

Racial differences in management and outcomes of acute myocardial infarction during COVID19 pandemic

Short running title: Racial disparities in outcomes of AMI during COVID19 pandemic.

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Conflict of interest

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Abbreviations

AMI	Acute myocardial infarction
BAME	Black, Asian and Minority Ethnic
COVID-19	Corona virus disease 2019
COPI	Control of Patient Information Regulations
NICOR	National Institute of Cardiovascular Outcomes Research
NHS	National Health Service
NSTEMI	Non ST elevation acute myocardial infarction
STEMI	ST elevation acute myocardial infarction
MINAP	Myocardial Ischaemia National Audit Project
BCIS	British Cardiovascular Intervention Society
PCI	Percutaneous coronary intervention
UK	United Kingdom
US	United States
ID	Identification
OR	Odds ratios
IRR	Incidence rate ratio

Abstract:

Objective: There are concerns that health care and outcomes of BAME communities are disproportionately impacted by the COVID19 pandemic. We investigated admission rates, treatment and mortality of Black, Asian and Minority Ethnic (BAME) with acute myocardial infarction (AMI) during COVID19.

Methods: Using multisource national healthcare records, patients hospitalised with AMI in England during 1st February- 27th May 2020 were included in the COVID19 group, whereas patients admitted during the same period in the previous three consecutive years were included in a pre-COVID19 group. Multilevel hierarchical regression analyses were used to quantify the changes in-hospital and 7-day mortality in BAME compared to whites.

Results: Of 73,746 patients, higher proportions of BAME patients (16.7% vs 10.1%) were hospitalised with AMI during the COVID19 period compared to pre-COVID19. BAME patients admitted during the COVID19 period were younger, male and likely to present with STEMI. COVID19 BAME group admitted with NSTEMI less frequently received coronary angiography (86.1% vs 90.0%, $p<0.001$) and had a longer median delay to reperfusion (4.1h vs 3.7h, $p<0.001$) compared with whites. BAME had higher in-hospital (OR 1.68 95%CI 1.27-2.28) and 7-day mortality (OR 1.81 95%CI 1.31-2.19) during COVID19 compared to pre COVID19 period.

Conclusion: In this multisource linked cohort study, compared to whites BAME patients had proportionally higher hospitalisation rates with AMI, less frequently received guidelines indicated care and had higher early mortality during COVID19 period compared to pre COVID19 period. There is a need to develop clinical pathways to achieve equity in the management of these vulnerable populations.

Key Questions:

What is already known about this subject? Studies have found an increased risk of mortality in the BAME communities during the COVID19 pandemic.

What does this study add? This population based cohort study provides important information about the incidence, clinical and procedural characteristics of BAME patients presenting with AMI compared to Whites during COVID-19 pandemic in England. There was

a marked increase in the admission rates with AMI amongst the BAME during the COVID-19 pandemic compared to pre-COVID-19 period. BAME patients during COVID-19 were less likely to receive guideline indicated care and had increased mortality compared to pre-COVID-19 era.

How might this impact on clinical practice? Immediate counter measures are required to increase patient awareness and promote equity in the cardiac care of this underserved population during the ongoing COVID-19 pandemic.

Introduction:

The novel severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), has resulted in over 1.3 million deaths worldwide¹. A disproportionately higher infection and mortality rate have been observed in the Black, Asian and Minority Ethnic (BAME) communities compared to white populations²⁻⁷. The UK has the highest COVID19 related death rates in Europe and also the most diverse population from various ethnic backgrounds. During the first COVID19 wave, almost 34% of the COVID19 related intensive care admissions were from BAME origin⁸. Health data derived from over 17 million adults in the UK observed a two-fold increase in COVID19-related mortality in the BAME group compared to white patients⁹, and similarly higher infection and fatality rates have been observed in the African Americans in the US¹⁰.

