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Sex Differences in Dispatcher Suspicion of Acute Myocardial Infarction and Mobile Intensive Care Unit Dispatch During Emergency Calls for Chest Pain: A Secondary Analysis of a Prospective Multicentre Cohort.

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Abstract

Background

Sex-related differences may arise at the earliest stages of acute chest-pain assessment. We examined whether recorded sex was associated with dispatcher suspicion of acute myocardial infarction (AMI) and mobile intensive care unit (MICU) dispatch during physician-led emergency medical calls.

Methods

We performed a secondary analysis of a prospective multicentre cohort of adults hospitalized after calling one of four French physician-staffed emergency medical communication centres for non-traumatic chest pain. Associations between recorded sex and MICU dispatch or dispatcher suspicion of AMI were estimated using modified Poisson regression with sequential adjustment for cardiovascular risk factors and clinical presentation. Adjusted absolute probabilities were obtained by marginal standardization. Using independently adjudicated AMI as the clinical reference, sex-specific sensitivity, specificity, and false-negative rates were also estimated.

Results

Among 2,042 patients, 993 (48.6%) were female-recorded. AMI occurred in 6.9% of female-recorded and 18.7% of male-recorded patients. Dispatcher suspicion of AMI occurred in 25.1% versus 38.0%, and MICU dispatch in 33.4% versus 46.6%, respectively. After full adjustment, recorded female sex remained associated with lower probabilities of MICU dispatch (adjusted RR 0.85, 95% CI 0.77–0.95) and dispatcher suspicion of AMI (adjusted RR 0.81, 95% CI 0.71–0.92). Adjusted absolute differences were − 6.3 percentage points for both MICU dispatch and dispatcher suspicion. For dispatcher suspicion, sensitivity was 60.6% in female-recorded versus 67.2% in male-recorded patients, while specificity was 77.5% versus 68.7%. For MICU dispatch, sensitivity was 69.6% versus 80.6% and specificity 69.3% versus 61.3%.

Conclusions

Among hospitalized patients assessed for non-traumatic chest pain, dispatcher suspicion of AMI and MICU dispatch were less frequent among female-recorded patients after accounting for measured clinical characteristics. Both decisions showed higher specificity but numerically lower sensitivity among female-recorded patients; sensitivity differences were imprecisely estimated. These findings describe sex-associated differences in prehospital decision patterns but do not establish inappropriate care or under-triage.

INTRODUCTION

Acute coronary syndromes (ACS) remain time-critical conditions in which early recognition, appropriate triage, and timely access to specialized care are essential components of management [1]. Sex-related differences in acute myocardial infarction (AMI) have been extensively documented across epidemiology, clinical presentation, management, and outcomes [2–4]. Although chest pain remains the predominant presenting symptom of ACS in both women and men, the distribution of cardiovascular risk factors, associated symptoms, underlying coronary disease, and causes of acute chest pain differs between sexes [2–4]. Contemporary guidance has therefore emphasized the risk of delayed or missed recognition of ACS in women while cautioning against overly simplistic distinctions between “typical” and “atypical” presentations [1, 4].

Sex-related differences extend to the prehospital phase. In a population-based cohort of more than 250,000 emergency medical service attendances for acute chest pain, Dawson et al. reported differences between women and men across several components of prehospital and hospital care, including electrocardiography, treatment, transport, and subsequent management [3]. Among patients with confirmed AMI, differences in delay before hospital presentation have also been repeatedly described. A recent meta-analysis of 29 studies involving more than 127,000 patients found that female sex was associated with longer prehospital and patient-related delays [5], consistent with previous multicentre observations in patients with ST-segment elevation myocardial infarction [6]. These findings establish that sex-related differences may occur throughout the acute chest-pain pathway but do not identify how decisions are made at its earliest medical stage.

