

PREHOSPITAL CARE

Changes in the emergency workload of the London Ambulance Service between 1989 and 1999

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*Emerg Med J* 2005;22:56–59. doi: 10.1136/emj.2004.016741

Objectives: To examine changes in the emergency workload of the London Ambulance Service (LAS) between 1989 and 1999.

Methods: All emergency responses by the LAS during week 16 in each of 1989, 1996, and 1999 were studied. For each week, 999 call responses were analysed by time and day of call, and age/sex of the patient. Call response rates were calculated using age/sex census population estimates for London. Changes in call rates over time were calculated as rate ratios.

Results: Emergency responses increased from 6624 to 13 178 in the index weeks of 1989–1999. The ratio of response rates (1999/1989) was 1.91 (95% CI: 1.85 to 1.96). The proportion of out of hours calls increased significantly, from 68.8% in 1989 to 71.3% in 1999 ($p=0.0003$). Response rates rose significantly more steeply for male patients than female patients from 1989 to 1999: rate ratio (95% CI); male patients 2.00 (1.91 to 2.08), female patients 1.69 (1.62 to 1.77), $p<0.0001$. Response rates varied by age in each of the three years investigated. Rates were consistently highest for patients aged 75 and above, and lowest for those aged 5–14. However, there was no evidence that call rates had increased disproportionately in any particular age group ($p=0.79$).

Conclusions: Demand for emergency ambulance services in London has doubled in a decade. This increase is similar for all age groups, with no evidence of a greater rise in demand among older people. Call rates have increased more steeply in men than in women. Demographic changes do not explain the observed increases in demand.

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Accepted for publication 1 September 2004

In recent years the UK has experienced a substantial increase in the use of ambulance services. This has precipitated studies that have attempted to understand the nature of the increase in the hope of ultimately reducing demand.^{1–3} While the demographic increase in the population of older people is associated with increased use of emergency department services, this does not fully account for the higher demand.³

In 1999–2000 there were 4 177 000 “999” calls to the ambulance service across England.⁴ The London Ambulance Service (LAS) received 967 300 emergency calls in the same period, more than any other English ambulance service and 23% of the total for the country. Between 1988–89 and 1998–99, the annual number of calls to the LAS more than doubled from 451 150 to 913 300.^{4,5}

Routine ambulance data published by the Department of Health tend to focus on call response targets rather than who is using the service.⁶ There is little published information relating to the age and sex of the patient for whom calls were made. It is therefore difficult to discover if the observed increase in 999 calls has occurred in particular sectors of the population such as among elderly people or whether this rise was uniformly spread across age/sex groups. Wrigley and colleagues recently investigated the changing demand for ambulance services, looking at the nature of calls⁷ but the age/sex profile of patients was not examined. Other studies have looked at the use of out of hours health services,^{8,9} but have not focused specifically on ambulance services or examined changes over time.

In a previous paper we reported on a survey of the emergency workload of the LAS during one week in 1996. In this paper we have used data from the same week in both 1989 and 1999 to investigate trends over 10 years. Specifically we have examined the distribution of emergency responses by the time of day and day of the week, and the age and sex

of the patient. We also incorporated the previously obtained 1996 data to provide an extra data point to help investigate the nature of any trends.

METHODS

All emergency 999 calls responded to by the LAS during the same week in 1989, 1996, and 1999 were studied (week 16: 24–30 April 1989, 29 April–5 May 1996, and 26 April–2 May 1999). This week was chosen as having a low probability of extreme weather conditions and to avoid school and public holidays, both of which may affect the nature and volume of 999 calls. Where there were multiple calls relating to the same response, only the first call was included. Data for 1989 had to be manually extracted from microfiche copies of the original individual records and entered onto a database. Data for 1996 and 1999 were already held in electronic form, having been taken from routine data forms (LA4s) by the LAS Management Information department. The following data were retrieved for each call: time and date, patient age, and patient sex.

Virtually all calls were made for a single patient, allowing us to calculate call rates using the resident population for Greater London.^{10–12} A very small proportion of calls (1989: $n=2$ (0.03%); 1996: $n=62$ (0.6%); 1999: $n=73$ (0.6%)) were for more than one patient. In this case only details of the first patient were available. The changes in call responses over time were calculated as rate ratios with corresponding 95% confidence intervals. The earliest year, 1989, was used as the baseline so that changes in 1996 and 1999 were each compared with 1989. For a small percentage of calls (8% in 1989; 4% in 1996; 7% in 1999), the ambulance crew had been unable to obtain the patient's age and so simply provided a category—baby, child, adult, elderly. Where this occurred we estimated the age to fit the age distribution of the original

data. This allowed us to maximise the use of the data available.

