Original research

Racial differences in management and outcomes of acute myocardial infarction during COVID-19 pandemic

Muhammad Rashid ,[1,2] Adam Timmis ,[3] Tim Kinnaird,[4] Nick Curzen ,[5] Azfar Zaman,[6] Ahmad Shoaib,[1,2] Mohamed O Mohamed ,[1] Mark A de Belder,[7] John Deanfield,[8] Glen Philip Martin ,[9] Jianhua Wu ,[10] Chris P Gale,[10,11] Mamas Mamas[1,2,12]

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For numbered affiliations see end of article.

Correspondence to
Dr Mamas Mamas, Keele Cardiovascular Research Group, School of Medicine, Keele University, Keele, UK; mamasmamas1@yahoo.co.uk

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ABSTRACT

Objective There are concerns that healthcare and outcomes of black, Asian and minority ethnic (BAME) communities are disproportionately impacted by the COVID-19 pandemic. We investigated admission rates, treatment and mortality of BAME with acute myocardial infarction (AMI) during COVID-19.

Methods Using multisource national healthcare records, patients hospitalised with AMI in England during 1 February–27 May 2020 were included in the COVID-19 group, whereas patients admitted during the same period in the previous three consecutive years were included in a pre-COVID-19 group. Multilevel hierarchical regression analyses were used to quantify the changes in-hospital and 7-day mortality in BAME compared with whites.

Results Of 73 746 patients, higher proportions of BAME patients (16.7% vs 10.1%) were hospitalised with AMI during the COVID-19 period compared with pre-COVID-19. BAME patients admitted during the COVID-19 period were younger, male and likely to present with ST-elevation acute myocardial infarction. COVID-19 BAME group admitted with non-ST-elevation acute myocardial infarction less frequently received coronary angiography (86.1% vs 90.0%, p<0.001) and had a longer median delay to reperfusion (4.1 hours vs 3.7 hours, p<0.001) compared with whites. BAME had higher in-hospital (OR 1.68, 95% CI 1.27 to 2.28) and 7-day mortality (OR 1.81 95% CI 1.31 to 2.19) during COVID-19 compared with pre-COVID-19 period.

Conclusion In this multisource linked cohort study, compared with whites, BAME patients had proportionally higher hospitalisation rates with AMI, less frequently received guidelines indicated care and had higher early mortality during COVID-19 period compared with pre-COVID-19 period. There is a need to develop clinical pathways to achieve equity in the management of these vulnerable populations.

INTRODUCTION

The novel SARS-CoV-2 has resulted in over 1.3 million deaths worldwide.[1] A disproportionately higher infection and mortality rates have been observed in the black, Asian and minority ethnic (BAME) communities compared with white populations.[2–7] The UK has the highest COVID-19 related death rates in Europe and also the most diverse population from various ethnic backgrounds. During the first COVID-19 wave, almost 34% of the COVID-19 related intensive care admissions were from BAME origin.[8] Health data derived from over 17 million adults in the UK observed a twofold increase in COVID-19 related mortality in the BAME group compared with white patients,[9] and similarly higher infection and fatality rates have been observed in the African-Americans in the USA.[10]

Previous studies have found that BAME communities presenting with acute myocardial infarction (AMI) receive different care and have worse clinical outcomes than whites.[11–14] 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 COVID-19 pandemic.[15–18] There is evidence that BAME communities may be adversely impacted during the current COVID-19 outbreak, particularly those with pre-existing comorbidities.[3 19 20] Yet, most contemporary studies in the current era of the COVID-19 pandemic have focused directly only on characteristics and outcomes of BAME patients with COVID-19 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 COVID-19 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 with the white population before and during the current COVID-19 pandemic.

METHODS

Study data

The individual patient-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

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of the patients undergoing percutaneous coronary intervention (PCI) in England.[24] Finally, countrywide 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 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 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 1 January 2017 and 27 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 PCI and in-hospital death. The MINAP registry does not capture COVID-19 infection status of the patients included in this study. Patients with missing information on sex, ethnicity and readmission 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 (online supplemental 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 COVID-19 pandemic, patients admitted between 1 February 2020 and 27 May 2020 were defined as the 'COVID-19' period group (the first COVID-19 case was reported on 28 January 2020 in England), whereas a comparative group of patients hospitalised during the same period (1 February–27 May) in each of the last three consecutive years, 2017–2019, were grouped as the 'pre-COVID-19' 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 on the pandemic, we performed a subgroup analysis to investigate mortality before and after the lockdown measures were imposed in the UK on 23 March 2020. All patients before 23 March 2020 were included in the 'before lockdown' group, and all patients hospitalised after 23 March were included in the 'after lockdown' group.