Emergency medical dispatch represents a particularly important and less well characterized decision point. During telephone assessment, clinicians must estimate the probability and severity of ACS using information available from the call, usually before electrocardiography, biomarkers, or physical examination. Previous studies have reported sex-related differences in the allocation of advanced life-support resources [7], symptoms communicated during emergency calls [8], and the provision of prehospital care [9]. Clinical predictors of ACS during medical dispatch may also differ between female and male patients [10], while the overall diagnostic accuracy of telephone triage for ACS remains imperfect [11]. In the French physician-staffed emergency medical communication centre (EMCC) system, the dispatch physician can directly allocate a mobile intensive care unit (MICU), providing an opportunity to examine how diagnostic suspicion during the call translates into advanced prehospital resource allocation [12].

However, lower rates of AMI suspicion or MICU dispatch among female patients cannot in themselves be interpreted as under-triage or inappropriate care. The underlying probability of AMI among patients presenting with chest pain differs by sex [3], and equal use of advanced prehospital resources would not necessarily represent optimal allocation. A clinically relevant assessment therefore requires distinguishing differences in resource use from differences in decision performance. It is important to

determine whether the sensitivity, specificity, and false-negative rates of dispatcher suspicion and MICU dispatch differ according to recorded sex, and whether dispatch patterns remain different;

The SCARE score was developed specifically to estimate ACS probability during telephone evaluation of non-traumatic chest pain using information available at medical dispatch [13] and has subsequently undergone external validation [14, 15]. The prospective multicentre cohort underlying one of these validations included standardized clinical information collected during the emergency call, dispatcher suspicion of AMI, MICU dispatch, and an independently adjudicated hospital diagnosis of AMI [15]. This provides an opportunity to address a question distinct from prediction-score validation. We therefore performed a secondary analysis of this cohort, restricted to patients subsequently hospitalized after an EMCC call for non-traumatic chest pain. We aimed to examine the association between recorded sex and dispatcher suspicion of AMI and MICU dispatch, and to compare the sex-specific operating characteristics of both decisions using adjudicated AMI as the clinical reference outcome.

METHODS

Study design and setting

We conducted a secondary analysis of the prospective multicenter cohort used to externally validate the SCARE score [15]. The cohort enrolled patients in four physician-staffed French EMCCs — Angers, Orléans, Poitiers, and Tours — between October 1, 2019, and February 25, 2020. This study is reported in accordance with the STROBE statement [16] and considered the principles of the Sex and Gender Equity in Research guidelines[17].

In the French EMS, EMCC physicians assess emergency calls and determine the appropriate response, including MICU dispatch, non-physician ambulance transport, referral to a community physician, or medical advice. MICUs are physician-staffed advanced prehospital teams providing intensive care-level assessment and treatment.

Study population

The source population included adults admitted to hospital after an EMCC call for non-traumatic chest pain. Exclusion criteria were inability to communicate in French, pregnancy, deprivation of liberty or legal guardianship, inability to answer questions, traumatic chest pain, refusal of care, and refusal to participate. Patients lost to follow-up were excluded because the final hospital diagnosis could not be adjudicated.

Patients with recorded sex available were included in the present analysis. Because the original cohort included only subsequently hospitalized patients, findings apply to this selected population rather than to all chest-pain callers.

Sex was recorded as a binary variable in the original database; gender identity was not collected. The terms “female-recorded” and “male-recorded” patients are therefore used throughout.

Data collection and candidate variables

During the emergency call, dispatch physicians completed a standardized study form recording age, cardiovascular history and risk factors, pain characteristics, associated symptoms, and their suspicion of AMI. Typical chest pain was defined as left-sided oppressive or squeezing chest pain [13]. Dispatcher suspicion of AMI was recorded as the physician’s subjective binary assessment that the presentation was likely related to AMI, without a standardized diagnostic threshold.

The primary outcome was MICU dispatch and the secondary outcome was dispatcher suspicion of AMI during the emergency call. Hospital-diagnosed AMI was used as the clinical reference outcome. AMI was adjudicated from hospital records by an independent cardiologist blinded to the EMCC dispatch decision according to the Fourth Universal Definition of Myocardial Infarction [18]. Additional analyses evaluated the operating characteristics of dispatcher suspicion and MICU dispatch relative to adjudicated AMI.