Trends in proportions of call responses from 1989 to 1999 were investigated using the χ^2 test for trend. The relations between call rates and the age/sex profile of the patient were analysed using negative binomial regression. All analyses were performed using Stata version 7.

RESULTS

All call responses

The total number of 999 calls responded to by the LAS during the study week increased by a factor of 1.65 from 6624 in 1989 to 10 921 in 1996. After adjusting for population growth,^{10–12} the ratio of call response rates was 1.61 (95% CI 1.56 to 1.66). Between 1989 and 1999, the number of call responses rose by a factor of 1.99. After adjusting, the ratio was 1.91 (95% CI 1.85 to 1.96).

When do people use the 999 ambulance service?

The number of calls increased steadily on all days of the week over the period studied. The distribution of call times had a similar pattern in each of the three years, with least calls between 0300 and 0600. However, there was a small, but statistically significant, increase in the proportion of calls made outside of normal working hours, defined here as between 1700 and 0900 on weekdays, and all day at weekends. This increase was particularly evident in the early evenings and on Sundays (table 1).

Who uses the 999 ambulance service?

In 1989, there were slightly more calls for female patients than male patients (51% compared with 49%). In 1996, the call numbers were almost the same. By 1999, there were proportionately more calls for male than female patients (53% compared with 47%). During this time period the proportion of males in the population actually decreased.

Overall call rates for female patients increased by a factor of 1.51 from 1989 to 1996, and by a factor of 1.69 between 1989 and 1999. Call rates for male patients rose by a factor of 1.62 from 1989 to 1996, and by a factor of 2.00 from 1989 to 1999 (table 2). Thus there was a steeper rise in call rates from 1989 to 1999 in males than in females and this was significant (Likelihood ratio test; $\chi^2 = 30.15$, DF = 1, $p < 0.0001$). Both call numbers and call rates varied by age, with the highest rates observed among older people in each of the three years. The increase in call rates from 1989 to 1999 varied by age (table 2) but this was not significant (Likelihood ratio test; $\chi^2 = 11.37$, DF = 16, $p = 0.79$).

DISCUSSION

This study has shown the substantial increase in demand for ambulance services within London between 1989 and 1999. The finding is consistent with previous published work⁷ and government statistics.^{4–5} However, this study is unique in that it examines the profile of urban ambulance users, looking at changes over 10 years. This investigation has shown that the increase in 999 call responses was not uniform; there was a greater increase in use among males than females, which was statistically significant. There was no statistical evidence that the observed increases in 999 call rates varied by age in this study. This conflicts with a study of emergency department admissions that reported a disproportionate increase in use by older people.³ Our study has also highlighted a statistically significant increase in the proportion of calls made outside of normal working hours. It is possible that the transfer of responsibility for out of hours GP services to primary care trusts during 2004 may lead to an even steeper increase in calls to the emergency services.

We studied changes between 1989 and 1999 but were able to supplement these data with data from our previous study, collected in 1996.¹ Although 1996 is not midway between 1989 and 1999, the use of a third data point enabled us to be

Table 1 Characteristics of 999 calls 24–30 April 1989, 29 April–5 May 1996, and 26 April–2 May 1999; results are number (%) of calls

Variable	1989	1996	1999
Day of the week			
Monday	993 (15.0)	1586 (14.5)	1859 (14.1)
Tuesday	902 (13.6)	1536 (14.1)	1739 (13.2)
Wednesday	919 (13.9)	1498 (13.7)	1936 (14.7)
Thursday	933 (14.1)	1549 (14.2)	1878 (14.3)
Friday	1053 (15.9)	1571 (14.4)	1955 (14.8)
Saturday	956 (14.4)	1626 (14.9)	1858 (14.1)
Sunday	868 (13.1)	1555 (14.2)	1953 (14.8)
Total	6624 (100.0)	10921 (100.0)	13178 (100.0)
$\chi^2 = 28.47$, DF = 12, $p = 0.005$			
Time of the day			
0000–0259	612 (9.2)	1127 (10.3)	1276 (9.7)
0300–0559	364 (5.5)	620 (5.7)	791 (6.0)
0600–0859	614 (9.3)	933 (8.5)	1195 (9.1)
0900–1159	1043 (15.7)	1723 (15.8)	1912 (14.5)
1200–1459	1056 (15.9)	1553 (14.2)	1883 (14.3)
1500–1759	1037 (15.7)	1644 (15.1)	2066 (15.7)
1800–2059	943 (14.2)	1711 (15.7)	2111 (16.0)
2100–2359	955 (14.4)	1610 (14.7)	1944 (14.8)
Total	6624 (100.0)	10921 (100.0)	13178 (100.0)
$\chi^2 = 39.86$, DF = 14, $p < 0.0001$			
Out of hours			
During GP hours	2067 (31.2)	3203 (29.3)	3784 (28.7)
Out of hours	4557 (68.8)	7718 (70.7)	9394 (71.3)
Total	6624 (100.0)	10921 (100.0)	13178 (100.0)
χ^2 for trend = 13.25, DF = 1, $p = 0.0003$			
Sex			
Male	3180 (48.5)	5278 (50.1)	6665 (52.7)
Female	3372 (51.5)	5263 (49.9)	5989 (47.3)
Total	6552 (100.0)	10541 (100.0)	12654 (100.0)
χ^2 for trend = 28.38, DF = 1, $p < 0.0001$			

Totals vary because of missing data.

