

Uncovering Gender Disparities in Secondary Care for Major Adverse Cardiovascular Events (MACE): Insights From the Hospital Episodes Statistics (HES) Database

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INTRODUCTION

- Gender-based differences in healthcare are well documented and occur for various reasons, not least because men have been considered as the "default patient" in clinical practice and medical research historically.¹
- Cardiovascular disease (CV) is an area with known gender-based disparities, with the British Heart Foundation describing the "heart attack gender gap", where women are more than twice as likely to die of coronary heart disease than breast cancer.²
- This study aims to explore the CV gender gap further by using real-world data from the UK to better understand potential differences in the and survival of patients admitted to hospital with a major adverse cardiovascular event (MACE).

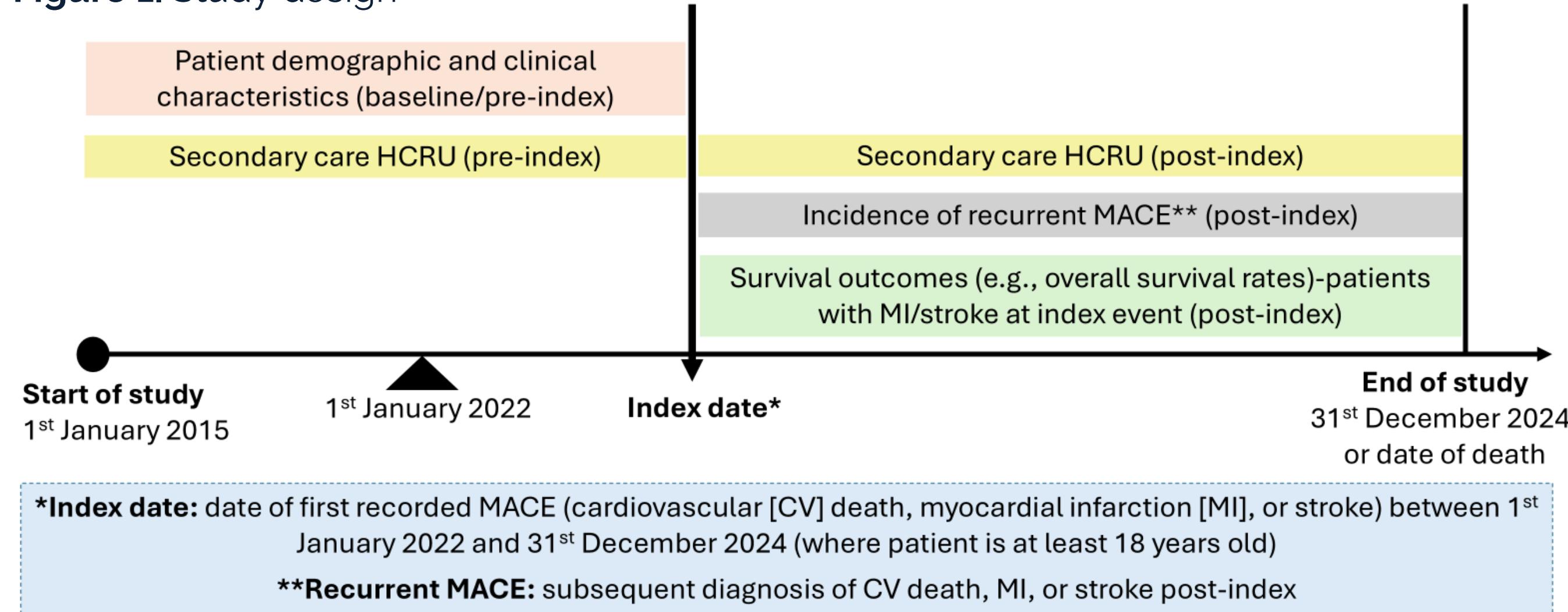
OBJECTIVES

- To describe and compare the demographics and clinical characteristics by patient gender at the time of the first MACE³ and at any subsequent MACE (for those with recurrent events)
- To describe and compare secondary care healthcare resource utilization (HCRU) pre- and post- MACE diagnosis, by patient gender
- To describe and compare the incidence of recurrent MACE diagnoses following a first composite MACE, by patient gender
- To describe and compare mortality outcomes following a first MACE by patient gender, including all-cause and CV-specific mortality.