To account for missing or incomplete data submission by different hospitals during the COVID-19 pandemic, a sensitivity analysis was undertaken including the data from 'rapid reporting hospitals' that have consistently submitted data to NICOR in the pre-COVID-19 and COVID-19 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. Online supplemental table 1 reports the list of variables along with their missing information used in the imputation models.

Continuous variables were expressed as median and IQR after inspecting for distribution of continuous variables using summary statistics, while categorical variables were presented as absolute numbers and percentages. χ^2 test 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 (IRRs) of AMI in the BAME group compared with 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 COVID-19 period variable was used to calculate the adjusted monthly mortality trends in the BAME group compared with the white population during the COVID-19 period, using equivalent months in the pre-COVID-19 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 online supplemental table 1. Stata MP V.16.0 was used to perform all the statistical analyses.

RESULTS

A total of 73 746 patients were included in the analysis; online supplemental figure 1 illustrates the STROBE flow diagram of study selection and record linkage across the three national datasets. Of 62 578 patients in the pre-COVID-19 group, 56 270 (90%) were white and 6308 (10%) were of BAME origin, whereas more BAME patients (16.7%, n=1863) were admitted with AMI during the COVID-19 period (online supplemental 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 with whites in 2020 (figure 1). During the COVID-19 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-COVID-19 period (figure 2). There was an increase in the rates of admissions with AMI (IRR 1.65, 95% CI 1.57 to 1.74) in the BAME group during the COVID-19 period compared with white population, with a similar monthly proportional rise observed during each month during the COVID-19 period compared with the pre-COVID-19 period (figure 3).

Overall, BAME patients were likely to be younger, male, had lower body mass index (BMI) and increased prevalence of hypercholesterolaemia, heart failure, angina, chronic kidney disease and insulin treated diabetes (table 1). During the COVID-19 period, a higher proportion of the BAME group presented with STEMI

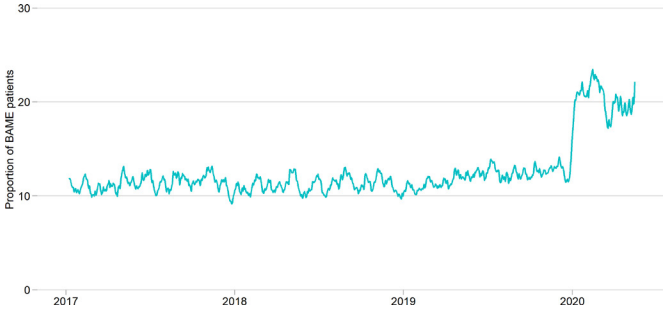

Figure 1 Time series plot of daily proportions of BAME patients hospitalised with diagnosis of AMI from 1 January 2017 to 27 May 2020. Lines represent a 14-day simple moving average (indicating the mean number of daily admissions for that day and the preceding 13 days) up to and including 22 March 2020. For data from 23 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 27 May 2020, adjusted for seasonality was plotted. AMI, acute myocardial infarction; BAME, black, Asian and minority ethnic.

(37.9% vs 34.6%, p=0.01) compared with the pre-COVID-19 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 with the white population during the COVID-19 period.

