's. The LAS applies exceptions as necessary for patients who suffer a cardiac arrest at some point during their incident, and also in instances where the patient does not present with cardiac chest pain and GTN has not been given (in line with JRCALC Clinical Practice Guidelines [2]). However, the

DH exclude all cardiac arrest patients from the sample and do not allow for exceptions to be provided for GTN where the patient is pain-free. Furthermore, the LAS clinical policy for administering aspirin if the patient is receiving anti-coagulant therapy (e.g. warfarin) varies from national guidelines, with aspirin permitted to be given with caution rather than contraindicated. In instances where aspirin was not administered due to anti-coagulant therapy, the LAS would class these cases as not receiving the drug (unless reasons were given) but the DH would treat them as an exception. These differences in criteria lead to variations in LAS and DH figures as can be seen in Table 5 below.

Reporting purpose	No. of Patients	Care Bundle Complete	Valid Exceptions to Completion	Care Bundle Incomplete
LAS*	2,963	36%; n=1,078	30%; n=896	33%; n=989
DH ACQI	2,690^	39%; n=1,045	22%; n=604	39%; n=1041

** Due to rounding, percentages do not equal 100%.*

^ The DH sample excludes 273 cardiac arrest patients..

Table 5. Care Bundle Provision

In 2011-12, LAS data showed that in total 66% of STEMI patients received either the full care bundle or had valid exceptions to its provision. The DH data was slightly lower at 61%.

Conveyance

Of the 2,963 patients, 2,957 patients (99.8%) were conveyed by LAS staff and 6 patients (0.2%) refused to travel to hospital against the advice of staff.

Pathway and Response Times

The LAS policy for STEMI patients advocates that all patients are taken directly to a Heart Attack Centre (HAC) for primary angioplasty (pPCI) treatment, unless there is a clearly documented, valid reason why this is not appropriate. Of the 2,957 STEMI patients who were conveyed by the LAS, 91% (n=2,697) were taken directly to a HAC. A further 8% (n=225) had a valid reason for being transported to an Emergency Department (ED), giving a total of 99% of patients who were taken to

the appropriate destination. Of the remaining 1% (n=35) of patients, 31 patients were taken to an ED, mainly due to LAS staff wishing to check their diagnosis with a doctor, when they should have been transported directly to a HAC. It was not possible to determine the destination for 4 patients.

	Patient Destination	
	Patients	**%**
All Patients*	2,957	100%
Direct to HAC	2,697	91%
ED – with valid reason	225	8%
ED – without valid reason	31	1%
Unclear if HAC or ED	4	0%

** Figure excludes 6 patients who refused conveyance to hospital.*

Table 6. Conveyance to Appropriate Destination.

Table 7 below shows that patients who were taken directly to a HAC had an average journey time from scene to hospital of 15 minutes; only 5 minutes longer than those who were taken appropriately to an ED. These times have remained the same as last year.

	Average Times (minutes)		
	Median	**Mean**	**Range**
All Patients	15	16	1 – 79*
Direct to HAC	15	16	1 – 79*
ED – with valid reason	10	11	1 - 40
ED – without valid reason	9	11	4 - 32
Unclear if HAC or ED	10	10	4 - 18

** The extended time refers to an incident where the patient went into cardiac arrest en route to hospital, requiring resuscitation before continuing with the journey.*

Table 7. Journey Times by Destination.

As can be seen in Table 8, the average time from the 999 call to arrival at hospital is similar for those conveyed to a HAC and an ED.

	Average Times (minutes)*		
	Median	**Mean**	**Range**
All Patients	58	62	24 - 231
Direct to HAC	60	62	24 - 186
ED – with valid reason	60	65	26 - 231
ED – without valid reason	55	57	38 - 83
Unclear if HAC or ED	57	63	45 - 91

** Call start times are based on Call Connect, which is the time the call was connected to the ambulance service.*

Table 8. Overall call to hospital times by destination.

Reperfusion

Of the 2,957 patients conveyed by staff in 2011-12, information regarding hospital treatment was available for 2,139 (72%) patients. 1,386 were confirmed as receiving reperfusion treatment. For 16 of these patients the type of reperfusion therapy given at hospital is not known, therefore these patients have been excluded from further analysis.

Primary Angioplasty

1,361 patients were confirmed as receiving primary angioplasty treatment (pPCI) at hospital. Of these, 1,318 (97%) were admitted directly to a HAC and 30 (2%) were initially appropriately transported to an ED by LAS staff. Additionally, there were 2 cases where it was unclear from PRF documentation whether the patient was transported to a HAC or an ED, and 11 cases where LAS staff took the patient to an ED without a valid reason.

Patients should receive pPCI within 150 minutes from the time of the 999 call (call to balloon) as part of national targets [1,3]. Table 9 below presents the average time from the 999 call to reperfusion for STEMI patients who received the pPCI procedure (call to balloon time). Of note, there is a difference in the way in which data is sourced for LAS and DH reporting, which leads to variation in figures. The LAS use information sourced from the 999 call records to ensure data accuracy as

well as data from MINAP. However, the DH ACQI's is based on data taken from the MINAP database alone, which has been entered by the hospitals and not sourced from the 999 call records. The DH data also excludes cases that meet MINAP's pre-defined list of delays and therefore the sample size is smaller.

