

CUSP London Data Dive 2019

with the London Ambulance Service

18th–21st March 2019

Programme



Context

Background

The London Ambulance Service NHS Trust (LAS) believes that all people of London deserve the best possible emergency and urgent care, and should be treated with dignity and respect. The challenge comes in delivering this high quality of care in the most efficient way whilst also supporting staff wellbeing, operating in a congested environment, and avoiding adding pressure to other parts of the NHS system.

LAS is the busiest UK ambulance service, receiving **1.8 million calls** per year, and responding to over **1.2 million incidents** annually. These incidents range from immediately life-threatening emergencies, where patients need advanced clinical support, to less life-threatening but still urgent care needs.

Operating out of **70+ sites** and 2 control rooms, more than 3,000 members of frontline staff respond to patients across the capital. The 620 square miles of London is divided into 5 sectors for operational purposes, each representing a number of boroughs, clinical commissioning groups (CCGs) and postcode districts.



Demand for Service

Demand or 'activity' is defined differently at the various stages of service:

- **Calls** – refer to the point at which the patient or a bystander call 999 and are connected to LAS control room call handlers.
- **Incidents** – any calls which cannot be resolved on the phone, and which are deemed to need a face-to-face response during the triage process, become an incident. An incident may involve multiple patients.
- **Responses** – when a resource is allocated to an incident and dispatched to the scene, this is known as a response. Certain incidents require multiple crews to attend, and in other cases the LAS may dispatch multiple crews to increase the chances of getting on-scene quickly, so an incident may receive multiple responses.

Service Delivery

The LAS workforce is made up of trained **Paramedics** and **Emergency Ambulance Crew (EACs)** from across London and the UK, and from further afield... a large cohort has been recruited from Australia in recent years due to the shortage of qualified paramedics leaving the UK education system.

Responses are primarily from one or more of the two main types of responders:

- **Double Crewed Ambulances (DCAs)** – the typical large ambulance vehicles;
 - Crewed by either:
 - 2 x EACs
 - 1 x EAC and 1 x Paramedic
- **Fast Response Units (FRUs)** – cars which can travel more quickly but cannot transport patients to hospital, so often require back-up from a DCA if they are first on-scene.
 - Crewed by:
 - 1 x Paramedic.

Additionally, the LAS operate motorbike and cycle responders, have support from voluntary and private providers, regularly run training shifts to give newly qualified frontline staff exposure to a variety of emergencies, and when needed work with HEMS – the air ambulance service.

