

Acute, non-COVID related medical admissions during the first wave of COVID-19: A retrospective comparison of changing patterns of disease

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Abstract

COVID-19 may have altered the case-mix of non-COVID acute medical admissions. Retrospective analysis of acute medical admissions to University Hospitals Birmingham NHS Foundation Trust, showed that medical admissions decreased in April 2020 compared to April 2019. The proportion of young adults, non-cardiac chest pain, musculoskeletal conditions and self-discharges decreased. The proportion of admissions due to alcohol misuse, psychiatric conditions, overdoses and falls increased. There were a higher number of patients admitted to ICU and greater inpatient mortality but not once COVID diagnoses were excluded. There was a significant change in hospitalised case-mix with conditions potentially reflecting social isolation increasing and diagnoses which rarely require hospital treatment, reducing. This analysis will help inform service planning.

Keywords

COVID-19, acute medicine, diagnoses, intensive care, mortality.

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Introduction

On 12th March 2020, the World Health Organization declared the novel coronavirus SARS-CoV-2 as a pandemic. The UK government strategy to mitigate risk led to a national lockdown (implemented 23/3/20). There was dramatic and rapid restructuring of acute NHS services in both primary and secondary care to meet the unprecedented change in clinical need.

The majority of unplanned admissions to acute hospitals are medical emergencies, with patients assessed and treated by the acute medical team.¹ Anecdotally, during the peak of the pandemic there appeared to be a decline in patient numbers admitted to medicine for reasons other than COVID-19. This corresponded to a reduction in the overall number of attendances to emergency departments nationally.² A decrease in hospital admissions for specific diagnoses, such as acute coronary syndrome, has been demonstrated³ however the impact of the COVID-19 pandemic on medical admissions overall has not been explored.

The aim of this study was to compare medical admissions during the height of the first wave of the COVID-19 pandemic with an equivalent pre-pandemic period in a large secondary care hospital which has seen a significant burden of COVID-19 cases and deaths.⁴

Methods

University Hospitals Birmingham NHS Foundation Trust (UHB), UK is one of the largest Trusts

nationally, treating over 2.2 million patients per year and housing the largest single intensive care unit (ICU) in Europe. UHB saw the highest number of COVID admissions in the UK (3670 confirmed cases by 27th August 2020) and the highest number of patients ventilated, with an expanded ICU capacity of >200 beds.

Retrospective data was collected for 1st–30th April 2019 and 1st–30th April 2020. This time period coincided with the peak of COVID-19 cases in the West Midlands.⁴ All patients admitted under acute medicine during these time periods were included. Patients referred through the acute stroke or ST elevation myocardial infarction pathway, direct specialty admissions including from the emergency department to ICU were not included. COVID-19 was confirmed by SARS-Cov-2 swab or a probable case of COVID-19 based on World Health Organization diagnostic parameters.⁵ Non-COVID patients were those with a negative SARS-Cov-2 swab and no suspicion of COVID-19.

Data was sourced from UHB's in-house electronic health system (EHS); Prescribing Information and Communication System (PICS). Data collected included patient demographics, presenting complaint, length of stay, discharge diagnosis, DNACPR status, critical care admission, and death during that admission episode. Discharge diagnoses were taken from electronic discharge documentation and bereavement documentation for patients who died during admission. Diagnoses were grouped into

Acute, non-COVID related medical admissions during the first wave of COVID-19

broad categories by clinicians. Any patients without a diagnosis on their discharge summary had their notes reviewed by a clinician and were categorised accordingly. Statistical analysis was performed using SPSS, version 26 (IBM). Continuous variables were compared between data sets using Mann-Whitney U tests. Categorical variables were compared using Fisher exact and Chi-Square tests. Results were considered significant if the p-value was <0.05 .

This work was supported by PIONEER, a Health Data Research Hub in Acute Care with ethical approval provided by the East Midlands – Derby REC (reference: 20/EM/0158).