Table 2 Frequency and rate of calls by age and sex

Age	1989			1996			1999			Ratio of rates (1989:1999)		
	Frequency (%)	Population	Rate*	Frequency (%)	Population	Rate*	Frequency (%)	Population	Rate*	Frequency (%)	Population	Rate*
	Ratio of rates (1989:1996)			Ratio of rates (1989:1996)			Ratio of rates (1989:1996)			Ratio of rates (1989:1996)		
All												
0-4	278 (4.3)	464500	59.8	523 (5.0)	497100	105.2	654 (5.2)	491000	133.2	654 (5.2)	491000	2.23
5-14	306 (4.7)	742900	41.2	587 (5.6)	861100	68.2	632 (5.0)	899500	70.3	632 (5.0)	899500	1.71
15-24	1106 (17.0)	1099200	100.6	1361 (13.1)	890300	152.9	1544 (12.3)	909900	169.7	1544 (12.3)	909900	1.69
25-34	1094 (16.8)	1195200	91.5	1746 (16.8)	1337200	130.6	1969 (15.7)	1329200	148.1	1969 (15.7)	1329200	1.62
35-44	596 (9.2)	910900	65.4	1073 (10.3)	988900	108.5	1529 (12.2)	1088100	140.5	1529 (12.2)	1088100	2.15
45-54	522 (8.0)	709300	73.6	905 (8.7)	797400	113.5	1209 (9.6)	817100	148.0	1209 (9.6)	817100	2.01
55-64	549 (8.4)	645600	85.0	851 (8.2)	603700	141.0	1073 (8.6)	604700	177.4	1073 (8.6)	604700	2.09
65-74	674 (10.4)	535900	125.8	1074 (10.3)	496400	216.4	1250 (10.0)	474100	263.7	1250 (10.0)	474100	2.10
75+	1383 (21.3)	448000	308.7	2275 (21.9)	429200	530.1	2682 (21.4)	427700	627.1	2682 (21.4)	427700	2.03
Total	6508 (100.0)	6751600	96.4	10395 (100.0)	6901300	150.6	12542 (100.0)	7041300	178.1	12542 (100.0)	7041300	1.85
Males												
0-4	163 (5.2)	237400	68.7	293 (5.7)	255200	114.8	377 (5.8)	251200	150.1	377 (5.8)	251200	2.19
5-14	181 (5.8)	379900	47.6	330 (6.4)	436300	75.6	374 (5.8)	457800	81.7	374 (5.8)	457800	1.71
15-24	480 (15.3)	538500	89.1	606 (11.7)	423200	143.2	739 (11.4)	435600	169.7	739 (11.4)	435600	1.90
25-34	489 (15.6)	592200	82.6	859 (16.7)	643600	133.5	996 (15.3)	634400	157.0	996 (15.3)	634400	1.90
35-44	326 (10.4)	450800	72.3	597 (11.6)	488200	122.3	902 (13.9)	536100	168.3	902 (13.9)	536100	2.33
45-54	316 (10.1)	351500	89.9	533 (10.3)	388900	137.1	745 (11.5)	397700	187.3	745 (11.5)	397700	2.08
55-64	343 (11.0)	318600	107.7	522 (10.1)	297700	175.3	631 (9.7)	294300	214.4	631 (9.7)	294300	1.99
65-74	362 (11.6)	236200	153.3	579 (11.2)	226800	255.3	720 (11.1)	220100	327.1	720 (11.1)	220100	2.13
75+	472 (15.1)	149200	316.4	840 (16.3)	148500	565.7	1008 (15.5)	153300	657.5	1008 (15.5)	153300	2.08
Total	3132 (100.0)	3254300	96.2	5159 (100.0)	3308400	155.9	6492 (100.0)	3380500	192.0	6492 (100.0)	3380500	2.00
Females												
0-4	112 (3.4)	227100	49.3	219 (4.2)	241900	90.5	269 (4.6)	239700	112.2	269 (4.6)	239700	2.28
5-14	125 (3.7)	363000	34.4	252 (4.9)	424800	59.3	245 (4.1)	441800	55.5	245 (4.1)	441800	1.61
15-24	619 (18.5)	560700	110.4	742 (14.3)	467100	158.9	777 (13.1)	474300	163.8	777 (13.1)	474300	1.48
25-34	602 (18.0)	603000	99.8	884 (17.1)	693700	127.4	944 (16.0)	694800	135.9	944 (16.0)	694800	1.36
35-44	263 (7.9)	460200	57.1	474 (9.1)	500800	94.6	608 (10.3)	552100	110.1	608 (10.3)	552100	1.93
45-54	205 (6.1)	357800	57.3	369 (7.1)	408400	90.4	452 (7.6)	419500	107.7	452 (7.6)	419500	1.88
55-64	199 (6.0)	327000	60.9	319 (6.2)	306000	104.2	429 (7.3)	310400	138.2	429 (7.3)	310400	2.27
65-74	305 (9.1)	299700	101.8	495 (9.6)	269600	183.6	521 (8.8)	254100	205.0	521 (8.8)	254100	2.01
75+	908 (27.2)	299000	303.7	1429 (27.6)	280800	508.9	1666 (28.2)	274200	607.6	1666 (28.2)	274200	2.00
Total	3338 (100.0)	3497500	95.4	5183 (100.0)	3593100	144.2	5911 (100.0)	3660900	161.5	5911 (100.0)	3660900	1.69

