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PII: S2589-790X(21)00268-7

DOI: <https://doi.org/10.1016/j.cjco.2021.09.026>

Reference: CJCO 446

To appear in: *CJC Open*

Received Date: 13 June 2021

Revised Date: 17 September 2021

Accepted Date: 26 September 2021

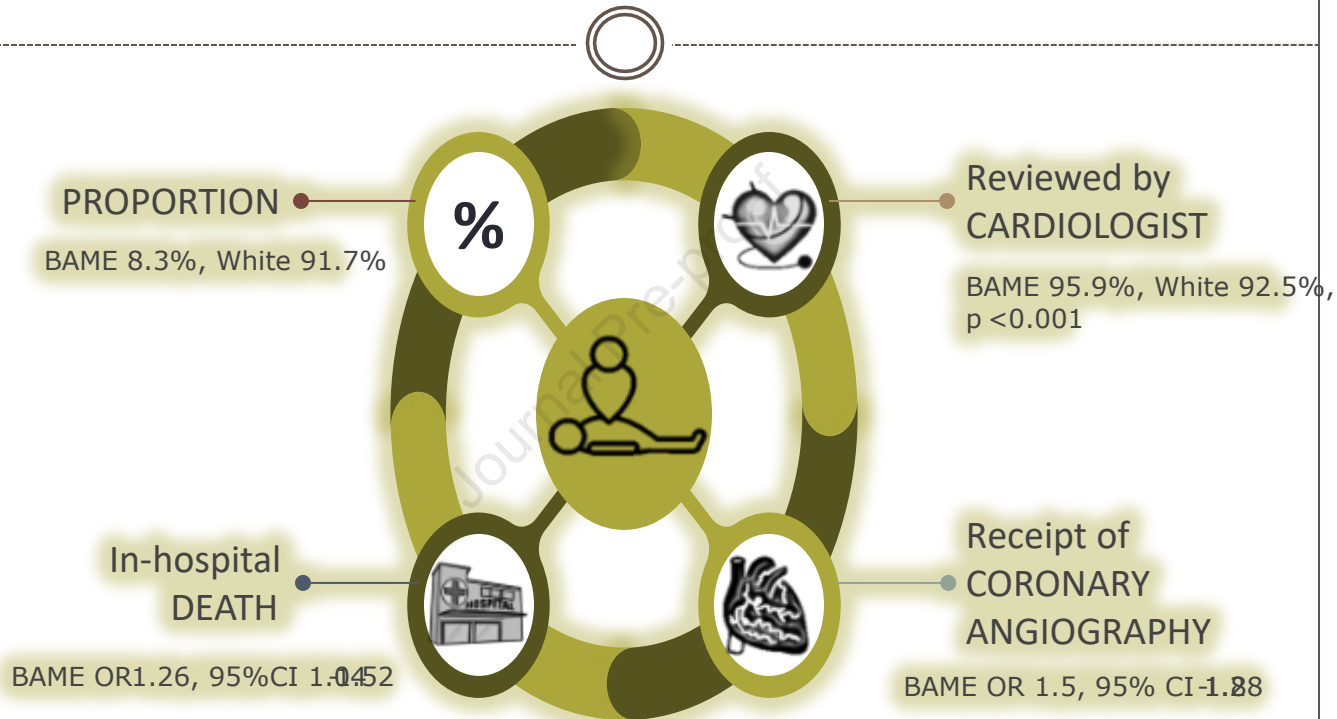
Please cite this article as: M. Dafaalla, M. Rashid, R.M Bond, T. Smith, P. Parwani, R. Thamman, S.M Moledina, M.M Graham, M.A. Mamas, Racial disparities in management and outcomes of out-of-hospital cardiac arrest complicating myocardial infarction; a national study from England and Wales, *CJC Open* (2021), doi: <https://doi.org/10.1016/j.cjco.2021.09.026>.

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BAME vs White in AMI with OHCA



Racial disparities in management and outcomes of out-of-hospital cardiac arrest complicating myocardial infarction; a national study from England and Wales

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Abstract

Background:

Studies of racial disparities in patients admitted with an OHCA in the setting of AMI have shown inconsistent results. Whether these differences in care exist in a universal healthcare system in England is unknown.

Methods:

Patients admitted with a diagnosis of AMI and OHCA between 2010 to 2017 from the Myocardial Ischaemia National Audit Project (MINAP) were studied. All patients were stratified based on ethnicity into Black, Asian, and Minority Ethnic (BAME) group versus White group. We used multivariable logistic regression models to evaluate the predictors of clinical outcomes and treatment strategy.