Results

The total number of medical admissions fell comparing April 2019 ($n=2409$) to April 2020 ($n=1682$). Patient demographics are shown in Table 1. Patients admitted in April 2020 were older than in April 2019 (median age (IQR) 2020: 69 years (52–82), 2019: 66 years (47–80), $p<0.001$). Age distribution of admissions is shown in Figure 1. As a proportion of total admissions, those aged 16–45 years decreased, while those aged 46–65 years, 66–75 years and over 76 years did not change.

The April 2020 cohort were more likely to be admitted to ICU (2020; 3.57% vs 2019; 0.75%, $p<0.001$) and were more likely to die during their admission (mortality 2020; 9.22% vs 2019; 3.28%, $p<0.001$). When COVID-19 admissions were excluded, there were no significant differences in either ICU admissions or mortality between the same months in the two years (Table 1).

The median length of stay was significantly longer in April 2020 than April 2019 (median (IQR) 2.65 days (0.51–6.86) vs 1.42 days (0.22–6.78), $p<0.001$). When only non-COVID related admissions were studied, there was no difference in length of stay in April 2020 compared to April 2019.

Twenty-eight percent of medical admissions in April 2020 were due to COVID-19. Excluding those COVID-19 patients, admissions in 2020 had a different distribution of presentations compared to 2019 (Figure 2).

The absolute number of non-COVID admissions were reduced compared to the same period in 2019 for all diagnostic categories except alcohol-related admissions and psychiatric conditions and overdoses (Table 2). The number of admissions due to psychiatric conditions and overdoses rose in 2020.

When viewed as a proportion of admissions, alcohol-related admissions ($p=0.004$), psychiatric conditions and overdoses ($p<0.001$) comprised a larger proportion of total admissions in April 2020 than in April 2019. The proportion of patients who were in hospital due to falls, syncope or presyncope also increased in April 2020 ($p<0.001$).

In April 2020 compared to April 2019, both the absolute number and the proportion of admissions that were due to non-specific chest pain, to musculoskeletal complaints and patients who self-discharged prior to assessment decreased ($p=0.02$, $p=0.01$ and $p=0.002$ respectively).

The proportion of patients with a documented Do Not Attempt Cardiopulmonary Resuscitation

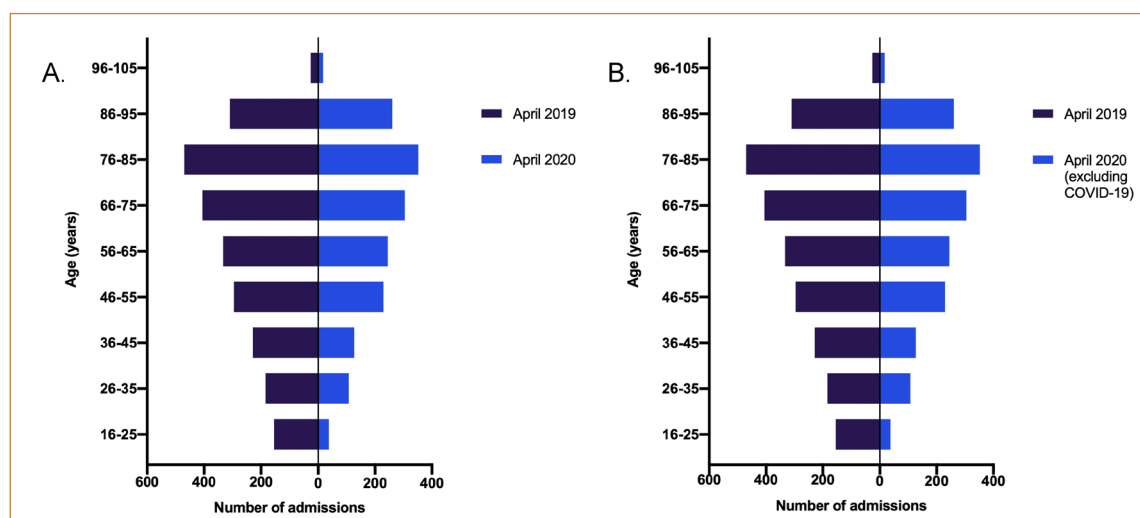


Figure 1. The age distribution of all medical admissions.