Key Performance Indicators

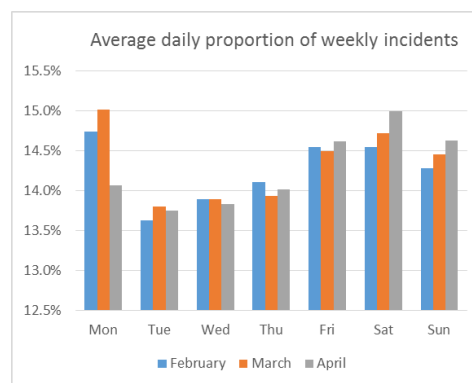
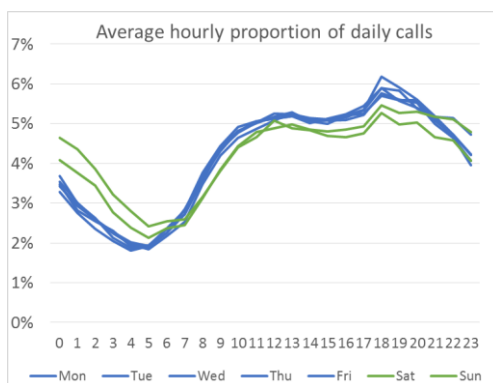
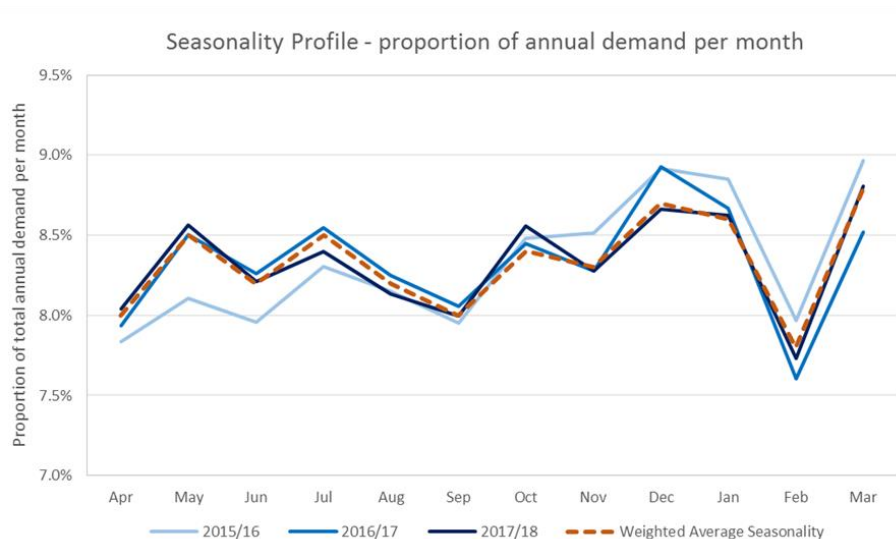
The LAS measures performance based on the average time it takes to respond to each of the main four categories of emergency.

Category	Types of Calls	Response Standard	% of Incident Demand
Category 1 (life-threatening event)	Cardiac Arrest Choking Unconscious Continuous Fitting Not alert after fall/ trauma	7 minute mean response time 15 minute 90 th percentile response time	On average 120-150 per day (~10%)
Category 2 (emergency/ serious incident)	Stroke Patients Fainting and not Alert Chest Pain Road Traffic Collisions Major Burns	18 minute mean response time 40 minutes 90 th percentile response time	Approximately 1800 per day (~60%)
Category 3 (urgent problem)	Falls Fainting and now Alert Limb Fractures Abdominal Pain	60 minute mean response time 120 minute 90 th percentile response time	Approximately 700-800 per day (~22%)
Category 4 (less urgent problem)	Vomiting Non-traumatic Back Pain Healthcare Admission Requests	180 minute 90 th percentile response time	Around 100 per day (~8%)

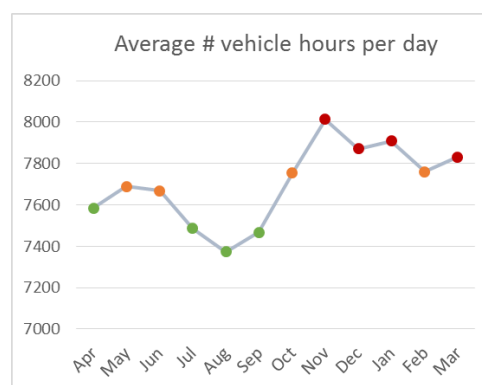
The Challenge

Predicting when someone might need to call 999 in a medical emergency is incredibly difficult – predicting where in London they might be at their time of need is even trickier. However, there is very strong **seasonality** to LAS demand, and an obvious hourly and daily pattern.