Previous studies have found that BAME communities presenting with acute myocardial infarction (AMI) receive different care and have worse clinical outcomes than whites¹¹⁻¹⁴. Health systems across the world have observed a substantial decline in admission with AMI and a concurrent rise in early mortality or complications during the COVID19 pandemic¹⁵⁻¹⁸. There is evidence that BAME communities may be adversely impacted during the current COVID19 outbreak particularly, those with pre-existing comorbidities^{3 19 20}. Yet, most contemporary studies in the current era of the COVID19 pandemic have focused directly only on characteristics and outcomes of BAME patients with COVID19 infection. However, it is possible that established differences in the cardiovascular care and outcomes of BAME communities in AMI may have been further exacerbated during the COVID19 pandemic.

Using linked records from nationwide registries, this study sought to define the characteristics, treatments and outcomes of BAME patients hospitalised with a diagnosis of AMI in England, compared to the white population before and during the current COVID19 pandemic.

Methods:

Study data:

The individual patients level data for this study were acquired from three large national registries in England. The Myocardial Ischaemia National Audit Project (MINAP) nationwide registry, the only whole-country AMI registry, prospectively collects detailed information about characteristics, quality of care and in-hospital outcomes of patients hospitalised across England in a single healthcare system (the National Health Service-NHS) ²¹⁻²³. The British Cardiovascular Intervention Society (BCIS) national audit database holds the information regarding the procedural characteristics, procedural treatment and outcomes of the patients undergoing percutaneous coronary intervention (PCI) in the England ²⁴. Finally, country wide information regarding the mortality status of all individual is recorded in the Civil registration system. The linkage of records across the three national registries was performed using a unique NHS number.

Ethical approval

The MINAP and BCIS data are collected and hosted by the National Institute of Cardiovascular Outcomes Research (NICOR) and used for audit and research purposes without formal individual patient consent under section 251 of the NHS Act 2006. Therefore, study was exempted from formal ethical approval. Furthermore, the contemporary death data linkage was granted by legal premise (under COVID-19 public health NHS England Directions 2020 conferred by section 254 of the Health and Social Care Act 2012) and expedited through NHS Digital. The Secretary of State for Health and Social Care has issued a time limited Notice under Regulation 3(4) of the NHS (Control of Patient Information Regulations) 2002 (COPI) to share confidential patient information. The study complies with the Declaration of Helsinki.

Study population and outcomes

The analytical cohort for this study consisted of adults (aged ≥ 18 years) hospitalised with a diagnosis of AMI between 1st January 2017 to 27th May 2020 in the MINAP registry. In addition to ethnicity, we collected information regarding demographics, important cardiovascular comorbidities, presenting clinical characteristics, in-hospital pharmacology,

reperfusion and invasive treatments, such as coronary angiography and percutaneous coronary intervention (PCI), and in-hospital death. The MINAP registry does not capture COVID19 infection status of the patients included in this study. Patients with missing information on sex, ethnicity and re-admission within 30-days of the index admission were excluded. As the NHS patient ID was required to link the individual patient record across the datasets, patients with missing NHS ID were also excluded. Readmission within 30 days was excluded because it was considered to be a complication from the index admission (Supplementary figure 1). Ethnicity recorded as Black, Asian and other minorities in the MINAP registry were defined as the BAME group. To compare the trends before and during the COVID19 pandemic, patients admitted between 1st February 2020 and 27th May 2020 were defined as the “COVID19” period group (the first COVID19 case was reported on 28th January 2020 in England), whereas a comparative group of patients hospitalised during the same period (1st February to 27th May) in each of the last three consecutive years, 2017-2019 were grouped as the “pre-COVID19” group. To study the procedural characteristics of patients, we linked the records of all patients in the MINAP registry during the study period with the BCIS PCI registry using the unique NHS patient ID. The in-hospital and 7-day mortality information for each patient was tracked from civil death register using the same unique NHS patient ID.