Legend: A. All medical admissions in April 2019 and April 2020 and B. All medical admissions in April 2019 and April 2020 (excluding patients with COVID-19). For both graphs, April 2019 patients are shown in dark blue and April 2020 patients are shown in mid-blue. Patients (both with and excluding COVID-19 presentations) were older in the 2020 cohort.

Acute, non-COVID related medical admissions during the first wave of COVID-19

Table 1. Patient characteristics for admissions in April 2019 and April 2020.

Legend: Diagnosis taken from discharge documentation for patients discharged from hospital, or from bereavement documentation for patients who died during admission. P-values comparing all admissions April 2019 vs all admissions April 2020 and comparing all admissions April 2019 vs Admissions in April 2020 (excluding those with a discharge diagnosis of COVID-19). P-values calculated using Mann-Whitney U test for continuous data (age, length of stay), Chi square for categorical variables (sex, critical care admission, mortality, documented DNACPR order). ICU = intensive care unit; DNACPR = do not attempt cardiopulmonary resuscitation; IQR = interquartile range; LOS = length of stay; Mortality = in-hospital mortality. For age, P-values in bold, comparing the proportion of adults aged 16 – 45 years, then 46 – 65 years, 66 – 75 years and over 76 years presenting in 2019 to 2020 (all admissions) and 2020 (excluding COVID-19).

	April 2019		April 2020							
	All acute medicine admissions		All acute medicine admissions		P-value (to April 2019)	Admissions excluding those due to COVID-19		P-value (to April 2019)	Admissions due to COVID-19	
	N	%	N	%		N	%		N	%
Admission	2409		1682			1222			460	
Age (yrs)										
Median (IQR)	66 (47-80)		69 (52-82)		<0.001	68 (51-82)		0.03	70.5 (54-83)	
16-25	155	6.43	38	2.26		33	2.70		5	1.09
26-35	184	7.64	108	6.42	<0.0001	91	7.45	<0.0001	17	3.70
36-45	229	9.51	127	7.55		93	7.61		34	7.39
46-55	296	12.29	229	13.61	0.142	164	13.42	0.219	65	14.13
56-65	333	13.82	245	14.57		179	14.65		66	14.35
66-75	406	16.85	304	18.07	0.314	227	18.58	0.195	77	16.74
76-85	470	19.51	352	20.93	0.421	244	19.97	0.208	108	23.48
86-95	310	12.87	261	15.52		180	14.73		81	17.61
96+	26	1.08	18	1.07		11	0.90		7	1.52
Male Sex	1054	43.75	881	52.38	<0.001	629	51.47	<0.001	252	54.78
ICU admission	18	0.75	60	3.57	<0.001	12	0.98	0.460	48	10.43
Mortality	79	3.28	155	9.22	<0.001	42	3.44	0.803	113	24.57
DNACPR	300	12.45	704	41.85	<0.001	449	36.74	<0.001	255	55.43
LOS (days)										
Median (IQR)	1.42 (0.22-6.78)		2.65 (0.51-6.86)		<0.001	1.82 (0.29-5.21)		0.56	5.37 (2.11-11.05)	

