

Supplemental Material

Table S1. Cerner Multum’s therapeutic classification categories used to define medication administration, most specific.

Medication category	Therapeutic classification
Anti-platelets	Category 3: 062 – Salicylates OR Category level 3: 211 – platelet aggregation inhibitors
Anti-anginal	Category level 2: 045 – antianginal agents OR Category level 2: 053 - vasodilators
Gastroenterological agents	Category level 2: 272 - proton pump inhibitors OR Category level 2: 094 - H2 antagonists OR Category level 2: 088 - antacids
Narcotic analgesics	Category level 2: 060 – narcotic analgesics
Benzodiazepines	Category level 2: 067 – benzodiazepines
NSAIDs	Category Level 3: 061 – Non-steroidal anti-inflammatory agents

Table S2. ICD-10 code and corresponding CCS codes used for identification of diagnoses of interest.

Diagnosis	ICD-10 code	ICD-9 code	CCS code
Acute myocardial infarction	I210-I2229	4100, 41000, 41001, 41002, 4101, 41010, 41011, 41012, 4102, 41020, 41021, 41022, 4103, 41030, 41031, 41032, 4104, 41040, 41041, 41042, 4105, 41050, 41051, 41052, 4106, 41060, 41061, 41062, 4107, 41070, 41071, 41072, 4108, 41080, 41081, 41082, 4109, 41090, 41091, 41092	100
Coronary atherosclerosis and other heart disease	I20-I209, I240, I248-I249, I2510-I252, I255-I259	4110, 4111, 4118, 41181, 41189, 412, 4130, 4131, 4139, 4140, 41400, 41401, 41406, 4142, 4143, 4144, 4148, 4149, V4581, V4582	101
Arrythmia	I470-I4892, I491-I499	4270, 4271, 4272, 42731, 42732, 42760, 42761, 42769, 42781, 42789, 4279, 7850, 7851	106
Essential hypertension, hypertension with complications and secondary hypertension, and hypertension complication pregnancy, childbirth and the puerperium	I10-I110, I119-I130, I1310-I32, I1150-I169, O10111-O169, H35037-H35033, I674, I973	4011, 4019, 4010, 40200, 40201, 40210, 40211, 40290, 40291, 4030, 40300, 40301, 4031, 40310, 40311, 4039, 40390, 40391, 4040, 40400, 40401, 40402, 40403, 4041, 40410, 40411, 40412, 40413, 4049, 40490, 40491, 40492, 40493, 40501, 40509, 40511, 40519, 40591, 40599, 4372, 64200, 64201, 64202, 64203, 64204, 64210, 64211, 64212, 64213, 64214, 64220, 64221, 64222, 64223, 64224, 64230, 64231, 64232, 64233, 664240, 64241, 64242, 64243, 64244, 64250, 64251, 64252, 64253, 64254, 64260, 64261, 64262, 64263, 64264, 64270, 64271, 64272, 64273, 6427, 64290, 64291, 64292, 64293, 64294	98, 99, 183
Congestive heart failure, non-hypertensive	I0981, I110, I130, I501-I509, I97130, I97131, O29121-O29129, Z95811, Z95812	39891, 4280, 4281, 42820, 42821, 42822, 42823, 42830, 42831, 42832, 42833, 42840, 42841, 42842, 42843, 4289	108
Peri-; endo-; and myocarditis; cardiomyopathy	A3681-A3950, A3952, B2682, B3320, B3322, B3324, B5881, D8685, I1012, I090, I255, I400-I43, I514, J1082, J1182, O903	03282, 03640, 03641, 03642, 03643, 07420, 07421, 07422, 07423, 11281, 11503, 11504, 11513, 11514, 11593, 11594, 1303, 3910, 3911, 3912, 3918, 3919, 3920, 393, 3980, 39890, 39899, 4200, 42090, 42091, 42099, 4210, 4211, 4219, 4220, 42290, 42291, 42292, 42293, 4229, 4230, 4231, 4232, 4233, 4238, 4239, 4250, 4251, 42511, 42518, 4252, 4253, 4254, 4257, 4258, 4259, 4290	97
Non-specific chest pain	R072, R0789, R079	78650, 78651, 78659	102
Pulmonary heart disease	I2601-I289	4150, 4151, 41512, 41513, 41519, 4160, 4161, 4162, 4168, 4169, 4170, 4171, 4178, 4179, V1255	103

Table S3. Variables considered in the LASSO regression and included in the final multivariable regression model after LASSO analyses.