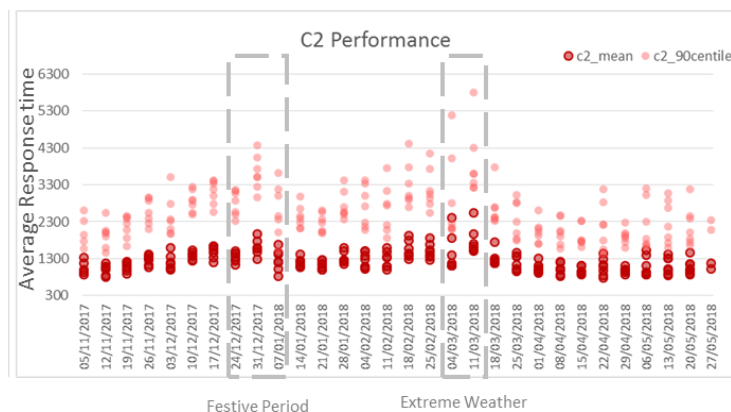


In order to provide the best service to the population of London, this demand needs to be balanced with the right amount of **resource** – LAS need to make sure they have enough staff on shift at each point of the day, week or year.



However, any population and therefore any workforce also has a human and **behavioural** element – people get sick in Winter (including staff), paramedics want holidays in the summer and at festive periods, staff want time off during school holidays to spend with their children... The balancing act of patient needs, staff welfare and maintaining a high quality service, can be quite difficult.

It is also known that **external factors** such as the weather, air quality, traffic network, and public events can have a major impact on performance and maintaining service delivery.



Like the rest of the NHS, the LAS also faces substantial and sustained growth in demand for care, mainly due to a growing and ageing population, an increase in acute and complex health conditions, patient expectations, and recruitment challenges.

What is being done?

London is a very diverse and multicultural city, with a residential population of **8.9 million people**. In addition to this, the city swells each morning with the incoming **commuter** population, and a large volume of **tourists**.

The LAS currently transports around 70% of the patients they see to hospital, and with the ever growing pressures on Emergency Departments, the Trust's new strategy is to endeavour to help patients remain in the community or transport them to alternative care pathways where appropriate – increasing the proportion of “**See & Treat**” rather than “**See & Convey**” (i.e. transported) patients. Alternatively, the LAS also tries to offer clinical advice over the phone where appropriate. This is known as “**Hear & Treat**”, and means crews can be kept available to attend patients that really do need that face-to-face assistance.

LAS Vision

The London Ambulance Service have four main goals:

1. Provide outstanding care for **patients**;
2. Be a first class employer, valuing skills, diversity and quality of life of their **people**;
3. Provide the best possible value for the **public**;
4. **Partner** with the wider NHS & public sector to optimise healthcare provision across London.

These four groups – patients, people, public and partners – are the main focus for all improvement initiatives, and are at the heart of LAS analytics, forecasting and predictive modelling.

The LAS is already a data-driven organisation, making decisions based on quantifiable evidence wherever possible. They primarily rely on internal data sources and publically available information, and not only offer descriptive statistics and analytics on what *has* happened, but attempt to predict what *will* happen, *why*, and what *can* be done better. There is much still left to discover in the data and many new relationships to determine – the LAS want to be able to **fully understand the factors impacting on demand, workforce and patients**, in order to build a better urgent and emergency healthcare service for the future.



Starting Point Questions

Specific questions we want to address include:

- 1. The population of London is incredibly diverse.* Can we better understand the different demographics and needs of our patients across the various regions of the city, in order to respond in the most appropriate way?
- 2. Each day the population of London swells with commuters and tourists.* Can we use transport data to enhance our understanding of the population of London at different times of the day, and therefore better predict demand?
- 3. Predicting the details of the next 999 call to arrive into our control room is a tricky matter.* Can we better understand the time between calls on any given day (to help us plan our staffing levels)? Are there any discerning characteristics of calls at different times of the day, week or year? Are there ways to identify a 'typical' day of call-taking, or days which might be similar?
- 4. London is an expensive place to live, so many of our staff have lengthy commutes which can impact on wellbeing.* Where do our staff live? How far do our staff travel on average to start their shift and does this vary with the time of day (and therefore transport options available)?
- 5. Perhaps given this higher cost of living compared to other UK cities, we also see a high rate of staff turnover.* Is there an identifiable pattern to 'leavers' in our frontline cohort, and where do these people go after LAS, when, and why?
- 6. The LAS' prime purpose is to respond quickly and efficiently to the population of London in their time of need.* What might the impact on the LAS's ability to respond be if staff cannot start their shift on time (e.g. due to transport issues)? What might happen to the balance of demand and capacity if staff recruitment becomes even harder?
- 7. Response times are heavily dependent on crew availability, location of crews at standby points, and the road network.* What are the most affected areas of London in terms of availability to respond, and are there any potential influencing factors, or correlations/patterns that can be determined? Is there benefit in using live traffic congestion data to support operations compared with static average road speeds? Is there any intelligence that can be gleaned from other transport networks about pressures in the overall London travel system?