BAME group experienced longer delays to reperfusion therapies for STEMI and time to coronary angiography for NSTEMI compared with white patients both during the pre-COVID-19 and COVID-19 periods. However, these differences were more pronounced during the COVID-19 period with an absolute increase of 30 min in time to reperfusion in STEMI and 2.2 hours in time to angiography in NSTEMI during COVID-19 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 with white patients during the COVID-19 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 purinergic receptor inhibitor (75.1% vs 78.2%, p<0.001) or dual

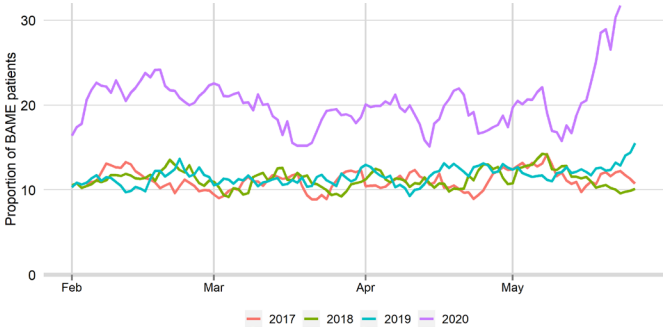

Figure 2 Time series plot of daily proportions of BAME patients hospitalised with diagnosis of AMI from 1 January 2017 to 27 May 2020 stratified according to the year of admission. Lines represent a 14-day simple moving average (indicating the mean number of daily admissions for that day and the preceding 13 days) up to and including 22 March 2020. For data from 23 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 27 May 2020, adjusted for seasonality was plotted. AMI, acute myocardial infarction; BAME, black, Asian and minority ethnic.

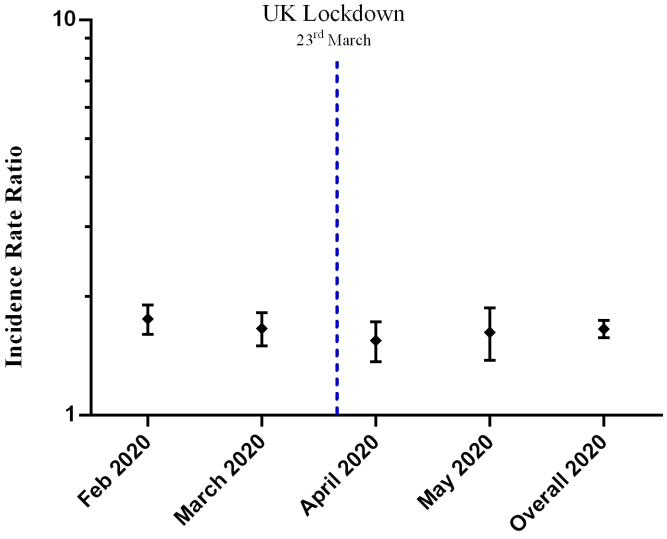

Figure 3 Monthly rates of AMI hospitalisations in BAME compared with white patients during the COVID-19 period. AMI, acute myocardial infarction; BAME, black, Asian and minority ethnic.Odds ratio presented on a logrithmic scale on Y-axis

antiplatelet medications (70.2% vs 73.2%, p=0.03) during the COVID-19 period (table 1).

During COVID-19 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 with 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 to 2.21) and 7-day mortality (OR 1.81, 95% CI 1.31 to 2.19) in the BAME group (relative to the white population) during the COVID-19 period versus the pre-COVID-19 period. There was also an increasing trend in the adjusted monthly in-hospital mortality from February 2020 (OR 1.67, 95% CI 1.12 to 2.65) to May 2020 (OR 2.39, 95% CI 1.15 to 5.63) in the BAME group (relative to the white population) during the COVID-19 period versus the pre-COVID-19 period (figure 4 and online supplemental 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 (23 March 2020) (OR 1.78, 95% CI 1.12 to 3.08) versus the prelockdown period (OR 0.95, 95% CI 0.81 to 1.10) (online supplemental 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 COVID-19 period compared with the pre-COVID-19 period (online supplemental 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 with white patients. The clinical and angiographic characteristics of the BAME group undergoing PCI during the COVID-19 period and the pre-COVID-19 period were largely unchanged (online supplemental table 4A,B). In the adjusted mortality analysis, overall ethnicity was not associated with any mortality hazard (OR 1.28, 95% CI 0.70 to 2.32) and had similar monthly in-hospital mortality and 7-day mortality during the COVID-19 period compared with the pre-COVID-19 period (table 2).