The SCARE score was not available during the index calls and was not included in the adjustment models because recorded sex and dispatcher suspicion of AMI are components of the score [13].

Statistical analysis

Continuous variables are reported as medians with interquartile ranges and categorical variables as numbers and percentages. Baseline characteristics were compared using absolute standardized mean differences (SMDs), without significance testing.

Associations between recorded female sex and MICU dispatch or dispatcher suspicion of AMI were estimated using modified Poisson regression with robust standard errors and reported as relative risks (RRs) with 95% confidence intervals (CIs) [19]. Three sequential models were fitted for each outcome: Model 0 included recorded sex only; Model 1 additionally included age, current smoking, history of coronary heart disease, diabetes mellitus, dyslipidaemia, hypertension, and family history of coronary heart disease; and Model 2 additionally included typical chest pain, inaugural pain, faintness, sweating, dyspnoea, anxiety, pain during physical activity, and postprandial pain. Age was modelled continuously. The fully adjusted model was interpreted as a conditional association rather than a causal effect of sex.

Adjusted absolute probabilities and risk differences were derived from Model 2 using marginal standardization.

Using adjudicated AMI as the reference outcome, sensitivity, specificity, and false-negative rates of dispatcher suspicion and MICU dispatch were calculated separately for female-recorded and male-recorded patients with 95% CIs. Absolute between-sex differences in sensitivity and specificity were also

estimated. For MICU dispatch, these measures were interpreted as descriptive indicators of resource allocation relative to AMI status rather than diagnostic accuracy, because MICU dispatch may also be appropriate for conditions other than AMI.

Primary regression analyses used complete cases, with sequential models fitted in a common complete-case population. A reduced model excluding family history of coronary heart disease, pain during physical activity, and postprandial pain was used as a sensitivity analysis. Missing covariate data were also addressed using multiple imputation by chained equations with 50 datasets and 20 iterations, and estimates were combined using Rubin's rules [20].

Centre and individual dispatcher identifiers were unavailable and could not be included in the models. Tests were two-sided, with $p < 0.05$ considered statistically significant for the primary analysis; secondary analyses were interpreted primarily from effect estimates and 95% CIs. Analyses were performed using R software (R Foundation for Statistical Computing, Vienna, Austria) [21].

Ethics

The original prospective study was approved by the Comité de Protection des Personnes Île-de-France V (reference 19.04.29.61213 Cat3; June 11, 2019) and registered at ClinicalTrials.gov (NCT04000490). Participants received study information and were included according to a non-opposition procedure approved by the ethics committee. The study was conducted in accordance with the Declaration of Helsinki. The present study was a secondary analysis of the de-identified dataset, with no additional participant contact or data collection.

RESULTS

Study population and baseline characteristics

The analysis included 2,042 patients, of whom 993 (48.6%) were female-recorded and 1,049 (51.4%) male-recorded. Female-recorded patients were slightly younger than male-recorded patients, with a median age of 55.0 years [interquartile range, 39.0–73.2] versus 58.0 years [44.0–73.0], respectively (SMD, 0.09).

Female-recorded patients were less frequently current smokers and had lower prevalences of coronary heart disease, diabetes mellitus, and dyslipidaemia. They also less frequently presented with typical chest pain, sweating, or pain during physical activity. The largest between-sex differences were observed for sweating (16.2% vs 27.9%; SMD, 0.28), history of coronary heart disease (13.9% vs 23.8%; SMD, 0.25), current smoking (25.6% vs 36.6%; SMD, 0.24), and pain during physical activity (7.1% vs 13.7%; SMD, 0.22) (Table 1).

Missing data were limited for most variables; family history of coronary heart disease, pain during physical activity, and postprandial pain had the highest proportions of missing observations.