Results:

From 14,287 patients admitted with AMI complicated by OHCA, BAME patients constituted a minority of patients (1,185(8.3%)) compared to White group (13,102(91.7%)). BAME patients were younger (BAME median age (IQR) 58(50-70) years, White group median age (IQR) 65(55-74) years). Cardiogenic shock (BAME 33%, White group 20.7%, $p < 0.001$) and severe LV impairment (BAME 21%, White group 16.5%, $p = 0.003$) were more frequent among BAME patients. BAME patients were more likely to be seen by a cardiologist (BAME 95.9%, White group 92.5%, $p < 0.001$) and were more likely to receive coronary angiography than the White group (OR 1.5, 95% CI 1.2-1.88). The BAME group had significantly higher in-hospital mortality (OR 1.26, 95% CI 1.04-1.52) and re-infarction (OR 1.52, 95% CI 1.06-2.18) than the White group.

Conclusion:

BAME patients were more likely to be seen by a cardiologist and receive coronary angiography than White group. Despite this, the in-hospital mortality of BAME patients, particularly the Asian population, was significantly higher.

Brief Summary

Most studies of racial disparities in AMI with OHCA used data from the United States, with a lack of studies in Europe and United Kingdom. We used the Myocardial Ischaemia National Audit Project (MINAP) to study the racial disparities on care and outcomes of AMI with OHCA between 2010 and 2017. While BAME patients were more likely to receive coronary angiography than the White group, the in-hospital mortality of BAME patients, particularly the Asian population, was significantly higher.

Introduction

Out-of-hospital cardiac arrest (OHCA) is a major cause of cardiovascular mortality^{1,2}. Approximately 275,000 persons experience OHCA in Europe annually, with only 29,000 persons surviving to hospital discharge³. Ethnicity is an important factor in determining an individual's place of residence, socioeconomic status, and access to cardiopulmonary resuscitation in the community, factors which are known to be associated with significant variation in the response to and outcomes of OHCA^{4,5}.

While many studies have assessed racial differences in the care of OHCA complicated by an AMI, the results have been inconsistent⁶⁻⁹. Some studies suggested that clinical outcomes were worse in the ethnic minorities compared to the White population^{6,7,10}. These studies attributed these racial disparities to various factors that affect community response, such as socioeconomic status, lack of awareness in recognition of symptoms, delay in seeking early medical help, and implicit bias from the treating physicians^{4,5}. For instance, a meta-analysis of racial disparities in outcomes of OHCA complicating AMI in the United States showed that Black population have worse outcomes than the White populations⁶. Most studies of racial disparities in AMI with OHCA used data from the United States (US), with a lack of studies that examined OHCA characteristics and survival in Europe and United Kingdom⁶. Data from the United Kingdom can give additional insights on the impact of racial disparities because of differences in population structure compared to the United States, and the availability of a universal healthcare access through the National Health Service (NHS). The NHS is a universal public sector system that provides universal access to health services to the whole population independent of their socioeconomic status. In contrast, access to United States healthcare systems and the quality of care received depend, to a greater extent, on patient's socioeconomic status and their medical insurance coverage. This means that individuals in the lower socioeconomic strata of society are unable to afford health care expenses despite large governmental expenditure, disproportionately placing the Black population at a disadvantage^{11,12}.

We used the Myocardial Ischaemia National Audit Project (MINAP), a national registry of AMI hospitalization in England and Wales, to study the impact of patients' ethnicity on the processes of care, and clinical outcomes of patients admitted with AMI complicated by OHCA between 2010 and 2017.

Methods:

Study design

The MINAP is a national cardiac audit that collects information around the presenting profile and clinical care of patients hospitalised with diagnosis of AMI in England^{13–15}. The data collected are utilised for auditing quality of care and public reporting of AMI patients and also provides a resource for academic research^{12,14,16}. The database contains information about patient demographics, admission time and method, cardiovascular comorbidities, clinical characteristics, relevant investigations, in-hospital pharmacological and interventional treatments, in-hospital outcomes and discharge treatments^{15,17}.

Study population

The cohort for this study included all patients aged >18 years, admitted with a final diagnosis of AMI (either STEMI or non-ST-segment myocardial infarction (NSTEMI)) and OHCA between January 1, 2010 and March 31, 2017. The discharge diagnosis of AMI was established by the treating clinician according to the presenting history, clinical examination, and the results of inpatient investigations based on the consensus document of the Joint European Society of Cardiology and American College of Cardiology¹⁸. The total number of patients diagnosed with AMI was 664,740. Of those, the number of patients who didn't present with OHCA was 511,329 patients. Patients with missing data including ST elevation on presentation (41,124 patients), ethnicity (55,153 patients), cardiac arrest site (22,140 patients), and in-hospital mortality information (20,707 patients) were excluded from the analysis. The final number of patients included in the cohort was 14,287 patients (Supplementary figure S1).