Outcome	Covariates included in LASSO	Covariates included in final model
Admission to hospital or observation	Sex, race, age, diabetes, hypertension, hyperlipidemia, substance abuse, asthma or COPD, obesity, depression, heart failure, arrival by ambulance, expected source of payment, triage level, cardiac enzyme testing, ECG testing, any diagnostic testing, evaluation by consulting physician	Sex, race, age, diabetes, hyperlipidemia, obesity, heart failure, arrival by ambulance, triage level, ECG testing, cardiac enzyme testing, evaluation by consulting physician
ECG testing	Sex, race, age, diabetes, hypertension, hyperlipidemia, substance abuse, asthma or COPD, obesity, depression, heart failure, arrival by ambulance, expected source of payment, triage level, evaluation by consulting physician	Sex, age, race, hypertension, asthma or COPD, heart failure, arrival by ambulance, triage level, evaluation by consulting physician
Cardiac enzyme testing	Sex, race, age, diabetes, hypertension, hyperlipidemia, substance abuse, asthma or COPD, obesity, depression, heart failure, arrival by ambulance, expected source of payment, triage level, evaluation by consulting physician	Sex, age, race, hypertension, heart failure, triage level, evaluation by consulting physician
Wait time	Sex, race, age, diabetes, hypertension, hyperlipidemia, substance abuse, asthma or COPD, obesity, depression, heart failure, arrival by ambulance, expected source of payment, triage level, evaluation by consulting physician	Sex, age, race, obesity, arrival by ambulance, expected source of payment, triage level
Emergency Triage	Sex, race, age, diabetes, hypertension, hyperlipidemia, substance abuse, asthma or COPD, obesity, depression, heart failure, arrival by ambulance, expected source of payment	Sex, age, race, depression, heart failure, arrival by ambulance

Table S4. Characteristics of young women presenting to the ED with chest pain, by race*

Sample size National estimate	White women 1,514 10,578,600	Women of color 805 6,302,059	
	Mean ± SD	Mean ± SD	p-value
Age	38.2 ± 11.0 years	36.6 ± 9.8 years	0.003
Expected source of payment	Percent	Percent	0.013
Private insurance	38.5% [35.4, 41.7%]	26.7% [21.5, 32.5%]	
Medicare	7.5% [5.8, 9.6%]	7.3% [5.2, 10.0%]	
Medicaid or CHIP or state-based program	30.1% [26.9,33.5%]	37.2% [31.1, 43.7%]	
Self-pay or no charge/charity	10.3% [7.8, 13.4%]	13.7% [9.6, 19.3%]	
Other/Unknown	13.6% [10.5, 17.4%]	15.2% [10.6, 21.2%]	
Arrival by ambulance (Estimated visits: White women: 10,186,904 Women of color: 6,183,416)			0.807
Yes	14.1% [12.0, 17.2%]	15.1% [10.9, 20.6%]	
No	82.2% [78.7, 85.1%]	83.0% [77.4, 87.5%]	
Episode of care			
Initial visit	86.0% [81.3, 89.6%]	87.6% [82.2, 91.5%]	0.473
Clinical Comorbidities			
Asthma/COPD	20.2% [17.5, 23.3%]	22.3% [18.7, 26.3%]	0.385
Heart Failure	3.4% [2.3, 5.1%]	4.0% [2.4, 6.5%]	0.644
Diabetes (Type 1, type2, unspecified)	10.4% [8.8, 12.3%]	14.5% [11.0, 18.7%]	0.056
Hyperlipidemia	9.3% [7.6, 11.5%]	8.4% [5.3, 13.2%]	0.71
Hypertension	24.0% [21.5, 26.8%]	34.7% [30.3, 39.3%]	<0.001
Obesity	7.2% [5.4, 9.5%]	11.0% [8.3, 14.5%]	0.014
Substance abuse	6.8% [5.3, 8.7%]	5.2% [3.5, 7.8%]	0.192
Depression	17.5% [14.9, 20.5%]	14.8% [11.4, 19.1%]	0.21
None	40.1% [36.3, 44.0%]	36.4% [32.1, 40.9%]	0.128
Vitals before triage	Mean ± SD**	Mean ± SD**	
Heart rate	87.3 ± 19.9 bpm	86.7 ± 15.7 bpm	0.567
Respiratory rate	18.8 ± 6.6 bpm	18.4 ± 3.2 bpm	0.1
Systolic BP	136.0 ± 22.6 mmHg	138.0 ± 21.7 mmHg	0.218
Diastolic BP	81.3 ± 13.8 mmHg	82.7 ± 14.0 mmHg	0.16
Pulse Oximetry	97.9 ± 3.7 %	98.3 ± 3.5 %	0.029

* Percentages based on national estimates

** Means calculated among those with values > 0 ; estimated number of ED visit for which vital signs were available: heart rate (white women: 10,124,358; women of color: 5,913,513), respiratory rate (white women: 10,021,039, women of color: 6,029,571), systolic BP (white women: 10,230,731, women of color: 6,126,387), diastolic BP (white women: 10,236,951, women of color: 6,125,976), pulse oximetry (white women: 10,138,233, women of color: 5,921,365).