Observed outcomes according to recorded sex

Hospital-diagnosed AMI occurred in 69 of 993 female-recorded patients (6.9%) and 196 of 1,049 male-recorded patients (18.7%). Dispatcher suspicion of AMI was recorded in 245 of 977 female-recorded patients (25.1%) and 395 of 1,039 male-recorded patients (38.0%). A MICU was dispatched for 332 of 993 female-recorded patients (33.4%) and 488 of 1,048 male-recorded patients (46.6%) (Figure 1).

Sequential associations with MICU dispatch and dispatcher suspicion of AMI

The complete-case population for MICU dispatch included 1,656 patients, of whom 664 received a MICU response. Recorded female sex was associated with a lower probability of MICU dispatch in the unadjusted model (RR, 0.72; 95% CI, 0.64–0.81). After adjustment for age and cardiovascular risk factors, the association was attenuated (aRR, 0.80; 95% CI, 0.71–0.90). Further adjustment for clinical characteristics available during the call resulted in additional attenuation, although the association remained present (aRR, 0.85; 95% CI, 0.77–0.95; p=0.003) (Table 2).

For dispatcher suspicion of AMI, the complete-case population included 1,649 patients, of whom 502 were suspected of having AMI. The unadjusted RR for female-recorded versus male-recorded patients was 0.64 (95% CI, 0.55–0.75). Adjustment for age and cardiovascular risk factors attenuated the association to 0.73 (95% CI, 0.63–0.84), and further adjustment for clinical presentation yielded an aRR of 0.81 (95% CI, 0.71–0.92; p=0.002) (Table 2).

Marginal standardization of the fully adjusted models yielded an adjusted probability of MICU dispatch of 36.7% (95% CI, 33.8–39.5) for female-recorded patients and 43.0% (95% CI, 40.2–45.7) for male-recorded patients, corresponding to an adjusted absolute difference of −6.3 percentage points (95% CI, −10.3 to −2.2). For dispatcher suspicion of AMI, the corresponding adjusted probabilities were 26.9% (95% CI, 24.2–29.7) and 33.2% (95% CI, 30.7–35.8), with an adjusted absolute difference of −6.3 percentage points (95% CI, −10.2 to −2.5).

Operating characteristics relative to adjudicated AMI

Using adjudicated AMI as the clinical reference, dispatcher suspicion of AMI had a sensitivity of 60.6% (95% CI, 48.5–71.5) in female-recorded patients and 67.2% (95% CI, 60.3–73.4) in male-recorded patients, an absolute difference of −6.6 percentage points (95% CI, −20.1 to 6.9). Corresponding false-negative rates were 39.4% (95% CI, 28.5–51.5) and 32.8% (95% CI, 26.6–39.7), respectively. Specificity was higher in female-recorded patients (77.5%; 95% CI, 74.7–80.1) than in male-recorded patients (68.7%; 95% CI, 65.5–71.8), with an absolute difference of 8.8 percentage points (95% CI, 4.6–12.9).

For MICU dispatch, sensitivity relative to subsequent AMI was 69.6% (95% CI, 57.9–79.2) in female-recorded patients and 80.6% (95% CI, 74.5–85.5) in male-recorded patients, an absolute difference of −11.0 percentage points (95% CI, −23.2 to 1.1). Corresponding false-negative rates were 30.4% (95% CI, 20.8–42.1) and 19.4% (95% CI, 14.5–25.5), respectively. Specificity was 69.3% (95% CI, 66.2–72.2) in

female-recorded patients and 61.3% (95% CI, 58.0–64.5) in male-recorded patients, an absolute difference of 8.0 percentage points (95% CI, 3.6–12.4) (Table 3).

Sensitivity analyses

Findings were consistent in sensitivity analyses. In the larger complete-case populations available for the reduced models, recorded female sex remained associated with lower probabilities of MICU dispatch (aRR, 0.86; 95% CI, 0.78–0.95; n=1,845) and dispatcher suspicion of AMI (aRR, 0.82; 95% CI, 0.73–0.93; n=1,830). Estimates obtained when the reduced model was fitted in the original fully adjusted complete-case populations were similar.