The primary outcome was in-hospital and 7-day all-cause mortality. Secondary outcomes included the differences in receipt of guideline-directed care between the BAME and white groups, including, specifically (a) time to reperfusion therapy (defined as time from symptom onset to reperfusion by primary PCI for ST-elevation acute myocardial infarction [STEMI]), (b) time to invasive coronary angiography for non-ST-elevation acute myocardial infarction (NSTEMI) and (c) use of dual antiplatelet medication. In order to elucidate the impact of social and other restrictions consequent upon the pandemic, we performed a subgroup analysis to investigate mortality before and after the lockdown measures were imposed in the UK on 23rd March 2020. All patients before 23rd March 2020 were included in the “before lockdown” group and all patients hospitalised after 23rd March were included in the “after lockdown” group.

To account for missing or incomplete data submission by different hospitals during the COVID19 pandemic, a sensitivity analysis was undertaken including the data from ‘rapid reporting hospitals’ that have consistently submitted data to NICOR in the pre-COVID19 and COVID19 periods.

Statistical analysis

Multiple imputations with chained equations were used to account for missing data assuming that data were missing at random, creating 10 datasets^{25 26}. Logistic, linear or multinomial regression models were used to impute for the missing information for binary, ordinal and continuous variables respectively. Supplementary table 1 reports the list of variables along with their missing information used in the imputation models.

Continuous variables were expressed as median and interquartile range after inspecting for distribution of continuous variables using summary statistics, whilst categorical variables were presented as absolute numbers and percentages. Chi-squared for the categorical variables and Mann-Whitney U test for continuous variables were used to compare the differences between the BAME and white groups. We calculated monthly hospitalisation incidence rate ratios (IRR) of AMI in the BAME group compared to the white population group for each month from January to May in 2020, using a Poisson regression model, with equivalent months in the previous years as a reference. Time series weekly plots were constructed using 7-day simple moving average (the mean number of daily hospitalisations for that day and preceding 6 days) adjusting for seasonality.

Finally, we used multilevel hierarchical logistic regression models with a random intercept in order to account for the nested structure of patients within the hospitals. An interaction term between the ethnicity and COVID19 period variable was used to calculate the adjusted monthly mortality trends in the BAME group compared to the white population during the COVID period, using equivalent months in the pre-COVID19 period as a reference. All models were adjusted for age, sex, baseline demographics, cardiovascular comorbidities, in-hospital pharmacology and all other confounders as listed in supplementary table 1. Stata MP16.0, College Station, Texas, US was used to perform all the statistical analyses.

Results:

A total of 73,746 patients were included in the analysis, supplementary figure 1 illustrates the STROBE flow diagram of study selection and record linkage across the 3 national datasets. Of 62,578 patients in the pre-COVID19 group, 56,270 (90%) were white and 6,308 (10%) were of BAME origin, whereas more BAME patients (16.7%, n=1,863) were admitted with AMI during the COVID19 period (supplementary figure 1). Time series analysis of 14-day mean number of daily hospitalisations with AMI revealed a significant uplift in the rates of hospitalisations in BAME group compared to whites in 2020 (figure 1). During the COVID19

period, the monthly proportion of BAME patients admitted with AMI also increased from 16.2% in February 2020 to 17.7% in May 2020 whereas, by contrast, the rate was stable during each month in the pre-COVID19 period (Figure 2). There was an increase in the rates of admissions with AMI (IRR 1.65 95%CI 1.57-1.74) in the BAME group during the COVID19 period compared to white population, with a similar monthly proportional rise observed during each month during the COVID19 period compared to the pre-COVID19 period (figure 3).

Overall, BAME patients were likely to be younger, male, had lower body mass index (BMI) and increased prevalence of hypercholesterolemia, heart failure, angina, chronic kidney disease and insulin treated diabetes (Table 1). During the COVID19 period, a higher proportion of the BAME group presented with STEMI (37.9% vs 34.6%, $p=0.01$) compared to the pre-COVID19 period. The BAME group were also more likely to experience out of hospital cardiac arrest (7.6% vs 6.2%, $p=0.04$) and cardiogenic shock (3.5% vs 2.4%, $p<0.001$) compared to the white population during the COVID19 period.