On average, the time from the 999 call to the pPCI procedure (call to balloon time) was 107 minutes, which is an improvement of 1 minute from last year. The portion of this time which is accounted for by the hospital has also decreased, from 50 minutes to 48 (with a range of 4-427 minutes). Furthermore, 93% (n=1,253) of patients received pPCI within 150 minutes of the 999 call; an improvement of 2% on the figures calculated for 2010-11. The DH data, although using a smaller group of patients, is comparable to the LAS figures.

Measure	Patients^	Average Times (minutes)			% within 150 minutes
		Median	Mean	Range	
LAS*	1,353	107	112	42 - 485	93% (n=1,253)
DH ACQI**	1,172	108	114	48 – 955[#]	92% (n=1,083)

^ Excludes 8 patients recorded as having received pPCI treatment but for whom no reperfusion time information was available.

** 999 call times are taken from LAS data sources, including the EOC Log and MDT's and pPCI times are taken from MINAP.*

*** 999 call and pPCI times are sourced from MINAP data entered by hospitals.*

[#] Two cases within the MINAP database have extended call to balloon times; it is likely that this is a result of inaccurate data entry by the hospital which have not been corrected following feedback from the LAS.

Table 9. Time to reperfusion for patients receiving pPCI

Reasons for extended call to balloon times can be attributed to delays both pre- and post- arrival at hospital. Where the extended times were caused prior to reaching the hospital, common reasons were delays in dispatching an ambulance during periods of increased demand, callers not reporting cardiac symptoms and therefore patients receiving a lower priority response, the nearest HAC being closed, and patients suffering a cardiac arrest requiring resuscitation. Where the delay has occurred after the patient has been handed over (an extended door to balloon time), information on reasons for delays can, in some cases, be accessed through the MINAP database. Reasons provided by hospitals for extended times this year include delays in accessing the cardiac catheter laboratory at the HAC, cardiac arrests, further consideration of treatment options and other complications.

Thrombolysis

Nine STEMI patients were confirmed as receiving clot-dissolving thrombolytic treatment; all were taken directly to a HAC.

National guidelines [1,4] state that thrombolysis should be given within 60 minutes of the call for help (call to needle time). In the nine recorded cases, the average time from the 999 call to treatment was 106 minutes, with the time taken from arrival at hospital to treatment (door to needle time) accounting for 59 minutes. Hospitals recorded details of delays for two cases; in both there were delays in accessing the cardiac catheter laboratory at the HAC.

Patient Outcome

Patient outcome data was available for 1,351 of the 2,139 patients with treatment information available. 96% (n=1,293) were discharged alive, which is consistent with the survival rates for STEMI patients reported over the past three years.

Information on the length of hospital stay was available for 1,272 of the 1,293 patients who were discharged alive. The average length of stay in hospital for surviving patients was 5 days, which is an increase of 1 day from that reported in previous years.

Discussion

During 2011-12, the LAS continued to ensure that STEMI patients received a high quality service through a prompt response, thorough assessment and treatment, and excellent compliance to the Heart Attack Centre pathway.

Response times continue to remain within the DH 8 minute target, with an average response of 7 minutes this year. 75% of all calls were classed as a Category A call, and received an average response of 6 minutes. Journey times have remained consistent with recent years with conveyance to a HAC taking just 5 minutes longer than to an ED. The vast majority (99%) of patients were taken directly to a HAC or to an ED with a valid reason. A small number of cases remained where staff conveyed to a local ED for diagnosis of the ECG by doctors, but this has reduced considerably from previous years. This indicates that we continue to reach this group of time-critical patients rapidly, and following assessment convey them to an appropriate location for reperfusion treatment.

The reperfusion data shows that 93% of patients who received primary angioplasty were treated within the 150 minute target, with an average call to balloon time of 107 minutes. For the fifth year in a row, 96% of patients who received reperfusion therapy were discharged alive from hospital - timely access to high quality treatment will have played an important role in this achievement. The continuing high levels of effective treatment and survival are testament to the high quality of care provided by both LAS and hospital staff.

However, there are areas in which the LAS can continue to improve. The time we spend on scene has once again increased, which will have impacted on the length of time available to the hospital to undertake reperfusion treatment. While in some cases a delay on scene is unavoidable, wherever possible staff should be aiming to keep the time spent on scene to a minimum to ensure that the patient arrives at hospital as early as possible.

This year, a STEMI care bundle has been monitored by the DH as part of the ACQI's. 66% of patients either received the full care bundle or a combination of elements with valid exceptions this year, which leaves a considerable amount of

room for improvement. The LAS performed well in the delivery of aspirin and GTN. In addition the number of patients who received two pain assessments (or having valid exceptions to this) has increased noticeably, improving to over 90% for the first time. However, analgesia administration remains the area of care where staff are least compliant with guidelines.

