

Incidence of emergency calls and out-of-hospital cardiac arrest deaths during the COVID-19 pandemic: findings from a cross-sectional study in a UK ambulance service

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ABSTRACT

Background In response to the COVID-19 pandemic, a national lockdown was introduced on 23 March 2020. In the following weeks, emergency departments in the UK reported a reduction in attendances. We aimed to explore the incidence of emergency calls across North East England, as well as the number of out-of-hospital cardiac arrest (OHCA) deaths.

Methods Data were collected for all patients who contacted North East Ambulance Service between 4 March 2019–2 June 2019 and 2 March 2020–31 May 2020 suffering stroke, ST elevation myocardial infarction, allergy, asthma, chronic obstructive pulmonary disease, falls, intoxication, seizure, sepsis, acute coronary syndrome and OHCA.

Results There were a reduction in incidence of calls, excluding OHCA, resulting in ambulance activation during the pandemic compared with same period in 2019, 16 743 versus 19 639, respectively (–14.74%). The decline in calls was partially reversed by the end of May 2020. Incidence of OHCA at the time of the national lockdown had increased by 13.79% with a peak increase of 73.56% in the second week in April 2020. OHCA deaths peaked in the first 2 weeks in April 2020, 95.65% and 90.07%, respectively, but by the end May 2020, incidence of OHCA and OHCA deaths had returned to prelockdown levels.

Conclusion Incidence of emergency calls were reduced during the pandemic compared with 2019. There was a rise in incidence of OHCA and OHCA deaths during the same period; however, these changes appear transient. Further research is required to understand patient behaviour towards seeking help during the pandemic and the long-term consequences of not doing so.

BACKGROUND

COVID-19 required the reorganisation of UK emergency healthcare provision in order to accommodate the anticipated significant numbers of critically ill patients.¹ The first reported UK fatality from COVID-19 was on 5 March 2020 and was followed by a national lockdown introduced on 23 March 2020.² In the subsequent weeks, EDs in the UK reported a reduction in attendances.³ Ambulance services play a vital role in identifying and treating those who are critically unwell or injured. Anecdotal evidence suggested patients may have been behaving differently during the pandemic by delaying seeking help, resulting in a reduction

Key messages

What is already known on this subject

- ▶ During the pandemic and the subsequent government lockdown, EDs in the UK reported a reduction in attendances.

What this study adds

- ▶ There were fewer emergency calls to North East Ambulance Service during the pandemic compared with the same period last year. At the same time there was an increase in incidence of out-of-hospital cardiac arrest (OHCA) and OHCA deaths.
- ▶ These changes appear to have been largely transient, and incidence of emergency calls, OHCA and OHCA deaths returned to near normal rates by the end of May 2020.
- ▶ Ambulance services as well as the wider NHS needs to engage with the public to ensure those who require emergency care continue to seek help during the pandemic.

in demand for ED and a rise in adverse outcomes, such as out-of-hospital cardiac arrest (OHCA). We aimed to explore the incidence of ambulance activation for a range of the most common emergency conditions occurring across North East England, as well as the number of OHCA deaths. We compared data during the pandemic with that during the same non-pandemic period in 2019.

PATIENTS AND METHODS

North East Ambulance Service (NEAS) NHS Foundation Trust is 1 of 10 ambulance services in England, serves a population of 2.71 million people⁴ and conveys patients to eight EDs. Anonymised data were collected for all patients who contacted NEAS between 2 March 2020 and 31 May 2020 for a range of the most common emergency conditions resulting in ambulance activation; these were stroke, ST elevation myocardial infarction (STEMI), allergy, asthma, chronic obstructive pulmonary disease (COPD), falls, intoxication, seizure, sepsis, acute coronary syndrome (ACS) and OHCA. We compared these data to that from 4 March 2019 to 2 June 2019, a non-pandemic period. Complete electronic patient care records (ePCRs) were eligible for inclusion. Repeat calls to the same incident and



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Table 1 Incidence of emergency calls 2019 versus 2020 (n)