DISCUSSION

In this national investigation using multisource linked nationwide healthcare records data from the world's largest single healthcare

Table 1 Baseline characteristics, pharmacological and invasive management of BAME compared with white patients stratified according to pre-COVID-19 and COVID-19 pandemic periods from the MINAP registry

Variables	Pre-COVID-19 whites n=56 270	Pre-COVID-19 BAME n=6308	P value	COVID-19 whites n=9305	COVID-19 BAME n=1863	P value
Age, years, median (IQR)	70 (59–80)	63 (53–75)	<0.001	69 (59–78)	62 (52–73)	<0.001
Male, n (%)	37 524 (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, n (%)	3918 (7.1)	375 (6.1)	0.003	537 (6.2)	129 (7.6)	0.041
Clinical syndrome			<0.001			0.012
STEMI, n (%)	18 413 (35.1)	1673 (30.2)		2790 (34.6%)	608 (37.9%)	
NSTEMI, n (%)	34 099 (64.9)	3869 (69.8)		5264 (65.4%)	996 (62.1%)	
Creatinine µmol/L, median (IQR)	84 (71–104)	88 (73–113)	<0.001	83 (70–101)	85 (71–105)	<0.001
Killip class			<0.001			<0.001
No heart failure, n (%)	41 002 (81.0)	4630 (79.6)		6582 (83.6)	1343 (84.4)	
Basal crepitation, n (%)	6122 (12.1)	641 (11.0)		828 (10.5)	120 (7.5)	
Pulmonary oedema, n (%)	2175 (4.3)	382 (6.6)		274 (3.5)	74 (4.6)	
Cardiogenic shock, n (%)	1306 (2.6)	167 (2.9)		188 (2.4)	55 (3.5)	
LV systolic function			<0.001			<0.001
Good, n (%)	19 309 (41.7)	2697 (49.5)		3161 (43.7)	754 (47.5)	
Moderate, n (%)	11 652 (25.2)	1265 (23.2)		1761 (24.4)	411 (25.9)	
Poor, n (%)	4093 (8.8)	450 (8.3)		613 (8.5%)	121 (7.6)	
Not assessed, n (%)	11 241 (24.3)	1032 (19.0)		1697 (23.5)	303 (19.1)	
Previous medical history						
Percutaneous coronary intervention, n (%)	7691 (15.1)	1354 (23.4)	<0.001	1372 (17.1)	339 (20.2)	0.003
Coronary artery bypass graft, n (%)	3648 (7.1)	589 (10.2)	<0.001	556 (7.0)	112 (6.7)	0.686
Heart failure, n (%)	3848 (7.5)	493 (8.6)	0.003	593 (7.5)	107 (6.6)	0.213
Hypercholesterolaemia, n (%)	16 098 (31.5)	2733 (47.6)	<0.001	2482 (31.1)	676 (41.4)	<0.001
Angina, n (%)	11 402 (22.2)	1539 (27.1)	<0.001	1610 (20.3)	341 (21.1)	0.472
Cerebrovascular disease, n (%)	4393 (8.6)	464 (8.1)	0.252	654 (8.2)	136 (8.2)	0.972
Myocardial infarction, n (%)	12 144 (23.5)	1778 (30.7)	<0.001	1919 (23.8)	395 (23.6)	0.874
Peripheral vascular disease, n (%)	2528 (4.9)	207 (3.6)	<0.001	399 (5.0)	48 (2.9)	<0.001
Chronic kidney disease, n (%)	3664 (7.2)	746 (13.0)	<0.001	588 (7.3)	157 (9.6)	<0.001
Diabetes			<0.001			<0.001
Not diabetic, n (%)	41 749 (76.1)	3077 (50.3)		6351 (75.3)	1078 (61.2)	
Diet controlled, n (%)	2265 (4.1)	285 (4.7)		379 (4.5)	79 (4.5)	
Oral medications, n (%)	6879 (12.5)	1805 (29.5)		1091 (12.9)	390 (22.1)	
Insulin therapy, n (%)	3979 (7.3)	948 (15.5)		611 (7.2)	214 (12.2)	
Hypertension, n (%)	27 142 (52.2)	3871 (66.0)	<0.001	6351 (75.3)	1078 (61.2)	<0.001
Smoking status			<0.001			<0.001
Never smoked, n (%)	15 205 (32.9)	2630 (54.6)		2434 (33.9)	683 (47.6)	
Previous smoker, n (%)	17 917 (38.8)	1017 (21.1)		2670 (37.2)	332 (23.1)	
Current smoker, n (%)	13 057 (28.3)	1172 (24.3)		2071 (28.9)	421 (29.3)	
Asthma/COPD, n (%)	9155 (17.8)	790 (13.8)	<0.001	1477 (18.7)	211 (13.1)	<0.001
Family history of CHD, n (%)	12 021 (27.4)	1240 (28.4)	0.192	1919 (28.3)	394 (27.1)	0.342
In-hospital pharmacology						
Low molecular weight heparin, n (%)	18 365 (41.3)	1686 (38.5)	<0.001	2626 (39.9)	473 (37.6)	0.131
Unfractionated heparin, n (%)	12 933 (29.1)	996 (22.9)	<0.001	2031 (30.2)	378 (29.8)	0.802
Warfarin, n (%)	1901 (4.3)	127 (2.9)	<0.001	237 (3.6)	28 (2.2)	0.014
Loop diuretic, n (%)	10 948 (24.6)	1153 (26.3)	0.012	1490 (22.5)	299 (23.5)	0.485
Glycoprotein IIbIIIa inhibitor use, n (%)	2802 (6.2)	344 (7.4)	<0.001	527 (7.9)	111 (8.7)	0.321
Processes of care and outcomes						
Seen by cardiologist, n (%)	54 057 (97.0)	6047 (97.1)	0.667	8415 (96.8)	1744 (96.5)	0.564
Percutaneous coronary intervention, n (%)	26 075 (62.1)	2794 (54.7)	<0.001	4571 (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, hours, 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, n (%)	25 548 (85.9)	3137 (84.3)	0.095	4478 (90.0)	758 (85.1)	<0.001