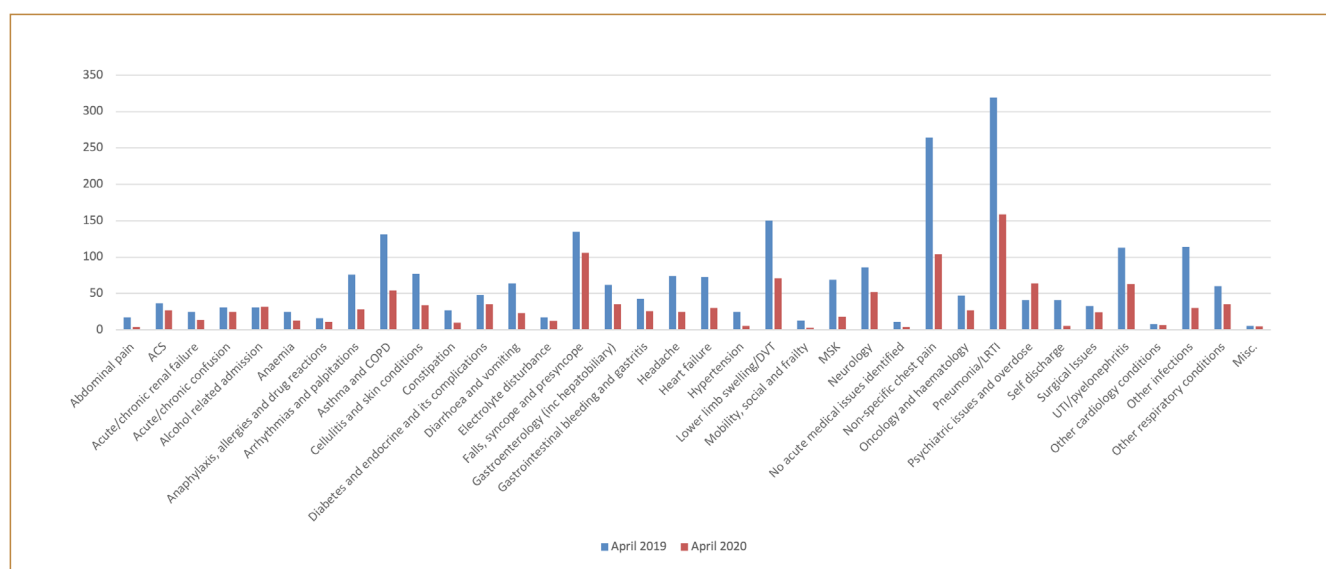


Figure 2. Discharge diagnosis for medical patients admitted in April 2019 and April 2020 (excluding patients with COVID-19).

Legend: Diagnosis taken from discharge documentation for patients discharged from hospital, or from bereavement documentation for patients who died during admission. ACS = acute coronary syndrome; COPD = chronic obstructive pulmonary disease; DVT = deep vein thrombosis; LRTI = lower respiratory tract infection; MSK = musculoskeletal pain; UTI = urinary tract infection.

Acute, non-COVID related medical admissions during the first wave of COVID-19

(DNACPR) decision increased significantly between April 2019 and April 2020 for both COVID and non-COVID admitting complaints and across all age groups (Table 3).

Discussion

This study compares acute medicine admissions over one month during the height of COVID-19 and the same month in 2019 and describes changes in health-seeking behaviour during these times.

Overall, the number of medical admissions fell in April 2020 compared to April 2019. The largest reduction in the proportion of admissions was for younger adults, with no significant change in the proportion of other age groups. Young adults access healthcare differently, with higher utilisation of

urgent and emergency services.^{6,7} Further research should assess whether this reduction in hospital presentation was associated with any negative outcomes. If not, alternative, community health services may be more appropriate for some within this age group in the future.

The proportion of alcohol-related and psychiatric admissions increased. The COVID-19 pandemic may have impacted mental health for multiple reasons, including anxiety, social isolation and work and financial uncertainty.^{8,9} It is predicted this impact will be sustained and adequate services will need to be available for these patients.¹⁰

The proportion of admissions for non-specific chest pain and musculoskeletal complaints decreased. It is currently unclear if this reduced

Table 2. Discharge diagnoses for patients admitted as emergency medical admission.

Legend: P-values are those when the proportion of admissions from April 2019 was compared to non-COVID admissions April 2020. COPD = chronic obstructive pulmonary disease; DVT = deep vein thrombosis; LRTI = lower respiratory tract infection; UTI = urinary tract infection. Blue text indicates where there was a significant decrease in the proportion of cases between the two months and red indicates where there was a significant increase in the proportion of cases between April 2019 and April 2020.