Aetiology	March week 1	March week 2	March week 3	March week 4	April week 1	April week 2	April week 3	April week 4	May week 1	May week 2	May week 3	May week 4	May week 5	Total
Stroke	89	90	99	97	95	100	99	116	105	92	102	107	100	1291
2019	99	128	109	126	106	122	134	114	103	123	142	115	113	1534
Actual diff	-10	-38	-10	-29	-11	-22	-35	2	2	-31	-40	-8	-13	-243
% diff	-11.24	-42.22	-10.10	-29.90	-11.58	-22.00	-35.35	1.72	1.90	-33.70	-39.22	-7.48	-13.00	-18.82
STEMI	20	14	19	25	17	19	16	18	22	19	22	17	27	255
2019	21	25	31	20	21	30	20	22	16	24	26	20	28	304
Actual diff	-1	-11	-12	5	-4	-11	-4	-4	6	-5	-4	3	-1	-49
% diff	-4.76	-44.00	-38.71	25.00	-19.05	-36.67	-20.00	-18.18	37.50	-20.83	-15.38	-15.00	-3.57	-16.12
Allergy	20	9	8	9	13	14	12	15	11	13	11	15	22	172
2019	23	22	24	17	23	21	20	16	20	18	22	19	20	265
Actual diff	-3	-13	-16	-8	-10	-7	-8	-1	-9	-5	-11	-4	2	-93
% diff	-13.04	-59.09	-66.67	-47.06	-43.48	-33.33	-40.00	-6.25	-45.00	-27.78	-50.00	-21.05	10.00	-35.09
Asthma	72	81	133	137	105	79	67	60	51	47	47	50	70	999
2019	100	93	108	116	89	95	65	86	92	85	98	92	81	1200
Actual diff	-28	-12	25	21	16	-16	2	-26	-41	-38	-51	-42	-11	-201
% diff	-28.00	-12.90	23.15	18.10	17.98	-16.84	3.08	-30.23	-44.57	-44.71	-52.04	-45.65	-13.58	-16.75
COPD	262	196	194	230	246	223	203	192	198	180	166	179	252	2721
2019	316	307	261	279	300	269	265	296	230	219	278	248	249	3517
Actual diff	-54	-111	-67	-49	-54	-46	-62	-104	-32	-39	-112	-69	3	-796
% diff	-17.09	-36.16	-25.67	-17.56	-18.00	-17.10	-23.40	-35.14	-13.91	-17.81	-40.29	-27.82	1.20	-22.63
Falls	162	112	103	135	145	149	172	168	150	182	176	151	213	2018
2019	173	203	181	166	175	172	176	152	156	179	176	171	151	2231
Actual diff	-11	-91	-78	-31	-30	-23	-4	16	-6	3	0	-20	62	-213
% diff	-6.36	-44.83	-43.09	-18.67	-17.14	-13.37	-2.27	10.53	-3.85	1.68	0.00	-11.70	41.06	-9.55
Intoxication	227	147	147	122	129	154	148	167	194	182	206	197	271	2291
2019	215	237	263	238	208	220	262	230	290	276	257	291	270	3257
Actual diff	12	-90	-116	-116	-79	-66	-114	-63	-96	-94	-51	-94	1	-966
% diff	5.58	-37.97	-44.11	-48.74	-37.98	-30.00	-43.51	-27.39	-33.10	-34.06	-19.84	-32.30	0.37	-29.66
Seizure	116	80	85	67	75	77	82	88	95	85	77	87	94	1108
2019	113	130	114	150	102	116	112	119	96	109	121	98	112	1492
Actual diff	3	-50	-29	-83	-27	-39	-30	-31	-1	-24	-44	-11	-18	-384
% diff	2.65	-38.46	-25.44	-55.33	-26.47	-33.62	-26.79	-26.05	-1.04	-22.02	-36.36	-11.22	-16.07	-25.74
Sepsis	112	86	96	87	112	123	79	71	58	61	69	63	90	1107
2019	81	92	125	111	113	134	104	132	106	113	113	113	124	1463
Actual diff	31	-6	-29	-26	-1	-11	-25	-61	-48	-52	-44	-50	-34	-356
% diff	38.27	-6.52	-23.20	-23.01	-0.88	-8.21	-24.04	-46.21	-45.28	-46.02	-38.94	-44.25	-27.42	-24.33
ACS	266	201	208	257	238	243	242	237	296	270	289	299	347	3393
2019	359	279	282	280	300	278	284	313	265	352	307	309	297	3905
Actual diff	-93	-78	-74	-23	-62	-35	-42	-76	31	-82	-18	-10	50	-512
% diff	-25.91	-27.96	-26.24	-8.21	-20.67	-12.59	-14.79	-24.28	11.70	-23.30	-5.86	-3.24	16.84	-13.11