METHODS

- Study design:** An observational cohort study based on the Hospital Episode Statistics administrative database of hospital admissions, linked to the Office for National Statistics death registration data in the United Kingdom.
- Study population:** Adult patients (≥ 18 years old) with a first-ever diagnosis of a MACE (cardiovascular death, myocardial infarction, or stroke)³ between 1st January 2022 and 31st December 2024, inclusively (eligibility period) (Figure 1).

Figure 1. Study design



Statistical analysis

- T-tests, χ^2 test, and Fisher's exact test were used to compare the differences in patient characteristics.
- Incidence rate ratios (IRRs) were estimated using generalized linear regression models, adjusting for gender, age, Charlson comorbidity index, Index of Multiple Deprivation, ethnicity, and prior CV history and fit to a large random sample of the overall cohort.
- Survival analyses used accelerated failure time models, adjusting for the confounders listed above.

RESULTS

- A total of 696,967 patients who experienced a MACE were included in the study, with women comprising 41.8% female, and men 58.2% of the cohort (Table 1).
- Men had over double proportion of prior revascularization procedures prior to first MACE (7.8%, $p < 0.001$), despite being a younger population with a lower burden of comorbid conditions.

Table 1. Baseline characteristics of patients experiencing a first MACE

	Female	Male	SMD
	N = 291,008	N = 405,959	
Age, years, Mean (SD)	77.32 (13.62)	71.49 (13.95)	-0.42
Charlson comorbidity index, N (%)	0 39,468 (14.0%)	71,680 (18.0%)	0.04
	1-2 4,327 (1.5%)	5,494 (1.4%)	0.00
	≥ 3 247,213 (85.0%)	328,785 (81.0%)	-0.04
Ethnicity, N (%)	White 237,093 (81.0%)	315,255 (78.0%)	-0.04
	Asian 12,963 (4.5%)	24,136 (5.9%)	0.01
	Black 6,651 (2.3%)	8,478 (2.1%)	0.00
	Other/mixed 4,847 (1.7%)	8,888 (2.2%)	0.01
	Missing 29,454 (10.0%)	49,202 (12.0%)	0.02
IMD, N (%)	Decile 1 (most deprived) 29,623 (10.0%)	43,378 (11.0%)	0.01
	Decile 5 29,376 (10.0%)	40,584 (10.0%)	0.00
	Decile 10 (least deprived) 26,291 (9.0%)	35,238 (8.7%)	0.00
	Missing 4,244 (1.5%)	7,446 (1.8%)	0.00
First MACE type, N (%)	CV death 108,499 (37.0%)	125,655 (31.0%)	-0.06
	Nonfatal acute MI 70,501 (24.0%)	146,998 (36.0%)	0.12
	Nonfatal stroke 112,008 (38.0%)	133,306 (33.0%)	-0.06
History of prior revascularization, N (%)	9,194 (3.2%)	31,498 (7.8%)	0.05

CV: cardiovascular; IMD: Index of Multiple Deprivation; MI: myocardial infarction; SD: standard deviation; SMD: standardized mean difference.

RESULTS (Cont.)

Incidence of recurrent MACE

- The first MACE experience by women were more frequently CV-deaths than they were for men (37% vs 31%, respectively, Figure 2).
- This trend continued for those with subsequent MACE, where women experienced a higher proportion of CV death than men (5.8% vs 4.2% at event #2, 11% vs 0.8% event).
- Recurrent MACE incidence was not significantly different between men and women when adjusting for confounders (IRR = 1.01 [95% CI: 1.00-1.02], $p = 0.078$, Figure 3).