Continued

Table 1 Continued

Variables	Pre-COVID-19 whites n=56 270	Pre-COVID-19 BAME n=6308	P value	COVID-19 whites n=9305	COVID-19 BAME n=1863	P value
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, n (%)	41 050 (78.2)	4404 (78.8)	0.281	6069 (78.2)	1123 (75.1)	<0.001
Dual antiplatelet medication, n (%)	30 527 (72.7)	3437 (74.4)	0.002	4617 (73.2)	878 (70.2)	0.032
ACE inhibitors, n (%)	31 589 (69.6)	3205 (71.5)	0.008	4889 (72.0)	967 (73.6)	0.251
In-hospital mortality, n (%)	3154 (5.9)	283 (4.8)	<0.001	441 (5.2)	117 (6.7)	<0.001
7-day mortality, n (%)	4415 (8.3)	385 (8.0)	<0.001	568 (6.7)	143 (8.2)	0.026

BAME, black, Asian and minority ethnic; BMI, body mass index; bpm, beats per minute; CHD, coronary heart disease; COPD, chronic obstructive pulmonary disease; LV, left ventricle; MINAP, Myocardial Ischaemia National Audit Project; NSTEMI, non-ST-elevation myocardial infarction; P2Y12, purinergic receptor inhibitor; STEMI, ST-elevation myocardial infarction.

system, we observed the following important findings: (A) BAME communities had proportionally higher rates of AMI-related hospitalisations compared with whites during the COVID-19 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 COVID-19 period, whereas some differences were reversed, such as BAME patients were more likely to present with STEMI, out-of-hospital cardiac arrest and cardiogenic shock during the COVID-19 period compared with pre-COVID-19. 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 with pre-COVID-19 period, BAME communities experienced an increased in-hospital and 7-day mortality (relative to whites) during the COVID-19 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 COVID-19 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 COVID-19 pandemic.