*Rates are calls per 100000 population; percentages may not add to 100 because of rounding.

more confident about the nature of the trends over the 10 year period.

This study is limited in that it only examines one week of data for each of the three years studied. However, the study weeks avoided school and public holidays, when the numbers of visitors to the capital may increase. Furthermore, there were no extremes of temperature or rainfall, which might have affected ambulance use, during any of the three weeks. The number of calls ranged from 6624 to 13 178 per week, and therefore gave a substantial sample of healthcare use. In each of the three study years, the percentage of calls within the sample week was very similar, varying between 1.40% and 1.47%. Therefore the comparison between the three weeks is not obviously biased. We used resident population data to calculate call response rates, which excludes tourists and non-resident commuters. While tourists and non-resident commuters seem likely to be healthier than the general population, we cannot be certain that their exclusion has not affected our results.

The finding of a greater increase in calls for males than females is interesting. It is well reported that women consult GPs more frequently than men and this trend has not changed in recent years.¹³ The General Household Survey in 1998–99 reported that the ratio of men to women who had consulted a GP in the two weeks before interview was 0.67.¹⁴ The opposite finding for ambulance service use in 1999 suggests that men may now seek medical help at a later stage than women. This is consistent with the perceived relation between masculine identity and risk taking.¹⁵ Violent crime may also contribute to high service use among males. The British Crime Survey showed that men were more likely to be victims of violent crime than women. In 1999 the ratio of violent crimes in men compared with women was 1.3.¹⁶

In recent years the government has introduced various initiatives to manage the increasing demand for emergency ambulance services. NHS Direct, a nurse run telephone advice service, was first announced by the government in December 1997¹⁷ and was introduced in London during 2000. One of the aims of this service was to provide faster access to necessary health services, by advising callers on the best action to take, such as self care, consulting a GP, or calling an ambulance.^{18–19} However, there is evidence that the introduction of NHS Direct had no effect on use of ambulance services.²⁰ The increase in the proportion of out of hours calls suggests that the introduction of NHS Direct has not managed to reduce ambulance service use at times when GP appointments are not available.

The LAS has taken significant steps to try to manage the increased demand for services. In 1999 the service began to offer clinical telephone advice, although callers could still insist on an ambulance response. Since December 2003, the LAS do not send an ambulance where an emergency response is considered unnecessary, according to a standard protocol. Instead callers are advised of more appropriate methods of accessing NHS treatment for non-urgent conditions. Campaigns have also been launched to raise public awareness about when it is appropriate to dial 999 (<http://www.londonambulance.nhs.uk/news/inappropriate/inappropriate.html> accessed 15 Dec 2003).

This study has shown that emergency ambulance use is rising more steeply among certain sections of the population. Thus it is clear that further research is needed to understand

why more patients are using ambulance services than previously.

ACKNOWLEDGEMENTS

We wish to thank Sue Meehan and Michael Damiani from the Management Information Department at the London Ambulance Service for providing the data, and Liz Limb at St George's for help with data entry.

CONTRIBUTORS

JLP and CRV conceived, initiated, and coordinated the study. CC extracted and coded data from the London Ambulance Service. PJP and JLP analysed the data. PJP and JLP wrote this paper, with input from CRV and CC. JLP acts as guarantor for this paper.

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Funding: the data analysis was funded by the South Thames Regional Health Authority.

Competing interests: none declared.

Ethical approval: not required.

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Emerg Med J 2005 22: 56-59

doi: 10.1136/emj.2004.016741

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