BAME group experienced longer delays to reperfusion therapies for STEMI and time to coronary angiography for NSTEMI compared to white patients both during the pre-COVID19 and COVID19 periods. However, these differences were more pronounced during the COVID19 period with an absolute increase of 30 minutes in time to reperfusion in STEMI and 2.2 hours in time to angiography in NSTEMI during COVID19 period. There was also significantly lower use of coronary angiography (85.1% vs 90.0%, $p<0.001$) in NSTEMI in the BAME group compared to white patients during the COVID19 period (Table 1). Finally, the BAME group was also less likely to undergo PCI (61.5% vs 67.2%, $P<0.001$), and to receive a second antiplatelet in the form P2Y12 inhibitor (75.1% vs 78.2%, $p<0.001$) or dual antiplatelet medications (70.2% vs 73.2%, $p=0.03$) during the COVID19 period (Table 1).

During COVID19 period, there was a significantly higher unadjusted in-hospital (6.7% vs 5.2%, $p=0.01$) and 7-day mortality (8.2% vs 6.7%, $p<0.001$) in the BAME group compared to the white population. After adjusting for baseline differences and all available potential confounders, we observed a higher overall in-hospital mortality (OR 1.68 95%CI 1.27-2.21) and 7-day mortality (OR 1.81 95%CI 1.31-2.19) in the BAME group (relative to the white population) during the COVID19 period versus the pre-COVID19 period. There was also an increasing trend in the adjusted monthly in-hospital mortality from February 2020 (OR 1.67 95%CI 1.12-2.65) to May 2020 (OR 2.39 95%CI 1.15-5.63) in the BAME group (relative to the white population) during the COVID19 period versus the pre-COVID19 period (Figure 4,

supplementary table 2). We also observed a significant rise in adjusted in-hospital mortality in the BAME group (relative to the white cohort) after the lockdown (23rd March 2020) OR 1.78 (95%CI 1.12-3.08) versus the pre-lockdown period OR 0.95 (95%CI 0.81-1.10) (Supplementary figure 2). In the sensitivity analysis using the data from rapid reporting hospitals, we observed similar trends in the in-hospital and 7-day mortality during the COVID19 period compared to the pre-COVID19 period (supplementary table 3)

Out of 73,746 patients in the MINAP ACS registry, 34,582 (46.9%) received PCI and were studied in the BCIS PCI registry during the study period. Overall, the BAME group undergoing PCI were likely to be younger, male and had lower BMI compared to white patients. The clinical and angiographic characteristics of the BAME group undergoing PCI during the COVID19 period and the pre COVID19 period were largely unchanged. (Supplementary table 4a and 4b). In the adjusted mortality analysis, overall ethnicity was not associated with any mortality hazard (OR 1.28 95%CI 0.70-2.32) and had similar monthly in-hospital mortality and 7-day mortality during the COVID19 period compared to the pre-COVID19 period (Table 2).

Discussion

In this national investigation using multisource linked nationwide healthcare records data from the world's largest single healthcare system, we observed the following important findings: (a) BAME communities had proportionally higher rates of AMI related hospitalisations compared to whites during the COVID19 pandemic (b) Although, BAME patients have different presenting characteristics and comorbidity profile, some differences such as younger age, male sex and lower BMI were magnified during the COVID19 period whereas some differences were reversed- such as BAME were more likely to present with STEMI, out of hospital cardiac arrest and cardiogenic shock during the COVID19 period compared to pre COVID19. BAME communities had longer time to reperfusion for STEMI, lower use of invasive strategy for NSTEMI, and experienced long delays in receiving coronary angiography. c) Compared to pre COVID19 period, BAME communities experienced an increased in-hospital and 7-day mortality (relative to whites) during the COVID19 pandemic. d) In contrast, BAME patients who were referred for an invasive strategy and underwent PCI had similar in-hospital mortality before and during the COVID19 pandemic. These observed associations suggest delayed patient response and widening differences in the utilisation of guidelines recommended care in the BAME patients hospitalised with AMI during the COVID19 pandemic.