MINAP define the patient's ethnic group based on patient self-reporting based on categories used to capture race that are used nationally in this and other national electronic health records. All patients were stratified into two groups based on the ethnicity into Blacks, Asians, and Minority Ethnic (BAME) group versus Whites ethnicity group. The BAME group included those whose race was recorded as Blacks (including Caribbean, African, Black British, and any other Blacks background), Asians (including Indian, Pakistani, Bangladeshi, Asian British, any other Asian Background – but excluding Chinese) and other Non-Whites ethnicity (including Chinese). We collected detailed information on patient characteristics, clinical presentations, comorbidities, and discharge pharmacology. The outcomes of interest were in-hospital mortality, re-infarction, major bleeding, and utilization of coronary angiography and PCI. In-hospital major bleeding was defined as a composite of intracranial

bleeding, retroperitoneal bleeding, and any bleeding with $>3\text{g/L}$ fall in haemoglobin concentration.

Ethical approval

Ethical approval was not required for this study under current arrangements by the National Health Service (NHS) research governance because MINAP database was collected and used for research purposes without informed patient consent by the National Institute for Cardiovascular Outcomes Research under section 251 of the National Health Service Act 2006¹⁹.

Data quality:

MINAP tackles oversight by providing guidance and technical advice for staff entering data via a dedicated helpdesk, and consistently by using error-checking routines in MINAP data application. The completeness of 20 key fields is closely monitored and is generally above 95%. These fields include NHS number, discharge diagnosis, hospital mortality and secondary prevention medication prescribed at discharge. A data validation exercise is done annually and requires every hospital to re-enter 20 data items from the medical records of 20 randomly selected patients, using a specially designed data validation tool¹⁶.

Statistical analysis

We described the baseline characteristics as number and percentage for categorical variables, and as median and interquartile range (IQR) for continuous variables. Chi-square test and t-test were used to test for statistical significance between categorical and continuous variables respectively. The Kruskal Wallis test was used for skewed data. We used multiple imputation techniques with chained equations to account for the missing data. Age, sex, ethnicity, clinical diagnosis, and in-hospital mortality were registered as regular variables in the imputations model, while all other variables, including body mass index, seen by cardiologists, left ventricular (LV) systolic function, previous percutaneous coronary intervention (PCI), coronary artery bypass graft (CABG), heart failure, hypercholesterolemia, angina, cerebrovascular disease, peripheral vascular disease, creatinine levels, diabetes, hypertension, smoking status, asthma or COPD, family history of coronary disease, in-hospital use of low-molecular-weight heparin, warfarin, loop diuretics, oral beta blockers, and

angiotensin-converting enzyme inhibitor were imputed (Supplementary table S1). The variable selection in the model was based on previous studies using the MINAP registry and prior clinical knowledge¹⁴. Using these models, 10 imputed datasets were generated which were used to perform all the analyses. Multivariable logistic regression models were used to study the association between ethnicity and clinical outcomes. We undertook a sensitivity analyses to compare and contrast clinical characteristics, management strategies and clinical outcomes amongst Black population, Asian population, other Non-Whites ethnic minority (Other) and used the White group as a reference. All models included the same variables used in the multiple imputation models as well as the year of admission. Estimates in the form of odds ratios (ORs) and 95% confidence intervals (95% CIs) were reported. Statistical significance was considered with an alpha of 0.05 in all the 2-sided tests used. Stata version 14.1 was used to perform all the analyses.

Results:

Patients' characteristics:

From 14,287 patients admitted with AMI complicated by OHCA, BAME patients constituted the minority of patients (8.3%). BAME patients were younger (BAME median age (IQR) 58(50-70) years, White group median age (IQR) 65(55-74) years) with a lower proportion of females (BAME 18.0%, White group 23.2%, $p < 0.001$). Cardiogenic shock (BAME 33%, White group 20.7%, $p < 0.001$) and severe LV impairment (BAME 21%, White group 16.5%, $p = 0.003$) was more frequent amongst BAME patients. Cardiometabolic risk factors were more prevalent in BAME patients than White group patients, particularly diabetes (BAME 31%, White group 13%, $p < 0.001$), hypertension (BAME 48%, White group 41%, $p < 0.001$), hypercholesterolemia (BAME 35%, White group 26%, $p < 0.001$), heart failure (BAME 6.5%, White group 4.6%, $p = 0.008$), and chronic kidney disease (BAME 5.2%, White group 3.8%, $p = 0.024$). Table 1 shows the patients' characteristics and clinical presentation of AMI patients with OHCA. The proportion of AMI patients with OHCA from the BAME group tripled from around 4% in 2010 to 12% in 2017 (figure 1).