Multiple-imputation analyses also yielded estimates consistent with the complete-case analyses for MICU dispatch (aRR, 0.86; 95% CI, 0.78–0.94; n=2,041) and dispatcher suspicion of AMI (aRR, 0.83; 95% CI, 0.74–0.94; n=2,016).

DISCUSSION

In this secondary analysis of a prospective multicentre cohort of patients hospitalized after an EMCC call for non-traumatic chest pain, dispatcher suspicion of AMI and MICU dispatch were less frequent among female-recorded than male-recorded patients. Adjustment for age and cardiovascular risk factors substantially attenuated both associations, with further attenuation after accounting for clinical presentation. Nevertheless, recorded female sex remained associated with lower probabilities of both outcomes, corresponding to adjusted absolute differences of approximately 6 percentage points. Adjudicated AMI was also markedly less frequent among female-recorded patients. When AMI was used as the clinical reference, both dispatcher suspicion and MICU dispatch showed higher specificity among female-recorded patients, whereas sensitivity was numerically lower, although between-sex differences in sensitivity were imprecisely estimated.

These findings extend previous evidence of sex-related differences across the acute chest-pain pathway. Large prehospital cohorts have reported differences between female and male patients in assessment, treatment, transport, and subsequent management [3], while sex-related differences in prehospital delay among patients with AMI have also been described [5, 6]. Earlier dispatch studies reported differences in symptoms communicated during emergency calls, allocation of advanced life-support resources, and prehospital care [7–9]. Our study adds to this literature by examining diagnostic suspicion, allocation of a physician-staffed MICU, and independently adjudicated AMI within the same cohort and at a particularly early stage of medical decision-making.

Differences in cardiovascular profile and clinical presentation appear to explain part of the observed associations. The RR for MICU dispatch changed from 0.72 in the unadjusted model to 0.80 after adjustment for age and cardiovascular risk factors and to 0.85 after additional adjustment for presenting characteristics. Corresponding estimates for dispatcher suspicion were 0.64, 0.73, and 0.81. Female-recorded patients had lower prevalences of several cardiovascular risk factors and differed in some

presenting features, including typical chest pain, sweating, and exertional pain. However, these adjusted estimates should not be interpreted causally. Some presenting characteristics may themselves lie on pathways linking sex-related factors to clinical presentation and physician assessment; the fully adjusted model therefore represents a conditional comparison rather than an estimate of a direct effect of sex.

The sex-specific operating characteristics provide important context for interpreting lower rates of suspicion and MICU dispatch. AMI occurred in 6.9% of female-recorded compared with 18.7% of male-recorded patients, making equal rates of positive decisions neither expected nor necessarily desirable. Dispatcher suspicion had a sensitivity of 60.6% in female-recorded and 67.2% in male-recorded patients, whereas specificity was 77.5% and 68.7%, respectively. For MICU dispatch, sensitivity relative to subsequent AMI was 69.6% versus 80.6%, while specificity was 69.3% versus 61.3%. These results suggest a pattern of fewer positive decisions and greater specificity among female-recorded patients rather than simply lower resource use. However, sensitivity estimates among female-recorded patients were based on only 69 confirmed AMI cases, and their confidence intervals overlapped those of male-recorded patients. The data therefore neither demonstrate under-recognition nor exclude a clinically relevant difference in diagnostic sensitivity.

This distinction is important because differences in management do not themselves establish inappropriate care or inequity. Sex-related differences in ACS presentation are well recognized, but the traditional distinction between “typical” symptoms in men and “atypical” symptoms in women is overly simplistic [2, 4]. Chest pain remains a major presenting symptom in both sexes, with substantial overlap in presentation despite differences in associated symptoms and underlying cardiovascular risk. Telephone assessment may amplify the importance of these differences because electrocardiography, biomarkers, and physical examination are not available. Structured assessment may therefore help ensure consistent evaluation of cardiovascular history, pain characteristics, and associated symptoms. The SCARE score was specifically developed for this setting and has undergone external validation [13–15]. Nevertheless, prediction performance and equitable decision-making remain distinct objectives, and future evaluations of telephone triage tools should consider sex-specific sensitivity and false-negative rates in addition to overall discrimination.