It is recognised that a greater number of patients are being offered Entonox, and when coupled with a similar increase in the use of morphine, this indicates that more patients than ever before are now receiving at least one form of analgesia. While this is a good achievement, there were almost a quarter of patients who did not receive any analgesic without a valid reason. It is important to note that to be classed as having exceptions to administration, there must be a valid reason for not giving both Entonox and morphine; for a number of patients there was a documented reason for not receiving one form, but not the other. As such, it is vital that staff record all interventions plus patient refusals or inability to take any form of medication; the reasons for not providing treatment are as important as those for giving it.

Over the last year the LAS has undertaken a considerable amount of work to highlight and promote the importance of analgesia in the all-round care package for STEMI patients. This work included a review of pain management practices, and participation in the Ambulance Service Cardiovascular Quality Improvement (ASCQI) project[ii]. These projects resulted in the release of a pain assessment tool across the Service specifically designed for use with STEMI patients, plus enhanced educational materials (such as a clinical podcast, training updates and further cardiac newsletters and guidance). It is anticipated that this focus on pain management in STEMI patients will lead to greatly improved figures in the coming months and years.

It is important to note that this year there has been an increase in the number of patients presenting with valid exceptions to treatment. This is largely attributed to the rollout of a pathway for post-cardiac arrest patients who are transported directly to a HAC if there is evidence of a STEMI following the patient achieving cardiac

[ii] A national initiative aimed at improving pre hospital care by ensuring that every patient presenting with a STEMI receives each element of the care bundle.

output. In most of these situations, this group of patients would present in such a condition that the standard treatment options would not be appropriate, and therefore valid exceptions to treatment would be assigned.

Once again, the number of patients attended by staff and subsequently diagnosed with a STEMI has increased considerably from 1,976 in 2009-10 and 2,609 in 2010-11 to 2,963 this year. These increases may be a result of more patients recognising the symptoms of a heart attack and accessing the LAS as reflected by increasing 999 call volumes experienced over recent years. Furthermore, internal data collection and validation processes continue to evolve and improve, with the introduction of new destination coding and better overall documentation by staff enabling more reliable identification of cases.

In addition, the amount of outcome data that we were able to source from hospitals via the MINAP database has increased greatly, with treatment and outcome information available for almost three-quarters of patients. There remains variability in the quality of data available, but this too has improved. The LAS now routinely validates all aspects of the data it sources from MINAP and feeds back to hospitals requesting corrections be made to data or further information supplied as necessary. This is a crucial part of the preparation process for reporting call to reperfusion times as part of the ACQI's, reducing inaccuracies in the monthly data submitted to the DH. Continued support of this process by hospitals will ensure that MINAP data is good quality and accurately reflects the care provided by the LAS and hospitals. In future, it is hoped that enhanced functionality of the MINAP database, allowing Ambulance Services to edit pre-hospital information locally and directly, will provide more robust figures and reduce inefficiencies in the collection of data.

In conclusion, our staff should be praised for the high levels of compliance to the HAC pathway and recognised for their contribution to the optimum delivery of care to this high-risk patient group. We will continue to further enhance the treatment given to patients to ensure that patients in London receive a world class service.

Points for Action

The LAS needs to continue to focus future improvement work on:

- Enhancing analgesia provision.
- Examining reasons why time spent on scene is increasing.

Staff should be encouraged to:

- Undertake a step-wise pain management approach.
- Record all interventions taken, including reasons explaining why something may not have taken place, especially in the administration of analgesia.
- Where possible reduce time spent on scene.
- Ensure that all eligible patients are taken directly to a HAC or that a valid reason for conveyance to an ED is clearly documented on the PRF.
- Correctly document the destination hospital name and code to allow accurate identification of patients directly transported to HACs.
- Use illness code 87 for all patients with a confirmed STEMI by 12-lead ECG.
- Submit a copy of all 12-lead ECGs to Management Information together with the PRF (with requests for clinical feedback, clearly marked on the front of the ECG strip, if desired).

References

1. Department of Health. The Operating Framework for the NHS in England 2011/12. *Crown*, 2010.
2. Joint Royal Colleges Ambulance Liaison Committee. UK Ambulance Service Clinical Practice Guidelines. *Warwick*, October 2006.
3. Treatment of Heart Attack National Guidance: Final Report of the National Infarct Angioplasty Project (NIAP). *Crown*, October 2008.
4. National Services Framework for Coronary Heart Disease. *Crown*, March 2000.

Appendix 1: Analgesia

Entonox

		n	Percentage
Administered		463	16%
Valid Exception			
	Contraindicated	9	0%
	Patient Refused	322	11%
	Reduced Consciousness	226	8%
	Patient Not In Pain	481	16%
Not Administered		1,462	49%

Morphine

		n	Percentage
Administered		1,065	36%
Valid Exception			
	Contraindicated	365	12%
	Patient Refused	199	7%
	Patient not in Pain	477	16%
	No IV access possible (Paramedic Crew in attendance)	236	8%
Not Administered			
	Technician-only crew in attendance	291	10%
	No reasons given	330	11%