ACS, acute coronary syndrome; COPD, chronic obstructive pulmonary disease; STEMI, ST elevation myocardial infarction.

incomplete ePCRs were excluded; only primary diagnoses were analysed. Diagnosis of emergency conditions derived from face-to-face clinical assessment rather than telephone triage. We analysed the incidence of ambulance activation for each condition for both time periods and compared the actual and percentage difference for each week. We calculated the % weekly change of OHCA using the first week in March of each respective year as the baseline. OHCA death was measured by the number of patients declared deceased on scene. Percentages are presented correct to two decimal places.

RESULTS

The total number of calls to NEAS for the emergency conditions that resulted in ambulance activation were reduced during the pandemic compared with the reference standard: 16 743 versus 19 639, respectively (−14.74%). We observed a decline in emergency calls from the first week in March 2020 for all emergency conditions except OHCA. At the beginning of lockdown on 23 March 2020, calls for stroke reduced by 10.10%, STEMI by 38.71%, falls by 43.09% and ACS by 26.24%. The decline in calls was partially reversed by the end of May 2020, with incidence of some emergency conditions returning to, or exceeding, 2019 levels: STEMI (−3.57%), allergy (+10%), COPD (+1.20%), falls (+41.06%) and ACS (+16.84%) (table 1).

The incidence of OHCA was increased prior to the first COVID-19 fatality, and at the time of the national lockdown on 23 March 2020, incidence of OHCA had increased by 13.79%, with a notable surge of 73.56% in the second week in April. The number of OHCA deaths followed a similar trajectory, with an increase prior to the first COVID-19 fatality and lockdown and a peak in the first 2 weeks in April 2020, 95.65% and 90.07%, respectively. The incidence of OHCA and OHCA deaths returned to near baseline 2020 rates by the end of lockdown (table 2 and figure 1).

DISCUSSION

During the COVID-19 pandemic, there was a reduction in incidence of a range of the most common emergency conditions attended by NEAS. At the same time, there was an increase in OHCA and number of patients declared deceased on scene, with a noticeable spike in early April 2020. However, these changes appear transient, and by the end of May 2020, the incidence of emergency calls, OHCA and OHCA deaths had returned to near normal.

The reduction in emergency calls for conditions such as stroke, STEMI and ACS, and the increase in OHCA and numbers of patients who subsequently died, is notable and warrants further investigation. The reduction in incidence of ambulance activation suggests either a genuine decrease in all emergency conditions or a delay in, or reluctance to, seek help. This reduction may have been fuelled by the lockdown and explained by changes in public behaviour, the closure of many work places and the key government message to ‘stay at home’. It is not improbable that some of the additional OHCA deaths we observed occurred in patients who would have ordinarily contacted the ambulance service for help but who chose not to during the pandemic. Furthermore, the virus is known to cause respiratory or inflammatory response complications,⁵ acute coronary syndromes and thrombolytic emergencies,⁶ all of which may precipitate OHCA.

The reduction in STEMI and ACS we observed during the pandemic and return to near normal at the end of May is consistent with a national reduction in STEMI and ACS hospital

Table 2 Incidence of OHCA, % weekly change and weekly OHCA deaths (n)

	March week 1	March week 2	March week 3	March week 4	April week 1	April week 2	April week 3	April week 4	May week 1	May week 2	May week 3	May week 4	May week 5	Total
OHCA 2020														
Incidence (n)	87	85	99	91	115	135	115	115	121	105	102	85	97	1388
% weekly change*	0	−2.30	13.79	4.60	32.18	73.56	55.17	32.18	39.08	20.69	17.24	−2.30	11.49	
% Deceased on scene	83.91	76.47	85.86	84.62	95.65	90.07	85.19	86.09	82.64	87.62	88.24	88.24	87.63	
OHCA 2019														
Incidence (n)	38	33	33	45	40	41	36	41	37	33	29	27	38	471
% weekly change*	0	−13.16	−	18.42	5.26	7.89	−5.26	7.89	−2.63	−13.16	−23.68	−28.95	0	
% Deceased on scene	55.26	51.52	54.55	57.78	50.00	65.85	66.67	65.85	64.86	60.61	55.17	55.56	47.37	

* % weekly change calculated using March week 1 as the baseline for each respective year.