Data – Description of data available

A shared drive containing the relevant data sets will be provided for the event. The following information may also be useful for an understanding of how the core data is stored and utilised by LAS.

The LAS has a wealth of data, including: details of the 999 call, patient and location of the incident; vehicles dispatched and response times; details of the crews in attendance and the treatment given or healthcare pathway recommended; destination the patient was transported or referred to; information on workforce, fleet, logistics; and some patient health information (where appropriate). The LAS are also aware of external factors (including the weather, school holidays, road and transport networks, hospital pressures etc.) which impact their ability to respond optimally, but for which they do not have live data feeds or historic stores.

For this Data Dive, the LAS will share the following sets of data:

- **Calls** (at individual but non-identifiable level from Nov-17, and aggregated to daily level);
- **Incidents** (at individual but non-identifiable level from Nov-17, and aggregated to daily level);
- **Responses** (summarised at incident level from Nov-17);

For example Calls and Incident information will be contained in a single table with variables similar to the following:

Calls Table joined with **Incidents Table** joined with **Response information**

incidentid	callstart	age	sex	coordinateA	coordinateB	borough	stationcatchment	sectormame	ccgname
20180301...	2018-03-01 00:00:5...	22.00	F	5318	1811	City of London	Smithfield	North East Sector	NHS City and Hackney CCG
20180301...	2018-03-01 00:01:1...	35.00	M	5335	1850	Hackney	Shoreditch	North East Sector	NHS City and Hackney CCG
20180301...	2018-03-01 00:01:3...	24.00	M	5513	1832	Havering	Homchurch	North East Sector	NHS Havering CCG

callconcluded	lengthofcall	category	atscene	response_aqi	vehiclesarrived	totalonscenetime	totaljobcyclotime	hospitalname	conveyed
2018-03-01 00:25:25...	757	C2	2018-03-01 01:10:...	3300	2	6776	9888	Charing Cross	1
2018-03-01 00:20:33...	454	C1	2018-03-01 00:19:...	369	1	2276	4476	Kings College	1
2018-03-01 00:18:19...	314	C3	2018-03-01 01:55:...	5979	1	1956	4121	Homerton	1

Together these datasets make up the full patient journey whilst in the ambulance service care – from connection of the call made by the patient, relative or bystander to the LAS control room, up until the handover of patient care. A data dictionary for these variables will be shared during the Data Dive.

Additionally, the LAS will be sharing:

- **Capacity** (daily levels of patient facing vehicle hours – i.e. frontline resource levels);
- **Workforce Status** (anonymised data showing the staff joining, in post and leaving the service, at individual level over the past 3 years)
- **Staff Travel** (high granularity information of approximate home location and base station location, to allow for commuter journey calculations for all staff, in all roles)

For questions regarding traffic flow, resources such as the following may be useful:

- TfL managed roads (static) <https://api.tfl.gov.uk/Road>
- Traffic disruptions (RT & planned) <https://api.tfl.gov.uk/Road>
- Live traffic camera images CCTV 'Jam Cams' (RT) <https://api.tfl.gov.uk/Place>
- Variable Message (roadside signs showing planned works) Signs (RT) <https://api.tfl.gov.uk/>
- Red light and speed cameras (static) <https://api.tfl.gov.uk/Place>
- Accidents involving road users (static) <https://api.tfl.gov.uk/AccidentStats>
- Geographic boundary of the Greater London Authority road network (static) <http://roads.data.tfl.gov.uk/>