Processes of care:

BAME patients were more likely to be seen by a cardiologist (BAME 95.9%, White group 92.5%, $p < 0.001$), receive coronary angiography (BAME 88%, White group 79.6%, $p < 0.001$), and receive PCI (BAME 45%, White group 39.5%, $p = < 0.001$). Administration of dual antiplatelet therapy (BAME 75.6%, White group 77.6%, $p = 0.12$) and most of the other evidence-based medication like beta blockers (BAME 70.2%, White group 70.1%, $p = 0.93$) and fondaparinux (BAME 11.9%, White group 14.1%, $p = 0.054$) in BAME group was relatively similar to the White group as illustrated by table 2. However, ACEI (BAME 59.9%, White group 54.7%, $p = 0.002$) were more commonly administered in the BAME group whereas statins (BAME 55%, White group 58.2%, $p = 0.034$) were more commonly administered in the White group. After adjusting for baseline risk factor differences, BAME group were more likely to receive coronary angiography than the White group (OR 1.5, 95%CI 1.2-1.88) (Supplementary table S2).

Clinical outcomes:

The BAME group had higher crude in-hospital mortality (BAME 31.2%, White group 26.6%, $p < 0.001$) and re-infarction (BAME 3.6%, White group 2.3%, $p = 0.008$) rates than the Whites group. The bleeding rate was not significantly different between the two groups (BAME 2.8%, White group 3.1%, $p = 0.63$). The crude in-hospital mortality in White group has not changed over the last decade, in contrast, in-hospital mortality in BAME patients doubled from around 16% in 2010 to around 30% in 2017 (figure 2).

After adjusting for the comorbidities and in-hospital management, BAME group had significantly higher in-hospital mortality (OR 1.26, 95%CI 1.04-1.52) and re-infarction (OR 1.52, 95%CI 1.06-2.18) than the White group as shown in table 3.

Sensitivity analysis:

We did a sensitivity analysis to compare the clinical characteristics, management strategies and clinical outcomes amongst Black population, Asian population, other Non-Whites ethnic minority (Other) and used the White group as a reference. Clinical characteristics for each ethnic group are presented in supplementary table S3, whereas pharmacotherapy, management strategies, and crude in-hospital clinical outcomes in supplementary table S4. After adjustment, Black population in-hospital death (OR 0.88, 95% CI 0.52-1.5) and receipt

of coronary angiography (OR 1.5, 95% CI 0.84-2.77) were similar to the White population. In contrast, in-hospital death was higher in the Asian population (OR 1.4, 95% CI 1.1-1.78). Table 4 shows the clinical outcomes of the individual racial groups that make up the BAME group.

Discussion:

In this national cohort of AMI patients presenting with OHCA, BAME patients were younger, had a relatively higher risk comorbidity profile, and were sicker at the time of presentation with a greater frequency of STEMI, cardiogenic shock, and severe left ventricular impairment compared to the White population. BAME patients also had a relatively higher frequency of cardiovascular comorbidities like diabetes, hypertension, and history of previous PCI. Administration of evidence-based medications and processes of care in BAME patients were often better, with BAME patients more likely to be seen by a cardiologist and to receive coronary angiography than the White population. Despite this, the in-hospital mortality of BAME patients was significantly higher than their White counterparts, with the worst outcomes seen in the Asian population.

Notably, BAME patients often had better administration of evidence-based medications and process of care compared to the White population. The BAME population were much younger than the White population, sicker at time of presentation, and with higher prevalence of cardiovascular risk factors. This might have encouraged physicians to adopt a more invasive approach for management of the BAME patients. Furthermore, BAME patients were more likely to present with STEMI, which may also contribute to higher rates of coronary angiography use in this patient population. The MINAP registry does not capture data around optimization to target which is an important component of quality of care, and so cannot inform whether there are significant differences in the patient groups studied

Previous studies on the link between ethnicity and in-hospital management of OHCA revealed that ethnic minorities had lower rate of inpatient cardiac procedures compared to Whites. For instance, a registry study from the Los Angeles County Emergency Medical Services system in 2019 revealed that minority groups, particularly the Black and Asian populations, had a lower frequency of in-hospital interventions like the coronary angiography and PCI²⁰. Groeneveld et al examined the rates of cardiac procedure utilization and long-term survival after cardiac arrest. Their study showed that the Black population was less likely to undergo potentially life-saving procedures²¹. In the current analysis of a national cohort of AMI

with OHCA from England and Wales, we report that BAME patients had better access to some aspects of the inpatient management like receiving cardiologist input and use of coronary angiography and PCI. These findings suggest that in contrast to the studies performed in the United States, there are no significant racial disparities in the in-hospital management of AMI patients presenting with OHCA, and that the differences in the in-hospital processes of care might not contribute to the lower survival rate reported in BAME patients in the United Kingdom.