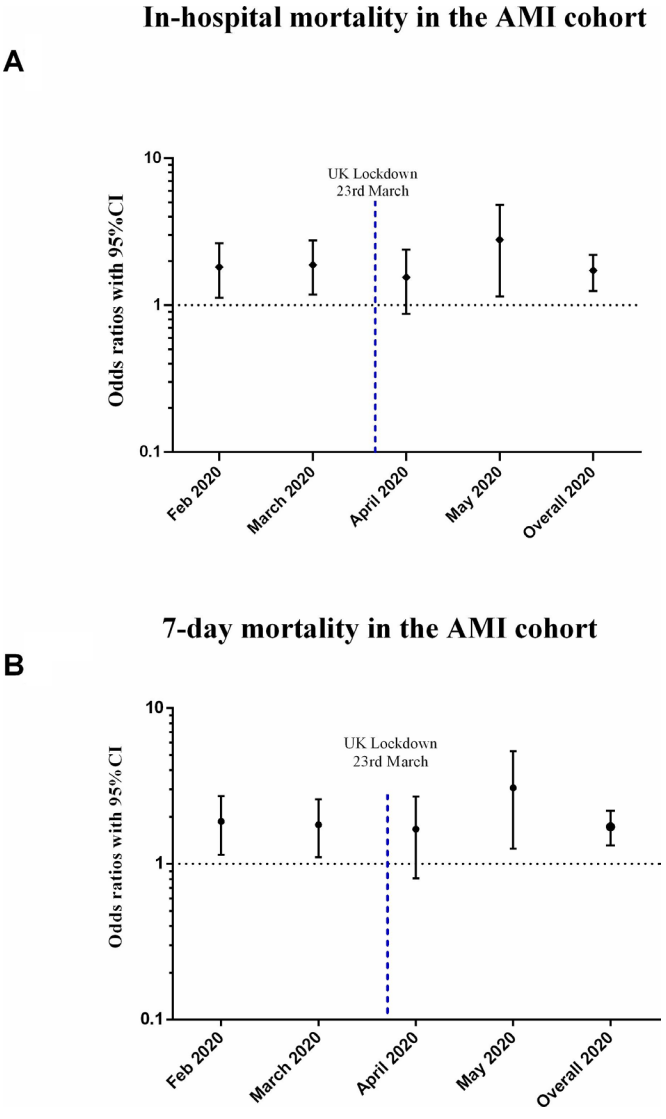

Figure 4 Adjusted mortality in BAME compared with white patients during COVID-19 period compared with pre-COVID-19 period in the AMI cohort. AMI, acute myocardial infarction; BAME, black, Asian and minority ethnic Odds ratios presented on a logrithmic scale on Y-axis

Table 2 Adjusted mortality in BAME compared with white patients undergoing PCI during COVID-19 period compared with pre-COVID-19 period

COVID-19 period	Reference	Adjusted OR (95% CI)*
Adjusted in-hospital mortality		
February 2020 (n=9996)	Pre-COVID-19 period	0.77 (0.46 to 1.28)
March 2020 (n=9088)	Pre-COVID-19 period	1.11 (0.26 to 4.63)
April 2020 (n=8206)	Pre-COVID-19 period	1.44 (0.24 to 8.60)
May 2020 (n=7292)	Pre-COVID-19 period	3.87 (0.55 to 12.98)
Overall mortality 2020 (n=34 582)	Pre-COVID-19 period	1.28 (0.70 to 2.32)
Adjusted 7-day mortality		
February 2020 (n=9996)	Pre-COVID-19 period	1.05 (0.27 to 3.10)
March 2020 (n=9878)	Pre-COVID-19 period	1.82 (0.45 to 7.37)
April 2020 (n=8206)	Pre-COVID-19 period	1.62 (0.14 to 3.99)
May 2020 (n=7292)	Pre-COVID-19 period	3.59 (0.49 to 8.31)
Overall mortality 2020 (n=34 582)	Pre-COVID-19 period	1.40 (0.68 to 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, unfraction heparin, GP 2b/3a inhibitor, furosemide, ACE inhibitor/angiotensin receptor blockers, aspirin, P2Y12 inhibitor, cardiogenic shock, arterial blood gas, Glasgow coma 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.
BAME, black, Asian and minority ethnic; COPD, chronic obstructive pulmonary disease; P2Y12, purinergic receptor inhibitor.

BAME communities have experienced significantly higher rates of death during the COVID-19 period, which are not fully explained by existing socioeconomic, lifestyle and health disparities.[14 27] Chronic conditions that are known to be associated with worst outcomes in COVID-19 infection, such as diabetes, obesity and cardiovascular disease, are more prevalent among 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 COVID-19 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 COVID-19 period were more likely to have STEMI and haemodynamic instability in the form of prehospital cardiac arrest and cardiogenic shock compared with pre-COVID-19 period.