BAME communities have experienced significantly higher rates of death during the COVID19 period which are not fully explained by existing socioeconomic, life style and health disparities^{14 27}. Chronic conditions, which are known to be associated with worst outcomes in COVID19 infection, such as diabetes, obesity and cardiovascular disease are more prevalent amongst the BAME communities. However, large-scale national data are lacking regarding both clinical characteristics and management of AMI in the BAME communities during the current COVID19 pandemic. Our study confirms that BAME communities presenting with AMI have an increased prevalence of certain cardiometabolic comorbidities such as diabetes, hypertension, chronic kidney disease and prior AMI. However, we observed important changes in the presenting characteristics of BAME communities, in that the BAME patients hospitalised during the COVID19 period were more likely to have STEMI and haemodynamic instability in the form of pre-hospital cardiac arrest and cardiogenic shock compared with pre-COVID period.

While many studies have reported reduced AMI related hospitalisations across the globe during the current COVID19 outbreak, there was a significantly higher rates of AMI-related hospitalisation amongst the BAME communities in England during COVID19 pandemic. In particular, there was significant uplift in the rate of hospitalisation in the BAME group during May 2020 which be a reflection of change in the health seeking behaviour following early concerns raised about increased risk of COVID19 related infection and death in the BAME communities. Our study identifies important differences in the management of BAME communities during the COVID19 period. Despite high-risk presenting characteristics, they were less likely to receive timely reperfusion treatment for STEMI with an absolute increase of 30 minutes in time to reperfusion in STEMI and 2.2 hours in time to angiography in NSTEMI. Available data on the racial disparities regarding the treatment and management of AMI have shown that BAME communities are at a significant disadvantage to receive guideline-indicated care and more likely to experience longer delays^{14 28-30}, and these known disparities may have widened during the current COVID19 pandemic due to restructuring of healthcare system, resource allocation and increased fear of nosocomial COVID19 infection. BAME patients who did undergo PCI during COVID19 had very similar clinical characteristics and risk profile compared to BAME patients in the pre COVID-19 group, but overall had higher comorbid burden and disease complexity compared to white patients.

We observed higher mortality in BAME communities during the COVID19 period compared to the pre-COVID19 period, particularly after the lockdown measures were introduced in the

United Kingdom. Excess COVID19 infection mortality amongst BAME communities is widely reported during the current COVID19 outbreak and there is a growing concern that this may be related to underlying health status, concurrent acute medical presentation such as AMI, stroke or thromboembolic disease, in addition to the known social and health status determinants^{20 31}. Although, we didn't have information regarding the COVID19 infection in our study, there appears to be an increased risk of in-hospital and early 7-day mortality in the BAME communities which may be related to delayed hospitalisation and reduced use of guideline-indicated care. BAME patients who did undergo PCI had similar outcomes to white patients before and during the COVID19 pandemic. It is possible that the overall increase in mortality amongst the BAME group may be related to the suboptimal care and lower use of guideline-indicated care such as an early invasive strategy in NSTEMI and dual antiplatelet medications. These racial differences in outcomes following AMI may be related to a myriad of patient level factors such as socioeconomic status, lack of awareness in recognition of symptoms, delay in seeking early medical help and implicit bias from the treating physicians^{32 33}. These data highlight the need to promote health awareness amongst the BAME communities and to develop policies to address differences in healthcare service utilisation.

Our data suggest that there is an urgent need to address the widening racial disparities in the care of AMI patient during the current COVID19 outbreak. By using multiple national data sources, we were able to access and link records of individual patients to create an unselected cohort from a unified national healthcare system. However, certain limitations must be acknowledged. First, we didn't have information regarding the COVID19 infection status of these patients and were unable to study the direct impact of COVID19 infection in this high-risk group. The limited or incomplete data submissions by the hospital during the COVID19 period may have obscured the racial disparities. Nevertheless, in our sensitivity analysis of data from rapid response hospitals, we observed similar results. Finally, the observational nature of these epidemiological data doesn't allow us to establish a causal relationship between COVID19 and increased mortality in the BAME group.

Conclusion:

In this large national cohort of AMI patients stratified according to ethnicity, we found significant differences in the presentation and management of BAME communities compared to the white population, with an associated increased early mortality. Further research is required to understand the short-term and long-term effects of COVID-19 amongst the ethnic

minorities. Future efforts should be focused to increase patient education and awareness, and develop policies to mitigate the racial differences in the resource utilisation and standardise the care of ethnic minorities.