- Congestion Charge (static) <http://roads.data.tfl.gov.uk/>
- Low Emissions Boundaries (static) <http://roads.data.tfl.gov.uk/>
- Blackwall tunnel journey times (static) <http://roads.data.tfl.gov.uk/>

Finally, the follow resources may be useful:

- Google Trends (time series of searches). <https://trends.google.com/trends/?geo=UK>
- A recent policy recommender project between LAS and KCL identified a number of new types of data which could help the ambulance service make more informed decisions and ultimately respond more efficiently to emergencies. <https://dash.kcl.ac.uk/>
- London Data Store. <https://data.london.gov.uk/>

You should also explore for other data.

Hackathon Practice

Students are requested to upload the code you develop during the hackathon to the CUSP London GitHub repository.

<https://github.com/cusp-london/Data-Dive-2019>

Please note that you should only upload your own code. Please do not upload any data.



2019 CHALLENGE PROGRAMME STRUCTURE

	Day 1 Mon March 18	Day 2 Tue March 19	Day 3 Wed March 20	Day 4 Thu March 21
9:00- 9:30	Check-in & Registration (refreshments)	Note change of venue for morning only		
9:30-11:00	Welcome to CUSP London & Challenges Review	Data Dive Session 3 (4x)	Data Dive Session 7 (4x)	Team Work & Presentation Rehearsals
11:00-11:30	Tea/Coffee Break			
11:30-13:00	Logistics & Team Formations	Data Dive Session 4 (4x)	Data Dive Session 8 (4x)	Team Work & Presentation Rehearsals
13:00-14:00	Lunch			
14:00-15:30	Data Dive Session 1 (4x)	Data Dive Session 5 (4x)	Data Dive Session 9 (4x)	Presentations
15:30-16:00	Tea/Coffee Break			
16:00-17:30	Data Dive Session 2 (4x)	Data Dive Session 6 (4x)	Data Dive Session 10 (4x)	Prize Giving
17:30-	Social Event	Evening Reception	End of Day / Free Time to Explore London	End of Event

Schedule

We will meet in the CUSP London space at **Kings College London** throughout the week. Please report to **CUSP London** in **Room BH(S)5.01**, 5th floor, Bush House (North Wing Entrance), Strand Campus:

<http://www.kcl.ac.uk/study/campus/strand.aspx>

<https://www.google.co.uk/maps/place/London+WC2B+4BG>

For wi-fi, either use eduroam or register for The Cloud (click on <https://service.thecloud.net/service-platform/>, select settings from the bottom and create account).



*** Please note that access to the Bush House Building by visitors is via gated entrance of the Bush House – referred to as the North Wing. This entrance is at the bottom of Kingsway. A representative from Kings College London will be at the main entrance of Bush House from 08.50 am.**

Day 1 – Monday, 18 March 2019 – CUSP London / King’s College London

Time:	Session 1: CUSP London, Room S5.01 in Bush House, Strand Campus
09.00 – 09.30	Arrival and Registration
09.30 – 10.00	Welcome to the CUSP London Data Dive 2018
10.00 – 11.00	Challenge Introduction and Review
11.00 – 11.30	Coffee and tea
11.30 – 13.00	Logistics & Team Formations – students will be divided into groups ahead of the event.
13.00 – 14.00	Lunch
14.00 – 15.30	Data Dive Session 1: Identification of research challenges
15.30 – 16.00	Coffee and tea
16.00 – 17.30	Data Dive Session 2: Identification of data sources
17.30 –	Social Event – visit to a historical British Pub.