Strengths and limitations

The main strengths of this study are its prospective multicentre design, collection of information during real emergency calls, and availability within the same cohort of dispatcher suspicion, MICU dispatch, and an independently adjudicated hospital diagnosis. Relative and absolute measures were reported, and results were consistent across complete-case, reduced-model, and multiple-imputation analyses.

Several limitations should be considered. Most importantly, the original cohort included only patients who were subsequently hospitalized. Because hospitalization may itself depend on sex, clinical presentation, perceived severity, diagnostic suspicion, and prehospital management, conditioning on hospitalization may introduce selection or collider bias. The findings therefore apply to hospitalized

patients and cannot be generalized to all patients contacting an EMCC for chest pain. Second, this observational study cannot determine whether individual dispatch decisions were appropriate, and residual confounding from clinical severity, symptom chronology, communication, alternative diagnoses, resource availability, or physician-level factors is possible. Centre and dispatcher identifiers were unavailable, preventing assessment of clustering and practice variation. Third, dispatcher suspicion was a subjective binary assessment without a standardized threshold. Fourth, the limited number of confirmed AMI events among female-recorded patients resulted in imprecise sensitivity estimates. Finally, sex was recorded as a binary variable, and gender identity was not collected.

CONCLUSION

Among patients hospitalized after an EMCC call for non-traumatic chest pain, dispatcher suspicion of AMI and MICU dispatch were less frequent among female-recorded than male-recorded patients. Differences in cardiovascular risk profile and clinical presentation explained part, but not all, of these associations. Relative to adjudicated AMI, both decisions showed higher specificity and numerically lower sensitivity among female-recorded patients, although sensitivity differences were imprecisely estimated. These findings describe sex-associated differences in prehospital decision patterns but do not establish inappropriate care, under-triage, or clinician bias.

Abbreviations

ACS
Acute coronary syndrome
AMI
Acute myocardial infarction
aRR
Adjusted relative risk
CI
Confidence interval
EMCC
Emergency medical communication centre
EMS
Emergency medical services
IQR
Interquartile range
MICU
Mobile intensive care unit
RR
Relative risk
SAGER
Sex and Gender Equity in Research

SMD
Standardized mean difference
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology

Declarations

Conflict of interest:

The authors declare no conflict of interest.

Use of artificial intelligence in manuscript preparation

OpenAI ChatGPT was used to assist with manuscript structuring and language editing. All scientific content, statistical analyses, interpretation, and references were reviewed and verified by the authors, who take full responsibility for the final manuscript.

Ethics approval and consent to participate

The original prospective study was approved by the Comité de Protection des Personnes Île-de-France V (reference 19.04.29.61213 Cat3; June 11, 2019) and registered at ClinicalTrials.gov (NCT04000490). Participants received study information and were included according to a non-opposition procedure approved by the ethics committee. The study was conducted in accordance with the Declaration of Helsinki. The present study was a secondary analysis of the de-identified dataset, with no additional participant contact or data collection.

Consent for publication:

Not applicable.

Competing interests:

The authors declare that they have no competing interests.

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Author Contribution

VG: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Visualization, Writing – original draft. TM: Conceptualization, Supervision, Writing – review and editing. JG, CH, MM, and MS: Data curation, Writing – review and editing. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

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Data availability:

The individual participant data underlying this study are not publicly available because their use is subject to ethical, regulatory, and institutional restrictions. De-identified data may be made available upon reasonable request to the corresponding author, subject to approval by the study sponsor and applicable regulations.