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Author contributions: MR & MM were responsible for the study design and concept. MR performed the data cleaning and analysis. MR and MM wrote the first draft of the manuscript, and all authors contributed to the writing of the paper.

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Table1: Baseline characteristics, pharmacological and invasive management of BAME compared to White patients stratified according to pre-COVID19 and COVID19 pandemic periods from the MINAP registry

Variables	Pre-COVID19 Whites N=56,270	Pre COVID19 BAME N= 6,308	P value	COVID19 Whites N=9,305	COVID19 BAME N=1,863	P value
Age, years median (IQR)	70 (59-80)	63 (53-75)	<0.001	69 (59-78)	62 (52-73)	<0.001
Male (%)	37524 (66.7%)	4566 (72.4%)	<0.001	6315 (67.9%)	1368 (73.4%)	<0.001
BMI, median (IQR)	27.4 (24.2-31.1)	26.7 (24.0-30.0)	<0.001	27.6 (24.4-31.3)	26.9 (24.1-30.0)	<0.001
Presenting Characteristics						
Heart rate, bpm, median (IQR)	77 (66-90)	77 (66-90)	0.841	77 (66-90)	79 (67-91)	0.070
Systolic blood pressure, median (IQR)	137 (119-156)	136 (119-155)	0.047	140 (121-159)	137 (120-157)	0.008
Cardiac arrest	3918 (7.1%)	375 (6.1%)	0.003	537 (6.2%)	129 (7.6%)	0.041
Clinical syndrome			<0.001			0.012
STEMI	18413 (35.1%)	1673 (30.2%)		2790 (34.6%)	608 (37.9%)	
NSTEMI	34099 (64.9%)	3869 (69.8%)		5264 (65.4%)	996 (62.1%)	
Creatinine umol/L, median (IQR)	84 (71-104)	88 (73-113)	<0.001	83 (70-101)	85 (71-105)	<0.001
<i>Killip Class</i>			<0.001			<0.001
No heart failure	41002 (81.0%)	4630 (79.6%)		6582 (83.6%)	1343 (84.4%)	
Basal crepitation	6122 (12.1%)	641 (11.0%)		828 (10.5%)	120 (7.5%)	
Pulmonary oedema	2175 (4.3%)	382 (6.6%)		274 (3.5%)	74 (4.6%)	
Cardiogenic shock	1306 (2.6%)	167 (2.9%)		188 (2.4%)	55 (3.5%)	
LV systolic function			<0.001			<0.001
Good	19309 (41.7%)	2697 (49.5%)		3161 (43.7%)	754 (47.5%)	
Moderate	11652 (25.2%)	1265 (23.2%)		1761 (24.4%)	411 (25.9%)	
Poor	4093 (8.8%)	450 (8.3%)		613 (8.5%)	121 (7.6%)	
Not assessed	11241 (24.3%)	1032 (19.0%)		1697 (23.5%)	303 (19.1%)	
Previous medical history						
Percutaneous coronary intervention	7691 (15.1%)	1354 (23.4%)	<0.001	1372 (17.1%)	339 (20.2%)	0.003