Figure 2. Sankey diagram showing the flow of patients' MACE diagnoses throughout their follow-up up to a 4th incidence of MACE including patients with no further MACE (grey)

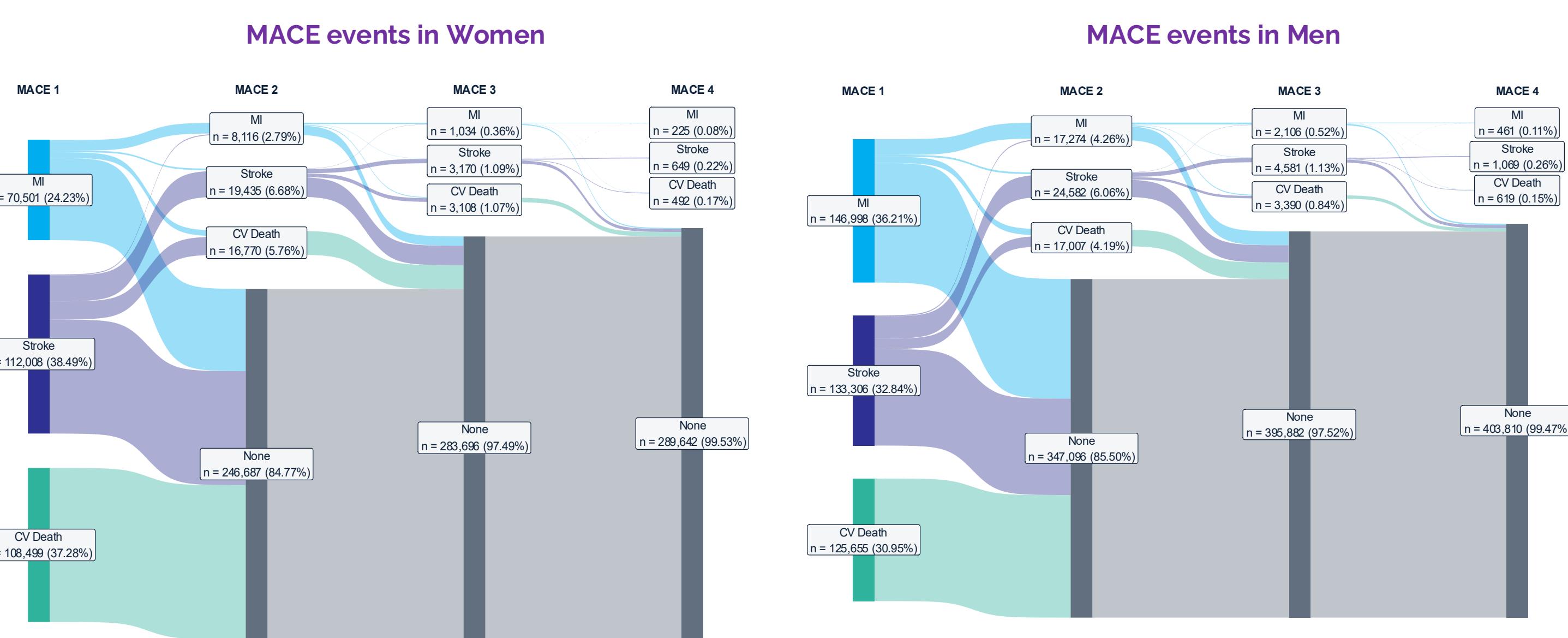
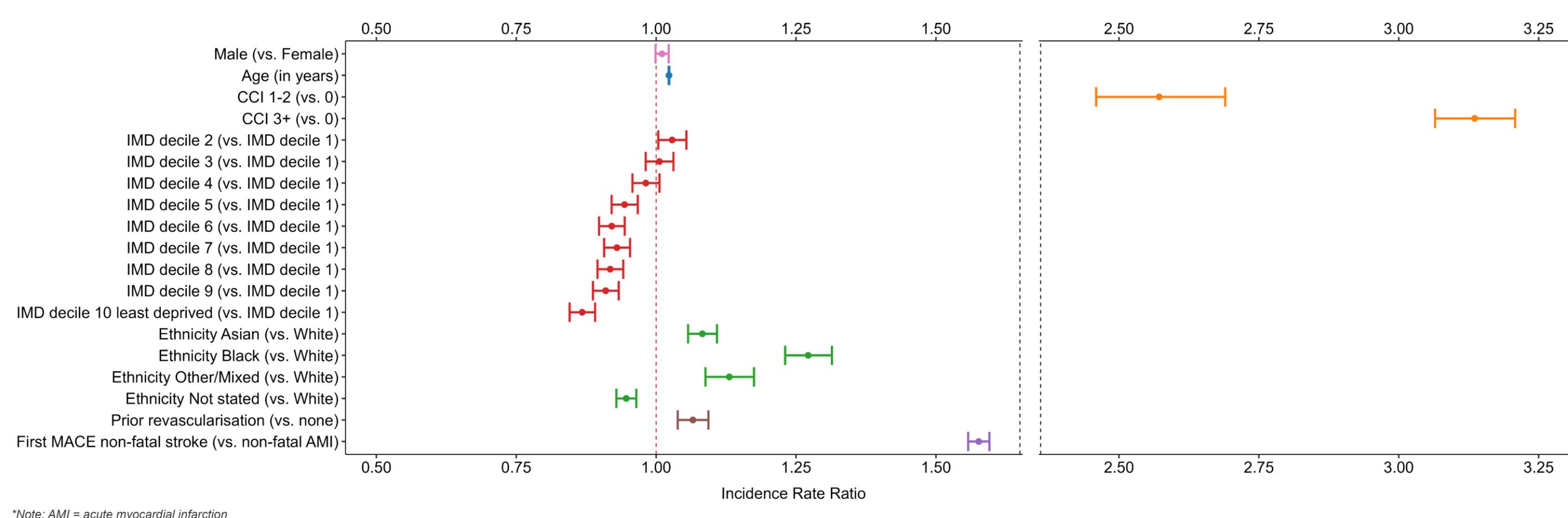