Grouped Diagnosis	Number of admissions			Percentage of admissions			P-value (comparing proportion of admissions 2019 and non-COVID 2020)
				April 2019	April 2020		
	April 2019	April 2020	% change	All admissions	All admissions	Excluding COVID-19 admissions	
Abdominal pain	17	4	-76.5	0.7	0.2	0.3	0.16
Acute coronary syndrome	37	27	-27.0	1.5	1.6	2.2	0.15
Acute or chronic renal failure	25	14	-44.0	1.0	0.8	1.2	0.77
Acute or chronic confusion	31	25	-19.4	1.3	1.5	2.1	0.08
Alcohol-related admission	31	32	3.2	1.3	1.9	1.6	0.004
Anaemia	25	13	-48.0	1.0	0.8	1.1	0.94
Anaphylaxis, allergies and drug reactions	16	11	-31.3	0.7	0.7	0.9	0.43
Arrhythmias and palpitations	76	28	-63.2	3.2	1.7	2.3	0.14
Asthma and COPD	131	54	-58.8	5.4	3.2	4.4	0.19
Cellulitis and skin conditions	77	34	-55.8	3.2	2.0	2.8	0.49
Constipation	27	10	-63.0	1.1	0.6	0.8	0.39
COVID-19	0	460	n/a	n/a	28.4	n/a	n/a
Diabetes and endocrine disease	48	35	-27.1	2.0	2.1	2.9	0.10
Diarrhoea and vomiting	64	23	-64.1	2.7	1.4	1.9	0.15
Electrolyte disturbance	17	12	-29.4	0.7	0.7	1.0	0.38
Falls	135	106	-21.5	5.6	6.3	8.7	<0.001

Acute, non-COVID related medical admissions during the first wave of COVID-19

Gastroenterology (including hepatobiliary)	62	35	-43.6	2.6	2.1	2.9	0.61
Gastrointestinal bleeding and gastritis	43	26	-39.5	1.8	1.6	2.1	0.48
Headache	74	25	-66.2	3.1	1.5	2.1	0.07
Heart failure	73	30	-58.9	3.0	1.8	2.5	0.32
Hypertension	25	6	-76.0	1.0	0.4	0.5	0.09
Lower limb swelling/DVT	150	71	-52.7	6.2	4.2	5.8	0.62
Mobility, social and frailty	13	3	-76.9	0.5	0.2	0.3	0.21
Musculoskeletal complaints	69	18	-73.9	2.9	1.1	1.5	0.01
Neurology	86	52	-39.5	3.6	3.1	4.26	0.31
No acute medical issues identified	11	4	-63.6	0.5	0.2	0.3	0.57
Non-specific chest pain	264	104	-60.6	11.0	6.2	8.5	0.02
Oncology and haematology	47	27	-42.6	2.0	1.6	2.2	0.60
Pneumonia/LRTI	319	159	-50.2	13.2	9.5	13.0	0.85
Psychiatric issues and overdoses	41	64	56.1	1.7	3.8	5.2	<0.001
Self-discharged	41	6	-85.4	1.7	0.4	0.5	0.002
Surgical Issues	33	24	-27.3	1.4	1.4	2.0	0.17
UTI/pyelonephritis	113	63	-44.3	4.7	3.8	5.2	0.38
Other cardiology conditions	8	7	-12.5	0.3	0.4	0.6	0.26
Other infections	114	30	-73.7	4.7	1.8	2.5	0.001
Other respiratory conditions	60	35	-41.7	2.5	2.1	2.9	0.51
Miscellaneous	6	5	-16.7	0.3	0.3	0.4	0.41

Table 3. DNACPR documentation rates based on demographics.

Legend: Patients were divided into those with a 'do not resuscitate' order or those for full resuscitation in the event of a cardiac arrest for the two time periods. For 2020 data, patients were further divided into those without COVID-19. For age, P-values compare those aged 16 – 55 years, 56 – 65 years, 66 – 75 years and over 76 year olds. Comparisons were made using a Fisher Exact test.