Table S5. Characteristics of young men presenting to the ED with chest pain, by race*

	White Men 1,266 8,787,519	Men of color 567 4,061,967	
	Mean ± SD	Mean ± SD	p-value
Sample size			
National estimate			
Age	39.2 ± 10.8 years	37.9 ± 10.4 years	0.050
Expected source of payment	Percent [95% CI]	Percent [95% CI]	0.193
Private insurance	37.0% [32.6, 41.6%]	28.2% [23.1, 33.9%]	
Medicare	8.8% [6.5, 12.0%]	8.7% [5.4, 13.6%]	
Medicaid or CHIP or state-based program	24.6% [20.9, 28.6%]	28.7% [23.8, 34.1%]	
Self-pay or no charge/charity	15.4% [12.1, 19.2%]	16.9% [12.9, 21.8%]	
Other/Unknown	14.3% [10.6, 18.9%]	17.6% [12.5, 24.3%]	
Arrival by ambulance (Estimated visits: White men: 8,566,321 Men of color: 3,911,390)			0.748
Yes	18.8% [15.5, 22.6%]	17.7% [14.0, 22.1%]	
No	78.7% [74.8, 82.2%]	78.6% [74.3, 82.4%]	
Episode of care			0.892
Initial visit	88.9% [85.6, 91.5%]	89.2% [83.8, 93.0%]	
Clinical Comorbidities			
Asthma/COPD	14.4% [11.8, 17.5%]	17.2% [13.4, 21.7%]	0.256
CHF	4.6% [3.3, 6.5%]	4.4% [2.4, 8.0%]	0.914
Diabetes (Type 1, type2, unspecified)	13.0% [11.1, 15.3%]	14.3% [10.6, 19.0%]	0.616
HLD	13.4% [10.7, 16.6%]	7.0% [4.8, 10.1%]	0.002
HTN	32.3% [28.9, 35.9%]	35.3% [30.3, 40.6%]	0.306
Obesity	6.2% [4.5, 8.5%]	6.7% [4.3, 10.3%]	0.764
Substance abuse	12.4% [9.5, 16.1%]	9.8% [6.9, 13.9%]	0.278
Depression	10.3% [8.5, 12.4%]	4.9% [3.0, 8.0%]	0.003
None	36.6% [32.8, 40.7%]	37.7% [31.9, 43.8%]	0.922
Vitals before triage	Mean ± SD **	Mean ± SD**	p-value
Heart rate	86.5 ± 19.9 bpm	84.5 ± 16.1 bpm	0.064
Respiratory rate	18.3 ± 3.6 bpm	17.9 ± 3.0 bpm	0.074
Systolic BP	139.9 ± 20.9 mmHg	140.9 ± 20.6 mmHg	0.520
Diastolic BP	85.2 ± 13.5 mmHg	85.0 ± 14.1 mmHg	0.835
Pulse Oximetry	97.2 ± 4.4%	97.2 ± 4.4 %	0.977

* Percentages based on national estimates

** Means calculated among those with values > 0 ; estimated number of ED visit for which vital signs were available: heart rate (white men: 8,395,385; men of color: 3,783,433); respiratory rate (white men: 8,475,973; men of color: 3,882,054); systolic BP (white men: 8,561,969; men of color: 3,916,911); diastolic BP (white men: 8,559,234 men of color: 3,909,458); pulse oximetry (white men: 8,408,171, men of color: 3,873,823)

Table S6. Triage and assessment of young women presenting to the Emergency Room with chest pain by race *