While many studies have reported reduced AMI related hospitalisations across the globe during the current COVID-19 outbreak, there was a significantly higher rates of AMI-related hospitalisation among the BAME communities in England during COVID-19 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 COVID-19 related infection and death in the BAME communities. Our study identifies important differences in the management of BAME communities during the COVID-19 period. Despite high-risk presenting characteristics, they were less likely to receive timely reperfusion treatment for STEMI with an absolute increase of 30 min 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 COVID-19 pandemic due to restructuring of healthcare system, resource allocation and increased fear of nosocomial COVID-19 infection. BAME patients who did undergo PCI during COVID-19 had very similar clinical characteristics and risk profile compared with BAME patients in the pre-COVID-19 group but overall had higher comorbid burden and disease complexity compared with white patients.

We observed higher mortality in BAME communities during the COVID-19 period compared with the pre-COVID-19 period, particularly after the lockdown measures were introduced in the UK. Excess COVID-19 infection mortality among BAME communities is widely reported during the current COVID-19 outbreak, and there is a growing concern that this may be related to underlying health status, concurrent acute medical presentation such AMI, stroke or thromboembolic disease, in addition to the known social and health status determinants.[20 S31] Although, we did not have information regarding the COVID-19 infection in our study, there appears to be an increased risk of in-hospital and early 7-day mortality in the BAME communities that 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 COVID-19 pandemic. It is possible that the overall increase in mortality among 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.[S32 S33] These data highlight the need to promote health awareness among 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 COVID-19 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 did not have information regarding the COVID-19 infection status of these patients and were unable to study the direct impact of COVID-19 infection in this high-risk group. The limited or incomplete data submissions by the hospital during the COVID-19 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 does not allow us to establish a causal relationship between COVID-19 and increased mortality in the BAME group.

Key messages

What is already known on this subject?

- Studies have found an increased risk of mortality in the black, Asian and minority ethnic (BAME) communities during the COVID-19 pandemic.

What might this study add?

- This population-based cohort study provides important information about the incidence, clinical and procedural characteristics of BAME patients presenting with acute myocardial infarction (AMI) compared with whites during COVID-19 pandemic in England. There was a marked increase in the admission rates with AMI among the BAME during the COVID-19 pandemic compared with pre-COVID-19 period. BAME patients during COVID-19 were less likely to receive guideline indicated care and had increased mortality compared with 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.

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 with 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 among 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.

Author affiliations
[1]Keele Cardiovascular Research Group, School of Medicine, Keele University, Keele, UK
[2]Department of Cardiology, Royal Stoke University Hospital, Stoke On Trent, UK

[3]NIHR Cardiovascular Biomedical Research Unit, Bart's Heart Centre, London, UK
[4]Department of Cardiology, University Hospital of Wales, Cardiff, UK
[5]Coronary Research Group, University Hospital Southampton NHS Foundation Trust, Southampton, UK
[6]Department of Cardiology, Freeman Hospital, Newcastle upon Tyne, UK
[7]National Institute for Cardiovascular Outcomes Research, Bart's Health NHS Trust, London, UK
[8]Institute of Cardiovascular Sciences, University College London, London, UK
[9]Division of informatics, Imaging and Data Science, Faculty of Biology, Medicine and Health, University of Manchester, Manchester, UK
[10]Leeds Institute for Data Analytics, University of Leeds, Leeds, UK
[11]Department of Cardiology, Leeds Teaching Hospitals NHS Trust, Leeds, UK
[12]Department of Medicine, Thomas Jefferson University, Philadelphia, Pennsylvania, USA

Twitter Muhammad Rashid @drrashid05, Nick Curzen @NickCurzen, Chris P Gale @cpgale3 and Mamas Mamas @MMamas1973

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ORCID iDs
Muhammad Rashid http://orcid.org/0000-0001-9725-1583
Adam Timmis http://orcid.org/0000-0003-1419-112X
Nick Curzen http://orcid.org/0000-0001-9651-7829
Mohamed O Mohamed http://orcid.org/0000-0002-9678-5222
Glen Philip Martin http://orcid.org/0000-0002-3410-9472
Jianhua Wu http://orcid.org/0000-0001-6093-599X

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