The low survival rates in BAME patients reported in the earlier studies from the United States were attributed to different factors related to the community response like delayed identification of OHCA, longer response time, lack of awareness about OHCA management, and the socioeconomic factors along with other social determinants of health²²⁻²⁴. To the best of our knowledge, this is the first national study from Europe to address the racial disparities in management and outcomes of AMI complicated by OHCA. Our study shows that the crude mortality rates in BAME population doubled over the study period in contrary to the White population where the in-hospital mortality rate remained relatively stable. Despite being younger and having similar in-hospital care compared to the White population, BAME patients had higher odds of in-hospital death. The survival following OHCA depends to a great extent on a “chain of survival” that begins by early recognition of OHCA and activation of the emergency response system; cardiopulmonary resuscitation (CPR); defibrillation; advanced life support, and integrated care after OHCA²⁵. The efficiency of this chain of survival is linked to socioeconomic status and neighbourhood characteristics^{4,5}. For example, Sasson et al analyzed a large cohort from the CARES registry in the United States and found that patients who had an OHCA in low-income Blacks’ neighborhoods were less likely to receive bystander-initiated CPR than those in high-income Whites neighborhoods⁴. Likewise, a recent study revealed that patients with low socioeconomic status receive delayed cardiopulmonary resuscitation⁵. The socioeconomic status and level of education were also linked to the CPR training disparities, with the White population being trained in CPR more frequently than BAME minorities^{26,27}. As BAME patients tend to have lower socioeconomic status and live in lower income neighbourhood compared to the White population in the United Kingdom²⁸, they have a higher risk of delayed OHCA identification, less efficient chain of survival, and subsequently worse clinical outcomes. Moreover, neighbourhoods with higher incidence of OHCA and low bystander CPR had a greater proportion of population from ethnic minorities and people not born in UK²⁹. The outcomes of the BAME minorities can be improved by

providing training on CPR and defibrillators to the BAME community members, ensuring adequate availability of defibrillators in the neighbourhoods, and engaging the community centres and leaders in improving the community awareness about the importance of the pre-hospital management of OHCA.

Our subgroup analysis showed that the Black population had similar survival rate and revascularization rate to the White population, but the Asian population had higher risk of in-hospital death and higher rates of coronary angiography and revascularization than the White population. In contrast to our results, Shah et al study on the outcomes of OHCA in South Asian population revealed that the quality of care and admission to survival rates in the South Asian group were comparable to the White population³⁰. While the reasons behind the lower survival rates we reported in the Asian group cannot be fully explained by this study, especially with the small number of Black and Asian patients in the MINAP registry, clinicians and policy makers may be interested in studying the pre-hospital factors that may be contributing to the lower survival rate in the Asian population as a step forward to reduce mortality in this group.

One of the main strengths of this study is that we are able to study whether there are racial disparities in the management and outcomes of AMI presenting with OHCA from a national registry in which the data were collected prospectively over a long period of time. This study also has limitations that should be considered when interpreting the results. First, as the MINAP registry is an in-hospital AMI registry, it only captures OHCA that complicates AMI and patients who survived to hospital admission. It provides no insight into outcomes of other types of OHCA, which may also have racial disparities. Second, the MINAP database lacks information regarding long term mortality and other outcomes and does not capture the appropriateness of treatment decisions related to coronary angiography and inpatient management nor adherence and optimal titration of evidence-based medications. There are no data related to intensive care management like post resuscitation cooling and ventilation. Finally, the MINAP registry does not provide any insight into the time to return of spontaneous circulation of OHCA in the community, or the management and quality of care prior to hospital admission. MINAP does not capture whether differences in the processes of care between both study groups is attributable to a higher prevalence of contra-indications to coronary angiography in the White group. Although MINAP provide an insight about the neurologic deficit immediately after the OHCA, it doesn't include information about the long-term survival free from neurologic deficit.

To conclude, BAME patients are increasingly presenting with AMI complicated by OHCA and have significantly higher in-hospital mortality compared to the White population despite of the consistent inpatient management. The differences in the community response and neighborhood characteristics that interfere with the chain of survival in BAME patients should be studied and addressed in order to close the gap in the in-hospital survival between the BAME and White population.