Coronary artery bypass graft	3648 (7.1%)	589 (10.2%)	<0.001	556 (7.0%)	112 (6.7%)	0.686
Heart failure	3848 (7.5%)	493 (8.6%)	0.003	593 (7.5%)	107 (6.6%)	0.213
Hypercholesterolemia	16098 (31.5%)	2733 (47.6%)	<0.001	2482 (31.1%)	676 (41.4%)	<0.001
Angina	11402 (22.2%)	1539 (27.1%)	<0.001	1610 (20.3%)	341 (21.1%)	0.472
Cerebrovascular disease	4393 (8.6%)	464 (8.1%)	0.252	654 (8.2%)	136 (8.2%)	0.972
Myocardial infarction	12144 (23.5%)	1778 (30.7%)	<0.001	1919 (23.8%)	395 (23.6%)	0.874
Peripheral vascular disease	2528 (4.9%)	207 (3.6%)	<0.001	399 (5.0%)	48 (2.9%)	<0.001
Chronic kidney disease	3664 (7.2%)	746 (13.0%)	<0.001	588 (7.3%)	157 (9.6%)	<0.001
Diabetes			<0.001			<0.001
Not diabetic	41749 (76.1%)	3077 (50.3%)		6351 (75.3%)	1078 (61.2%)	
Diet controlled	2265 (4.1%)	285 (4.7%)		379 (4.5%)	79 (4.5%)	
Oral medications	6879 (12.5%)	1805 (29.5%)		1091 (12.9%)	390 (22.1%)	
Insulin therapy	3979 (7.3%)	948 (15.5%)		611 (7.2%)	214 (12.2%)	
Hypertension	27142 (52.2%)	3871 (66.0%)	<0.001	6351 (75.3%)	1078 (61.2%)	<0.001
<i>Smoking status</i>			<0.001			<0.001
Never smoked	15205 (32.9%)	2630 (54.6%)		2434 (33.9%)	683 (47.6%)	
Previous smoker	17917 (38.8%)	1017 (21.1%)		2670 (37.2%)	332 (23.1%)	
Current smoker	13057 (28.3%)	1172 (24.3%)		2071 (28.9%)	421 (29.3%)	
Asthma / COPD	9155 (17.8%)	790 (13.8%)	<0.001	1477 (18.7%)	211 (13.1%)	<0.001
Family history of CHD	12021 (27.4%)	1240 (28.4%)	0.192	1919 (28.3%)	394 (27.1%)	0.342
In-hospital Pharmacology						
Low molecular weight heparin	18365 (41.3%)	1686 (38.5%)	<0.001	2626 (39.9%)	473 (37.6%)	0.131
Unfractionated heparin	12933 (29.1%)	996 (22.9%)	<0.001	2031 (30.2%)	378 (29.8%)	0.802
Warfarin	1901 (4.3%)	127 (2.9%)	<0.001	237 (3.6%)	28 (2.2%)	0.014
Loop Diuretic	10948 (24.6%)	1153 (26.3%)	0.012	1490 (22.5%)	299 (23.5%)	0.485
Glycoprotein IIb/IIIa inhibitor use	2802 (6.2%)	344 (7.4%)	<0.001	527 (7.9%)	111 (8.7%)	0.321
Processes of care and outcomes						
Seen by cardiologist	54057 (97.0%)	6047 (97.1%)	0.667	8415 (96.8%)	1744 (96.5%)	0.564
Percutaneous coronary intervention	26,075 (62.1%)	2794 (54.7%)	<0.001	4,571 (67.2%)	750 (61.5%)	<0.001
Time to reperfusion for STEMI, hours median IQR	3.6 (2.3-7.4)	3.3 (2.4-6.0)	<0.001	3.7 (2.5-8.2)	4.2 (2.5-7.2)	<0.001

Call for help , hour median (IQR)	1.34 (0.4-4.9)	1.52 (0.4-5.7)	<0.001	1.4 (0.5-5.5)	1.7 (0.5-6.8)	0.001
Coronary angiography in NSTEMI	25,548 (85.9%)	3137 (84.3%)	0.095	4,478 (90.0%)	758 (85.1%)	<0.001
Time to coronary angiography, hours median (IQR)	41.0 (4.33-89.3)	46.7 (10.9-95.8)	<0.001	27.0 (2.65-69.5)	39.6 (3.4-87.6)	<0.001
P2Y12 use	41050 (78.2%)	4404 (78.8%)	0.281	6069 (78.2%)	1123 (75.1%)	<0.001
Dual antiplatelet medication	30527 (72.7%)	3437 (74.4%)	0.002	4617 (73.2%)	878 (70.2%)	0.032
ACE inhibitors	31589 (69.6%)	3205 (71.5%)	0.008	4889 (72.0%)	967 (73.6%)	0.251
In-hospital mortality	3,154 (5.9%)	283 (4.8%)	<0.001	441 (5.2%)	117 (6.7%)	<0.001
7 day mortality	4,415 (8.3%)	385 (8.0)	<0.001	568 (6.7%)	143 (8.2%)	0.026