Tables

Tables 1-3 are available in the Supplementary Files section.

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Figures

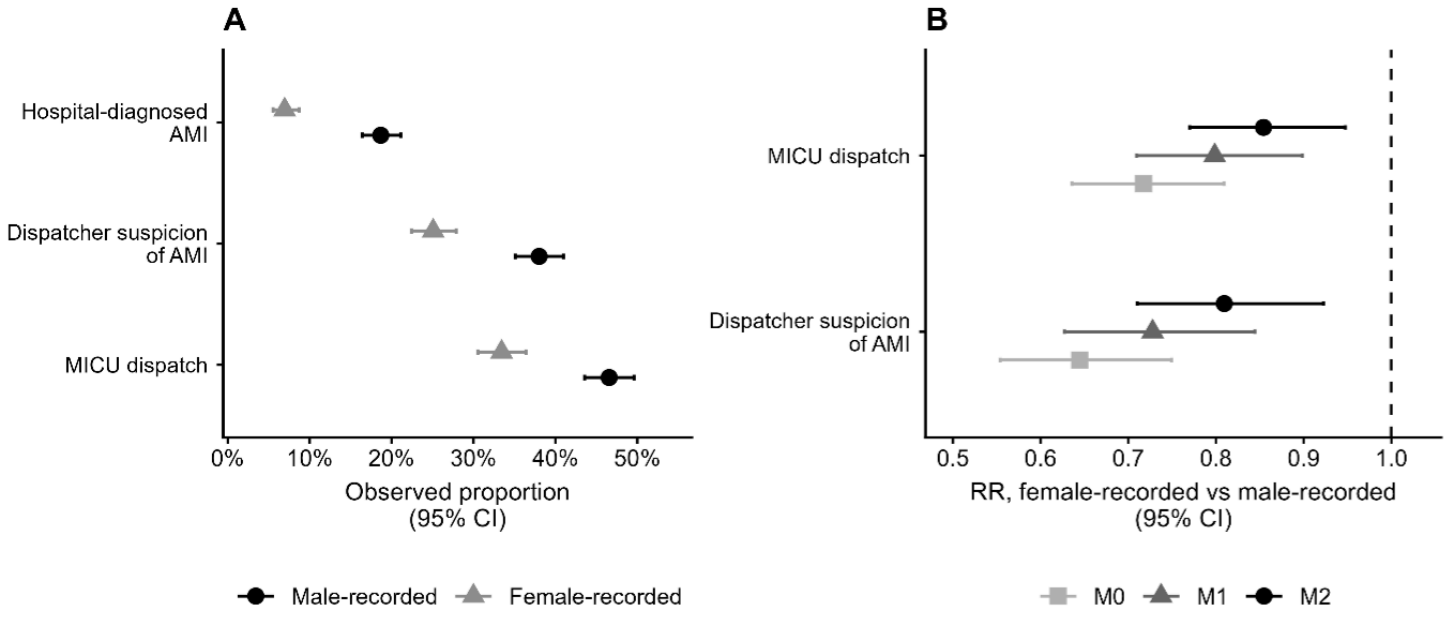


Figure 1

Observed outcome frequencies and adjusted associations with recorded female sex.

Panel A shows the observed proportions of hospital-diagnosed acute myocardial infarction (AMI), dispatcher suspicion of AMI, and mobile intensive care unit (MICU) dispatch according to recorded sex. Points represent proportions and horizontal lines 95% confidence intervals. Panel B shows relative risks for female-recorded versus male-recorded patients across sequential models. M0 included recorded sex only; M1 additionally included age and cardiovascular risk factors; M2 additionally included clinical

characteristics of the presenting episode. Points represent relative risks and horizontal lines 95% confidence intervals. The vertical dashed line indicates a relative risk of 1.00.

Abbreviations: AMI, acute myocardial infarction; CI, confidence interval; MICU, mobile intensive care unit; RR, relative risk.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AMIbygendertable.docx
- AMIbygenderSD.docx