Declarations of interest: none to declare

Funding Sources: none to declare

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Table 1: Patients' characteristics and clinical presentation of AMI patients with OHCA

Level	White	BAME	p-value
N	13102	1185	
Age (years), median (IQR)	65.0 (55.0, 74.0)	58.0 (50.0, 70.0)	<0.001
Women	3045 (23.2%)	213 (18.0%)	<0.001
BMI, median (IQR)	26.9 (24.0, 30.2)	26.3 (23.2, 29.5)	0.35
Clinical diagnosis			
STEMI	10027 (76.5%)	973 (82.1%)	<0.001
NSTEMI/UA	3075 (23.5%)	212 (17.9%)	
Site of infarction			
anterior	4298 (48.2%)	493 (55.5%)	<0.001
inferior	3074 (34.4%)	246 (27.7%)	
posterior	492 (5.5%)	38 (4.3%)	
lateral	450 (5.0%)	48 (5.4%)	
indetermined	610 (6.8%)	63 (7.1%)	
Killip class			
Killip class I	5357 (62.4%)	434 (49.9%)	<0.001
Killip class II	1020 (11.9%)	97 (11.2%)	
Killip class III	427 (5.0%)	44 (5.1%)	
Killip class IV (shock)	1781 (20.7%)	294 (33.8%)	
LV function			
Good *	2720 (26.2%)	248 (25.7%)	0.003
Moderate	3315 (31.9%)	296 (30.7%)	
Poor	1716 (16.5%)	203 (21.1%)	
Creatinine (mmol/l), median (IQR)	94.0 (78.0, 116.0)	97.0 (81.0, 126.0)	0.11
Elevated cardiac enzymes	11176 (97.1%)	939 (93.2%)	<0.001
Angina pectoris	1636 (14.4%)	162 (15.4%)	0.41
Previous MI	1982 (17.3%)	199 (18.8%)	0.22
Diabetes	1614 (13.4%)	334 (30.8%)	<0.001
Hypertension	4649 (40.6%)	511 (48.2%)	<0.001
Hypercholesterolemia	2934 (26.1%)	365 (35.1%)	<0.001
Smoking			
Never	3989 (37.4%)	527 (53.6%)	<0.001
Ex-smoker	2613 (24.5%)	145 (14.7%)	
Smoker	4056 (38.1%)	312 (31.7%)	
FH of coronary artery disease	2226 (23.8%)	167 (18.4%)	<0.001
Previous PCI	883 (7.7%)	134 (12.7%)	<0.001
Previous CABG	581 (5.1%)	50 (4.7%)	0.64

Stroke	713 (6.3%)	75 (7.1%)	0.28
Peripheral vascular disease	453 (4.0%)	20 (1.9%)	<0.001
Heart failure	525 (4.6%)	68 (6.5%)	0.008
Chronic kidney disease	429 (3.8%)	54 (5.2%)	0.024
Asthma/COPD	1378 (12.1%)	94 (8.9%)	0.002

* LV function assessment is based of ejection fraction measurement on transthoracic echocardiography
 BAME=black, Asian, and minority ethnic, , COPD= chronic obstructive pulmonary disease, CABG=
 coronary artery bypass graft, FH= family history, IQR= Interquartile range, LV= left ventricle, MI=
 myocardial infarction, PCI= percutaneous intervention, SD= standard deviation, STEMI: ST elevation
 myocardial infarction, NSTEMI: non ST elevation myocardial infarction

Table 2: Processes of care and unadjusted clinical outcomes of AMI patients with OHCA

Level	White	BAME	p-value
N	13102	1185	
Seen by cardiologist	11950 (92.5%)	1123 (95.9%)	<0.001
LMWH	5379 (50.0%)	430 (43.9%)	<0.001
Unfractionated heparin	4497 (42.1%)	378 (38.7%)	0.044
Fondaparinux	1507 (14.1%)	115 (11.9%)	0.054
Aspirin	11674 (93.4%)	1075 (94.8%)	0.069
GP IIIa/IIb inhibitors	1716 (15.7%)	161 (16.3%)	0.64
P2Y12 inhibitors	10064 (81.8%)	881 (80.3%)	0.21
DAPT	9700 (77.6%)	857 (75.6%)	0.12
Furosemide	3066 (28.8%)	272 (28.4%)	0.78
Oral beta blockers	7471 (70.1%)	682 (70.2%)	0.93
Discharged on beta blockers	7201 (56.8%)	629 (53.9%)	0.053
ACEI	5915 (54.7%)	584 (59.9%)	0.002
Statins	7371 (58.2%)	643 (55.0%)	0.034
Coronary angiography	10031 (79.6%)	1013 (88.2%)	<0.001
PCI	3707 (39.5%)	412 (45.4%)	<0.001
CABG	368 (3.9%)	34 (3.7%)	0.80
In-hospital death	3491 (26.6%)	370 (31.2%)	<0.001
Re-infarction	286 (2.3%)	40 (3.6%)	0.008
Bleeding	397 (3.1%)	33 (2.8%)	0.63

CABG= coronary artery bypass graft, DAPT= Dual antiplatelet therapy, IQR= Interquartile range, LV= left ventricle, MI= myocardial infarction, PCI= percutaneous intervention, SD= standard deviation, STEMI: ST elevation myocardial infarction, NSTEMI: non ST elevation myocardial infarction