	2019		2020		P-value (all 2019 and 2020)	2020 (Excluding COVID-19 admissions)		P-value (all 2019 and non- COVID 2020)
	N	%	N	%		N	%	
Sex								
Male	123/1054	11.7%	339/881	38.5%	<0.0001	218/629	51.5%	<0.0001
Female	177/1355	13.1%	365/801	45.6%	<0.0001	231/593	48.5%	<0.0001
Age								
16-25	0/155	0.0%	1/38	2.6%	<0.0001	1/33	3.0%	<0.0001
26-35	1/184	0.5%	2/108	1.9%		1/91	1.1%	
36-45	4/229	1.8%	2/127	1.6%		2/93	2.2%	
46-55	9/296	3.0%	26/229	11.4%		18/164	11.0%	
56-65	21/333	6.3%	59/245	24.1%	<0.0001	38/179	21.2%	<0.0001
66-75	48/406	11.8%	142/304	46.7%	<0.0001	93/227	41.0%	<0.0001
76-85	99/470	21.1%	251/352	71.3%	<0.0001	157/244	64.3%	<0.0001
86-95	105/310	33.9%	204/261	78.2%		129/180	71.7%	
96+	13/26	50.0%	17/18	94.4%		10/11	90.9%	

Acute, non-COVID related medical admissions during the first wave of COVID-19

presentation was associated with potential harm. However, if this were not the case, alternative pathways avoiding hospital attendance may be possible.

The proportion of admissions that related to falls and syncope increased. It would be important to assess if social isolation contributed to this increased burden of falls, as has been described previously.¹¹

Though the reasons for decreased medical admissions could not be explored, there may be several contributory factors. Admissions for pneumonia, asthma and COPD may have been reduced by public health measures leading to the reduction of other respiratory pathogens circulating in the community.¹² Public health messages may have discouraged people from attending hospital, particularly those with symptoms suggesting viral or lower respiratory tract infection, normally common reasons for attendance. Certain patient groups may be more concerned about attending hospital, for example the immunosuppressed. Services specifically introduced during the pandemic period bridging community and secondary care may have led to changes in patient attendance. The specific impact of these factors have not been evaluated here.

Overall, there was an increased proportion of patients admitted to ICU and a higher proportion of patients with a documented DNACPR decision across all diagnoses and age groups. These results are consistent with recent research from the same Trust.¹³ Previous research suggests advanced care plans and decisions are under-recorded in acute medical admissions.¹⁴ It will be of interest to determine if COVID-19 leads to a sustained change in medical practice. Of note, in those admitted for reasons other than COVID-19, there was no difference in in-hospital mortality, or in the proportion of patients admitted to critical care, despite the higher rate of documented DNACPR decisions.

This study has limitations. This is a single centre analysis. Patients were excluded if admitted directly to a specialty. These admission routes were available prior to April 2019, so will not affect comparison between years described here. However, centres without these admission routes may have a different alteration in the profile of admissions.

Conclusion

It is recognized that non-COVID medical admissions decreased during the COVID-19 pandemic, but this

short report highlights which conditions and patient groups were most affected. The greatest reductions were seen in young adults and for non-specific diagnoses which often do not require in-patient treatment (non-cardiac chest pain, for example). This suggests these admissions are avoidable, and potentially alternative services might be more appropriate. However, there was an increase in the proportion of medical admissions related to psychiatric conditions, alcohol and drug misuse and falls. This potentially highlights the risks of social isolation during lockdown and planning for future peaks of COVID-19 should ensure adequate support for people at risk of these conditions.

Author contributions.

All authors contributed to the design of the study, analysis of the data, drafted the paper and reviewed and approved the final version of the manuscript.

Conflicts of interest

BR, MP, SG have no conflicts of interest. ES declares grant income from HDR-UK, Medical Research Council, Wellcome Trust, NIHR, Alpha 1 foundation, British Lung Foundation. CA is supported by the NIHR.

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Data sharing agreement

To facilitate knowledge in this area, the anonymised participant data and a data dictionary defining each field will be available to others through application to PIONEER via the corresponding author. The data will be available upon request and following approval of a process to ensure ethical data governance and through a data access agreement. Please contact the corresponding author for details.

Acute, non-COVID related medical admissions during the first wave of COVID-19

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