Sample size National estimate	White women 1,514 10,578,600	Women of color 805 6,302,059	
	Percent [95% CI]	Percent [95% CI]	p-value
Triage level			0.352
Immediate/Emergent	20.1% [16.5,24.3%]	17.3%[12.5,23.5%]	
Urgent	38.9% [35.0,43.1%]	36.5%[29.1,44.7%]	
Semi-urgent/Non-urgent	13.4% [10.9,16.5%]	11.8% [7.5,18.0%]	
No triage	27.5% [22.3,33.5%]	34.4% [23.2,47.7%]	
Diagnostic testing			
BNP	7.0% [5.2,9.4%]	5.9% [4.1,8.3%]	0.461
Cardiac enzymes	19.2% [15.8,23.2%]	23.0% [16.7,30.7%]	0.244
D-Dimer	17.9% [14.7,21.5%]	14.5% [11.0,18.9%]	0.211
X-ray	73.6% [70.1,76.8%]	67.8% [61.7,73.3%]	0.051
ECG	76.1% [72.6,79.2%]	71.0% [65.3,76.2%]	0.084
Cardiac Monitor	27.8% [24.2,31.8%]	20.1% [15.4,25.9%]	0.018
CT chest	8.7% [7.0,10.8%]	9.3% [7.0,12.3%]	0.757
Toxicology screen	4.4% [3.0,6.3%]	3.2% [2.1,4.8%]	0.255
No testing	25.6% [69.5,77.2%]	23.0% [68.8,81.6%]	0.692
Seen by consulting physician	8.6% [6.7, 10.9%]	8.4% [5.9,11.8%]	0.909
	Mean ± SD**	Mean ± SD**	p-value
Wait time to see provider	42.7 ± 74.7 min	57.8 ± 92.2 min	0.0183

* Percentages based on national estimates

** Means calculated among those with values > 0 ; estimated number of ED visit for wait times were available: White women: 9,380,487 ; women of color: 5,325,775.

Table S7. Triage and assessment of young men presenting to the Emergency Room with chest pain by race*

Sample size National estimate	White Men 1,266 8,787,519	Men of color 567 4,061,967	
	Percent	Percent [95% CI]	p-value
Triage level			0.111
Immediate/Emergent	25.5% [21.3,30.4%]	18.6% [13.9, 24.5%]	
Urgent	38.0% [33.3,42.9%]	43.2% [35.9, 50.9%]	
Semi-urgent/Non-urgent	7.2% [5.2,10.0%]	8.1% [5.4, 12.0%]	
No triage	29.2% [23.5,35.7%]	30.1% [21.6, 40.2%]	
Diagnostic testing			
BNP	8.8% [6.8,11.2%]	8.6% [6.2, 11.8%]	0.930
Cardiac enzymes	24.0% [19.3,29.5%]	20.4% [14.8, 27.3%]	0.329
D-Dimer	12.8% [10.5,15.4%]	10.0% [7.0, 14.6%]	0.220
X-ray	75.5% [72.1,78.6%]	75.9% [70.2, 80.8%]	0.908
ECG	79.6% [76.5,82.4%]	77.2% [71.9, 81.7%]	0.388
Cardiac Monitor	32.8% [28.2,37.7%]	23.9% [18.2, 30.7%]	0.012
CT chest	9.1% [7.3,11.3%]	6.3% [4.4, 9.1%]	0.097
Toxicology screen	6.2% [4.7,8.2%]	9.8% [7.1, 13.4%]	0.037
No testing	23.1% [22.4,80.1%]	20.4% [72.8, 84.6%]	0.497
Seen by consulting physician	12.2% [9.7,15.3%]	12.3% [8.6, 17.5%]	0.956
	Mean ± SD (sample size)**	Mean ± SD (sample size)**	p-value
Wait time to see provider	34.0 min ± 58.5 (1,010)	44.0 min ± 67.8 (469)	0.0365

* Percentages based on national estimates

** Means calculated among those with values > 0 ; estimated number of ED visit for wait times were available: White men: 7,573,251 ; men of color: 3,608,747

Table S8. Medications administered to young women in ED presenting with chest pain by race*

	White women 1,514 10,578,600	Women of color 805 6,302,059	
	Percent	Percent	p-value
Medications prescribed in ED or at discharge	65.7% [62.1, 69.2%]	68.5% [63.8, 72.9%]	0.312
Anti-platelets	20.9% [17.6, 24.7%]	10.6% [7.7, 14.4%]	<0.001
Anti-anginal	9.1% [6.9, 11.9%]	6.0% [4.0, 9.1%]	0.093
Gastroenterological agents	8.4% [7.0, 10.3%]	7.5% [5.3, 10.6%]	0.549
Narcotic analgesics	18.1% [14.9, 21.8%]	11.5% [8.8, 15.0%]	0.002
Benzodiazepines	10.8% [8.7, 13.3%]	6.3% [4.2, 9.3%]	0.019
NSAIDS	17.0% [14.7, 19.6%]	18.7% [15.2, 22.7%]	0.459

* Percentages based on national estimates

Note that anticoagulants could not be analyzed due to <30 unweighted records among women and men

Table S9. Medications administered to young men in ED presenting with chest pain by race*