Table 3: adjusted clinical outcomes of AMI patients with OHCA and ethnicity (reference-White patients)

	White	BAME OR(95% CI)
In-hospital death	Reference	1.26(1.04-1.52)
Re-infarction	Reference	1.52(1.06-2.18)
Bleeding	Reference	0.88(0.61-1.29)

Table 4: Sensitivity analysis of clinical outcomes of AMI with OHCA and ethnicity

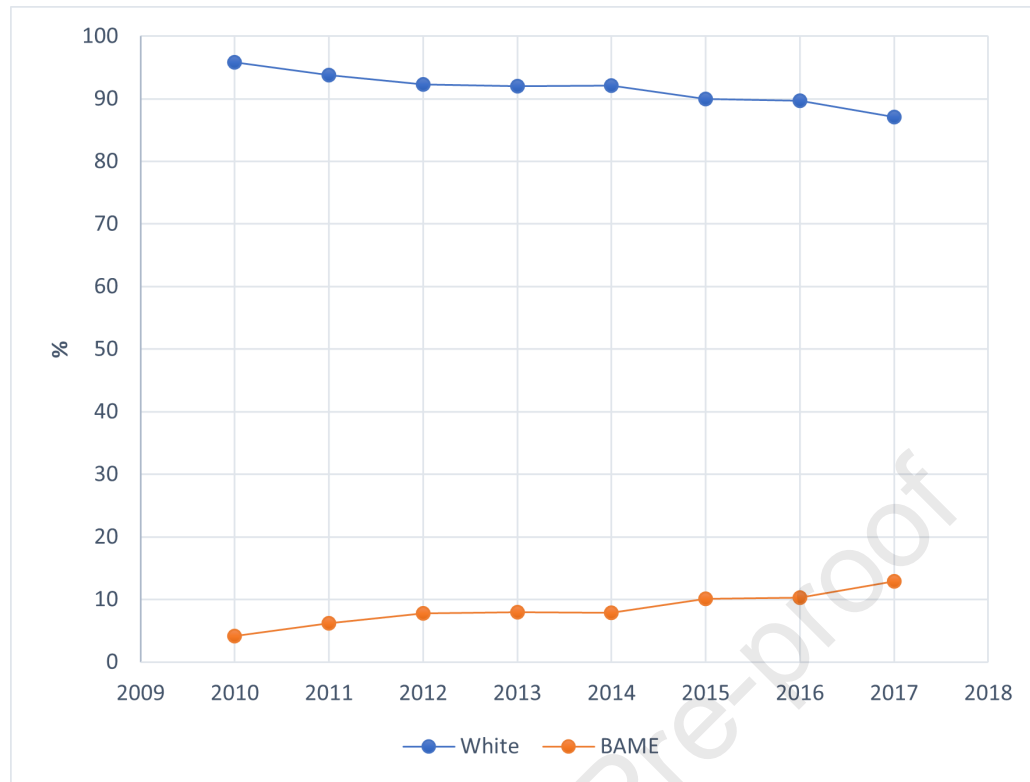
	White	Black OR(95% CI)	Asian OR(95% CI)	Other ethnicities OR(95% CI)
In-hospital death	Reference	0.88(0.52-1.51)	1.4(1.10-1.78)	1.17(0.85-1.62)
Re-infarction	Reference	2.1(0.89-1.5)	1.79(1.17-2.73)	0.8(0.34-1.8)
Bleeding	Reference	0.7(0.21-2.2)	1.05(0.67-1.66)	0.67(0.32-1.37)
Receipt of coronary angiography	Reference	1.53(0.84-2.77)	1.38(1.05-1.82)	1.81(1.18-2.78)