Day 2 – Tuesday, 19 March 2019 – CUSP London / King’s College London

09.15 – 09.30	Arrival – Strand Campus room S4.01. Please meet in the reception area of the King’s Strand building.
09.30 – 11.00	Data Dive Session 3: Data Cleansing and Linking I
11.00 – 11.30	Coffee and tea
11.30 – 13.00	Data Dive Session 4: Data Cleansing and Linking II
13.00 – 14.00	Lunch - Return to *Bush House(S)5.01
14.00 – 15.30	Data Dive Session 5: Analysis & Modelling I



15.30 – 16.00	Coffee and tea
16.00 – 17.30	Data Dive Session 6: Analysis & Modelling II
17.30	Hackathon Social Evening – Venue TBC

Day 3 – Wednesday, 20 March 2018 – CUSP London / King's College London

09.15 – 9.30	Arrival
09.30 – 11.00	Data Dive Session 7: Brainstorming, mini-presentation and peer feedback
11.00 – 11.30	Coffee and tea
11.30 – 13.00	Data Dive Session 8: Design for data visualisation
13.00 – 14.00	Lunch
14.00 – 15.30	Data Dive Session 9: Data visualisation and refining results I
15.30 – 16.00	Coffee and tea
16.00 – 17.30	Data Dive Session 10: Data visualisation and refining results II
17.30	Free time to explore London

Day 4 – Thursday, 21 March 2018 – CUSP London / King's College London

09.15 – 9.30	Arrival
09.30 – 11.00	Data Dive Session 11 Refining results and preparing presentations I
11.00 – 11.30	Coffee and Tea
11.30 – 13.00	Data Dive Session 12: Refining results and preparing presentations II
13.00 – 14.00	Lunch
14.00 – 16.00	Data Dive Final Session: Presentations and prize giving.
16.00 –	Close



The Judging Panel:

There will be 2 prizes awarded: Overall Winners and Best Technical

The Judges will consist of:

Director of CUSP London King's College London

Director of CUSP London University of Warwick

A Representative of the London Ambulance Service

A Representative of Bosch



General Information

We are looking forward to greeting students, researchers and academics from New York CUSP. We hope that the data challenge will be an enjoyable and productive week. The following section will provide you with details of where you will be staying, getting around London and locations of the data challenge.

Data Challenge - Locations

Throughout the week, we will meet in CUSP London at **King's College London** (Room BH(S)5.01, 5th floor, Bush House, Central Block, South, KCL, Strand, London WC2B 4BG). Bush House is accessible by London Underground from the following stations: Temple, Waterloo, Embankment, Covent Garden and Holborn. The main entrance to Bush House is at the south most end of Kingsway. Please see: <http://www.kcl.ac.uk/study/campus/strand.aspx>

Please note that you will need to provide ID to get into The Bush House. If any of you have any access requirements, please let us know in advance, as we will request a slope for the steps in front of the main entrance (or ask special access from the south side for barrier-free access). We can be reached via email at culp-london@kcl.ac.uk

Hospitality and Events

You will be provided refreshments and lunch each day. On **Monday 18 March**, there will be the option to visit and Historical British pub the *Ye Olde Cheshire Cheese* a Grade II listed public house (https://en.wikipedia.org/wiki/Ye_Olde_Cheshire_Cheese).

Additionally, there will be drinks and dinner at The Temple Brew House on the Tuesday so everyone can get to know each other and socialise. <https://www.templebrewhouse.com/>

Explore London

We will also ensure that you have some free time in the evening to explore the sights of London.

Getting Around London

Getting around London can be confusing. [The Transport for London \(TfL\)](#) network is huge and is comprised of the London Underground (colloquially known as the "Tube"), buses, trains, river transport, trams and even a cable car! Most visitors to London get what is known as a [Visitors Oyster Card](#) as this is cheaper than buying single tickets for every journey. Oyster cards work on most forms of London transport, though fares are higher for riverboat services and the Emirates cable car. They should also work on local train services within the London area.

Other helpful documents are available using links below:

[Walking Around Central London Map](#)

[London Underground Map](#)

[Useful London Underground Tips](#)