	White Men 1,266 8,787,519	Men of color 567 4,061,967	
	Percent	Percent	p-value
Medications prescribed in ED or at discharge	70.0% [65.5,74.1%]	67.7% [61.1, 73.7]	0.506
Anti-platelets	22.7% [18.6,27.3%]	19.8% [15.7, 24.5%]	0.2939
Anti-anginal	13.6% [11.0,16.7%]	5.8% [4.1, 8.3%]	<0.001
Gastroenterological agents	9.3% [7.1,12.0%]	8.9% [5.6, 13.7%]	0.861
Narcotic analgesics	16.9% [14.3,19.8%]	11.5% [8.6, 15.0%]	0.013
Benzodiazepines	8.3% [6.2,11.0%]	-	-
NSAIDS	70.0% [12.0,17.7%]	20.8% [15.7, 27.0%]	0.038

* Percentages based on national estimates

Note that anticoagulants could not be analyzed due to <30 unweighted records among women and men

Table S10. Disposition of young women presenting to the Emergency Room with chest pain by race*

	White women 1,514 10,578,600	Women of color 805 6,302,059	
	Percent	Percent	p-value
No follow up	4.9% [3.4, 7.1%]	6.7% [3.5,12.4%]	0.4
Return to care	75.1% [71.0, 78.9%]	74.0% [66.8,80.1%]	0.770
Transfer to other hospital	-	-	-
Admit	13.2% [10.0, 17.2]	11.1% [8.1,15.2%]	0.452
Admit to observation	3.4% [2.4, 4.8%]	4.8% [2.8,8.4%]	0.277
Admitted to hospital	9.9% [7.2, 13.5%]	6.8% [4.5,10.0%]	0.138
Other Disposition	4.3% [2.8,6.5%]	-	-
Unknown	-	-	-
Left Early	5.4% [3.5, 8.2%]	-	-

*Percentages based on national estimates

Table S11. Disposition of young men presenting to the Emergency Room with chest pain by race*

	White Men 1,266 8,787,519	Men of color 567 4,061,967	
	Percent	Percent	p-value
No follow up	6.5% [4.5, 9.3%]	8.6% [5.4, 13.5%]	0.3
Return to care	66.3% [62.1, 70.3%]	67.4% [61.0, 73.3%]	0.752
Transfer to other hospital	2.50% [1.6, 3.9%]	-	-
Admit	18.4% [15.6, 21.5%]	16.7% [12.7, 21.8%]	0.503
Admit to observation	5.1% [3.3, 7.6%]	6.6% [4.0, 10.6%]	0.332
Admitted to hospital	14.3% [11.9, 17.0%]	11.7% [8.8, 15.2%]	0.2077
Other Disposition	6.3% [4.6, 8.7%]	-	-
Unknown	-	-	-
Left Early	7.0% [4.7, 10.2%]	-	-

* Percentages based on national estimates

Table S12. ED diagnoses of all young adults presenting to the ED with chest pain.

	Women	Men		White	People of color		Total
Sample size	2,319	1,833	p-value	2,780	1,372	p-value	
National estimate	16,880,659	12,849,486		19,366,119	10,364,026		
Other chest pain	40.8%	44.0%	0.151	43.4%	40.0%	0.172	42.2%
Hypertensive diseases	10.1%	13.8%	0.011	11.5%	12.0%	0.747	11.7%
Arrhythmia	3.2%	4.9%	0.057	4.8%	-	-	3.9%
Coronary atherosclerosis and other heart disease	1.9%	3.3%	0.044	2.8%	-	-	2.5%
Heart failure & Cardiomyopathy	1.4%	1.7%	0.611	1.4%	1.8%	0.544	1.6%
Acute myocardial infarction	-	2.2%		1.8%	-	-	1.4%
Pulmonary heart disease	-	-		-	-	0.465	1.0%

Table S13. Hospital discharge diagnoses of young adults who presented to the ED with chest pain and were admitted to the hospital.

	Women	Men	p-value	White	People of color	p-value	Total
Sample size	299	318		429	188		
National estimate	2,093,591	2,294,069		3,006,144	1,381,517		
Other chest pain	59.7%	55.1%	0.495	58.8%	53.9%	0.36	57.3%
Hypertensive diseases	12.5%	14.7%	0.552	15.5%	-	-	13.6%
Arrhythmia	-	-	-	-	-	-	-
Coronary atherosclerosis and other heart disease	-	-	-	-	-	-	-
Heart failure & Cardiomyopathy	-	-	-	-	-	-	5.8%
Acute myocardial infarction	-	-	-	7.1%	-	-	6.5%
Pulmonary heart disease	-	-	-	-	-	-	-