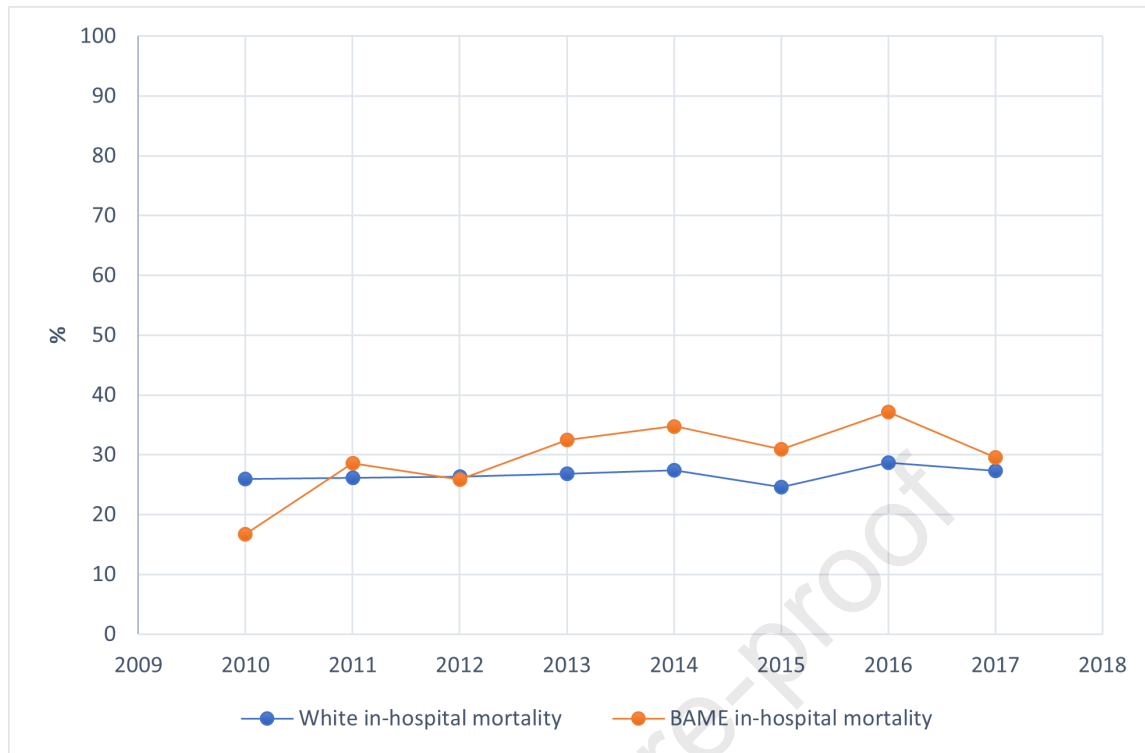
Figures' legends

Figure 1: Proportion of AMI patients with OHCA from BAME ethnicity

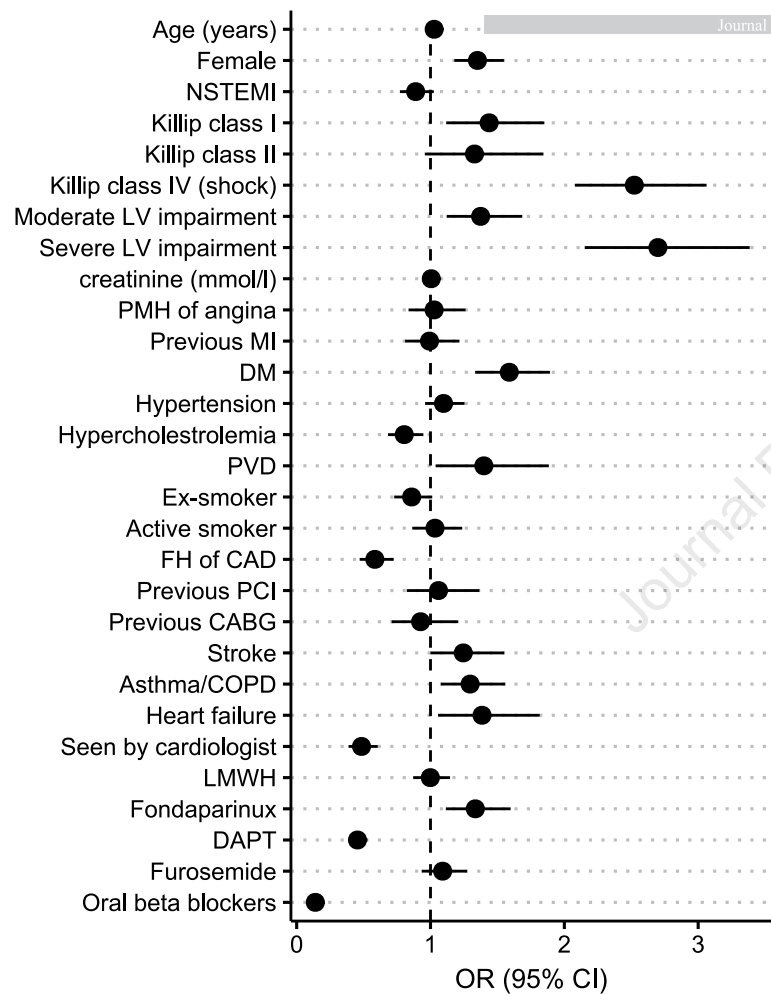
Figure 2: Crude in-hospital mortality rate of AMI patients with OHCA from BAME ethnicity

Figure 3: Independent predictors of in-hospital mortality of white and BAME patients





independent predictors of mortality of white AMI patients with OHCA



independent predictors of mortality of BAME AMI patients with OHCA