BMI=body mass index, SD= standard deviation, bmp= beats per minute, STEMI= ST elevation myocardial infarction, NSTEMI= non ST elevation myocardial infarction, LV= left ventricle, COPD= chronic obstructive airway disease, CHD = coronary heart disease, ACE= angiotensin converting enzyme, IQR= interquartile range, P2Y12= purinergic receptor inhibitor

Table 2: Adjusted mortality in BAME compared to White patients undergoing PCI during COVID19 period compared to pre COVID19 period.

COVID19 period	Reference	Adjusted odds ratio (95% confidence interval)*
Adjusted In hospital mortality		
February 2020 (n=9,996)	Pre COVID19 period	0.77 (0.46-1.28)
March 2020 (n=9,088)	Pre COVID19 period	1.11 (0.26-4.63)
April 2020 (n=8,206)	Pre COVID19 period	1.44 (0.24-8.60)
May 2020 (n=7,292)	Pre COVID19 period	3.87 (0.55-12.98)
Overall mortality 2020 (n=34,582)	Pre COVID19 period	1.28 (0.70-2.32)
Adjusted 7-day mortality		
February 2020 (n=9,996)	Pre COVID19 period	1.05 (0.27-3.10)
March 2020 (n=9,878)	Pre COVID19 period	1.82 (0.45-7.37)
April 2020 (n=8,206)	Pre COVID19 period	1.62 (0.14-3.99)
May 2020 (n=7,292)	Pre COVID19 period	3.59 (0.49-8.31)
Overall mortality 2020 (n=34,582)	Pre COVID19 period	1.40 (0.68-2.86)

*Adjusted for age, gender, ethnicity, heart rate, blood pressure, body mass index, serum creatinine level, family history of coronary heart diseases, left ventricle systolic dysfunction, history of heart failure, prior percutaneous coronary intervention (PCI), history of diabetes mellitus, hypercholesterolaemia, history of angina, history of myocardial infarction, history of Cerebrovascular accident, history of peripheral vascular disease, hypertension, smoking, asthma/COPD, admission under cardiology, prescription of low molecular weight heparin, warfarin, un-fraction heparin, GP 2b/3a inhibitor, furosemide, angiotensin converting enzyme inhibitor/angiotensin receptor blockers, aspirin, P2Y12 inhibitor, , cardiogenic shock, arterial blood gas, Glasgow come scale, mechanical ventilation, lesions attempted, vessel attempted, multivessel pci, number of stents inotropic support, intravascular ultrasound, fractional flow reserve, optical coherence tomography, intra-aortic balloon pump and impella use on imputed data

Figure 1: Time series plot of daily proportions of BAME patients hospitalised with diagnosis of AMI from 1st January 2017 to 27th May 2020.

Lines represent a 14-day simple moving average (indicating the mean number of daily admissions for that day and the preceding 13 days) up to and including 22nd March 2020. For data from 23rd March 2020, a 7-day moving average (indicating the mean number of admissions for that day and the preceding 6 days) up to and including 27th May 2020, adjusted for seasonality was plotted.

Figure 2: Time series plot of daily proportions of BAME patients hospitalised with diagnosis of AMI from 1st January 2017 to 27th May 2020 stratified according to the year of admission.

Lines represent a 14-day simple moving average (indicating the mean number of daily admissions for that day and the preceding 13 days) up to and including 22nd March 2020. For data from 23rd March 2020, a 7-day moving average (indicating the mean number of admissions for that day and the preceding 6 days) up to and including 27th May 2020, adjusted for seasonality was plotted.

Figure 3: Monthly rates of AMI hospitalisations in BAME compared to Whites patients during the COVID19 period.

Figure 4: Adjusted mortality in BAME compared to White patients during COVID19 period compared to pre COVID19 period in the AMI cohort