Figure 3. Incidence rate ratios (IRRs) of MACE incidence within the study population



Secondary HCRU pre- and post MACE

- Men and women had the same number of CV-related inpatient admissions in the period prior to their index MACE, with a mean = 1.2 admissions per patient year.
- Women had more inpatient admissions after a MACE, averaging 31.5 per patient-year compared with 27.9 for men ($p < 0.001$). When broken down by type:
 - Elective admissions were higher in men (19.3 vs. 18.5 per patient-year, $p < 0.001$).
 - Non-elective admissions were higher in women (21.8 vs. 17.4 per patient-year, $p < 0.001$).
- For index CV death, men had received more hospital-based care prior to their MACE than women (mean = 3.5 per patient year vs 3.0, respectively).

Survival post MACE

- Overall survival times were not different for men compared to women following a composite MACE (Acceleration Factor (AF) = 1.04 [95% CI: 0.99-1.08], $p = 0.113$).
- Age significantly accelerated time to death for patients (AF = 1.09 [95% CI: 1.09-1.10], $p < 0.001$).
- Increased burden of comorbid conditions was associated with a large acceleration in time to death (CCI of 3 or more AF = 6.26 [95% CI: 5.64-6.95], $p < 0.001$).
- White patients despite being at lower risk of MACE incidence overall were more likely to die sooner than patients with Asian or Other/Mixed backgrounds (AF = 0.77 [95% CI: 0.70-0.86] for Asians, AF = 0.77 [95% CI: 0.64-0.92] for Other/Mixed, both $p < 0.001$).

CONCLUSIONS

- Gender differences in MACE outcomes are complex: while men experience more events overall, our adjusted analyses show no clear disparity in incidence rates.
- Women tend to be older at first MACE, facing higher rates of cardiovascular death, including at subsequent MACE
- Patterns of MACE-related healthcare usage diverge between men and women: men receive more elective care before and after MACE, whilst women have higher rates of urgent and emergency admissions
- Deeper insight from more complete data sources would be beneficial for future research, understanding how and where patients engage with healthcare systems, and what factors drive these unequal rates of HCRU between men and women.
- Persistent inequalities across patient ethnicity and socioeconomic status underscore the importance of research into barriers to equitable cardiovascular care.

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