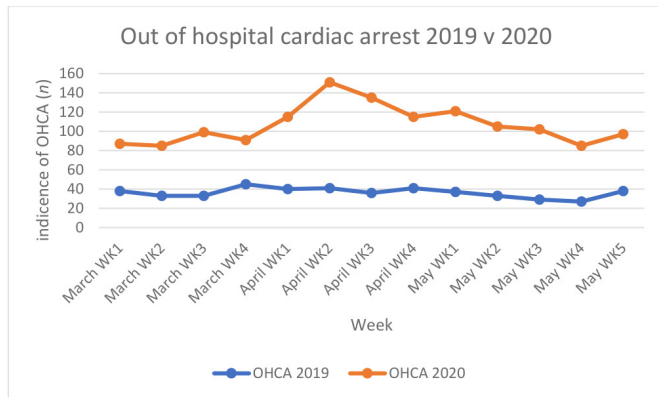


Figure 1 Weekly incidence of OHCA 2019 v 2020. OHCA, out-of-hospital cardiac arrest.

admissions that occurred as early as 2 weeks prior to the first UK COVID-19 fatality.⁷

The increase in OHCA deaths suggests patients were not resuscitated or were unresponsive to treatment. Witnesses of OHCA may have been reluctant to provide bystander cardiopulmonary resuscitation due to increased risks of disease transmission.⁸ An increase in incidence of OHCA and number of patients declared deceased on scene has also been reported in France and Italy,^{9 10} where disease prevalence has been particularly acute.

In the event of subsequent COVID-19 lockdowns or different pandemic, ambulance services as well as the wider NHS, need to engage with the public to ensure those who require emergency care are willing to seek help. Further research is required to fully understand patient behaviour towards seeking help and the long-term consequences of not doing so.

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REFERENCES

- 1 WHO. Strengthening the health systems response to COVID-19: creating surge capacity for acute and intensive care, 2020. Available: https://www.euro.who.int/__data/assets/pdf_file/0006/437469/TG2-CreatingSurgeAcuteICUcapacity-eng.pdf?ua=1 (accessed December 15, 2020).
- 2 Prime Minister's Office. Prime Minister's statement on coronavirus (COVID-19), 2020. Available: <https://www.gov.uk/government/speeches/pm-address-to-the-nation-on-coronavirus-23-march-2020> [Accessed 15 Dec 2020].
- 3 Holmes JL, Brake S, Docherty M, et al. Emergency ambulance services for heart attack and stroke during UK's COVID-19 lockdown. *Lancet* 2020;395:e93–4.
- 4 NHS. North East ambulance service NHS Foundation trust. Available: <https://www.neas.nhs.uk/about-us/who-we-are-and-what-we-do.aspx> [Accessed 22 Jun 2020].
- 5 Fried JA, Ramasubbu K, Bhatt R, et al. The variety of cardiovascular presentations of COVID-19. *Circulation* 2020;141:1930–6.
- 6 Klok FA, Kruijff MJHA, van der Meer NJM, et al. Incidence of thrombotic complications in critically ill ICU patients with COVID-19. *Thromb Res* 2020;191:145–7.
- 7 Maffham MM, Spata E, Goldacre R, et al. COVID-19 pandemic and admission rates for and management of acute coronary syndromes in England. *Lancet* 2020;396:381–9.
- 8 DeFilippis EM, Ranard LS, Berg DD. Cardiopulmonary resuscitation during the COVID-19 pandemic: a view from trainees on the front line. *Circulation* 2020;141:1833–5.
- 9 Marijon E, Karam N, Jost D, et al. Out-of-hospital cardiac arrest during the COVID-19 pandemic in Paris, France: a population-based, observational study. *Lancet Public Health* 2020;5:e437–43.
- 10 Odone A, Delmonte D, Scognamiglio T, et al. COVID-19 deaths in Lombardy, Italy: data in context. *Lancet Public Health* 2020;5:e310.