Appendix - A

The University of Kansas Medical Center (KUMC) has an established i2b2 based Healthcare Enterprise Repository for Ontological Narration (HERON). Identification and/or definitions of computable phenotypes used in this study are based on HERON queries. The HERON manual can be accessed at the following link:

https://www.kumc.edu/school-of-medicine/academics/departments/internal-medicine/divisions/medical-informatics/our-services/heron/heron-manual.html

Elements of Inclusion and Exclusion Criteria

1. Demographics: HERON has a separate table for demographics. This demographic table was used to collect data on date of birth, sex and race.
2. Age at Visit: It was computed by subtracting the patient's date of birth from the date of cardiac stress test (CST).
3. Emergency Department Visit: Emergency department visits were identified using "Emergency Department" variable, which is available in the "Visit Detail \ Encounter Type" folder in HERON.
4. Troponin Lab: It was identified using "TROPONIN I (#2326)" and "TROPONIN I", POC (#2327)" variables available in the "Laboratory Tests (KUH Hierarchy) \ Chemistry (KUH) \ 241-Cardiac Markers" folder in HERON.
5. Hospital Admission: It was identified via variables for observational stay or inpatient stay, which are "Observational Stay" and "Inpatient Hospital Stay," respectively, in the "Visit Detail \ Encounter Type" folder in HERON.
6. Cardiac Stress Test: It was identified using "Nuclear Cardiology (KUH)" variable, which is available in the "Cardiology Lab Results" folder in HERON. Nuclear CSTs were chosen because they are the only CSTs done inpatient at the study site.
7. Body Mass Index: It was identified using variable "Body Mass Index," which is available in the "Visit Details \ Visit Vitals" folder in HERON.

Outcome

1. Abnormal Cardiac Stress Test: Cardiac catheterization and/or coronary artery bypass graft (CABG) procedure after CST was used as indirect identifier for abnormal CST. Patients who underwent cardiac catheterization and/or CABG within 30 days of CST were considered to have abnormal CST.
2. Cardiac Catheterization: This procedure was identified by presence of any of the following variables in HERON:
    - "Left Heart Cath Procedure" available in the "Cardiovascular Registry (NCDR) \ V4 \ Diagnostic Cath" folder.
    - "Diagnostic Coronary Angiography Procedure" available in the "Cardiovascular Registry (NCDR) \ V4 \ Diagnostic Cath" folder.
    - "Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation" available in the "Procedures \ CPT-4 \ Medicine Services and Procedures \ Cardiovascular Procedures \ Cardiac Catheterization Procedures" folder.
    - "Therapeutic cardiovascular services and procedures on the coronary vessels" available in the "Procedures \ CPT-4 \ Medicine Services and Procedures \ Cardiovascular Procedures" folder.
3. Coronary artery bypass graft: This procedure was identified by the presence of any of the following variables in HERON:
    - "Combined arterial-venous grafting for coronary bypass" available in the "Procedures \ CPT-4 \ Surgery \ Surgical procedures on the cardiovascular system \ Surgical procedures on the heart and pericardium" folder in HERON.
    - "Bypass graft procedures" available in the "Procedures \ CPT-4 \ Surgery \ Surgical procedures on the cardiovascular system \ Surgical procedures on arteries and veins" folder in HERON.

- "Arterial grafting for coronary artery bypass" available in the "Procedures \ CPT-4 \ Surgery \ Surgical procedures on the cardiovascular system \ Surgical procedures on the heart and pericardium" folder in HERON.

Risk Factors / Covariates

4. History of Coronary Artery Disease: This risk factor was defined by the presence of any of the following variables before the date of CST:
    - "PERCUTANEOUS CORONARY INTERVENTION" available in the "History \ Surgical History \ General Surgical History" folder.
    - "HX CORONARY ARTERY BY-PASS GRAFT" available in the "History \ Surgical History \ General Surgical History" folder.
    - "CORONARY ARTERY BY-PASS GRAFT" available in the "History \ Surgical History \ General Surgical History" folder.
    - "Combined arterial-venous grafting for coronary bypass" available in the "Procedures \ CPT-4 \ Surgery \ Surgical procedures on the cardiovascular system \ Surgical procedures on the heart and pericardium" folder in HERON.
    - "Bypass graft procedures" available in the "Procedures \ CPT-4 \ Surgery \ Surgical procedures on the cardiovascular system \ Surgical procedures on arteries and veins" folder in HERON.
    - "Arterial grafting for coronary artery bypass" available in the "Procedures \ CPT-4 \ Surgery \ Surgical procedures on the cardiovascular system \ Surgical procedures on the heart and pericardium" folder in HERON.
    - ICD-10 code: I25.1 Atherosclerotic heart disease of native coronary artery
    - ICD-10 code: I25.2 Old myocardial infarction
    - ICD-10 code: I25.7 Atherosclerosis of coronary artery bypass graft(s) and coronary artery of transplanted heart with angina pectoris
    - ICD-10 code: I25.8 Other forms of chronic ischemic heart disease
    - ICD-10 code: I25.9 Chronic ischemic heart disease, unspecified

5. Hypertension: This risk factor was defined as:
    - Abnormally high blood pressure (BP) readings on two different days, which must occur within one year prior to the CST date or within one month after the CST date. For this study, abnormally high BP readings were defined as systolic blood pressure (SBP) of >= 140 mmHg or diastolic blood pressure (DBP) reading of >= 100 mmHg. Current cutoff values for the definition of hypertension are SBP > 130 mmHg and/or DBP > 80 mmHg. Higher thresholds were used in this study because of the variability in BP measurements in inpatient settings (for instance, in the emergency room, the patient will be talking and moving in the bed and the automatic BP cuff starts measuring the BP). SBP and DBP values were identified using the variables "Systolic Blood Pressure" and "Diastolic Blood Pressure," respectively, which are available in the "Visit Details \ Visit Vitals" folder in HERON.

      OR
    - Anyone who received any of the following medications during hospitalization or received it as prescription via Surescripts, within a year before the CST date or within a month right after the CST. Medications were identified using following variables in "Medications \ Cardiovascular Medications" folder in HERON:
        - [CV100] BETA BLOCKERS/RELATED
        - [CV200] CALCIUM CHANNEL BLOCKERS
        - [CV400] ANTIHYPERTENSIVE COMBINATIONS
        - [CV701] THIAZIDES/RELATED DIURETICS
        - [CV704] POTASSIUM SPARING/COMBINATIONS DIURETICS
        - [CV800] ACE INHIBITORS
        - [CV805] ANGIOTENSIN II INHIBITOR
        - [CV806] DIRECT RENIN INHIBITOR

6. Chronic Kidney Disease: This risk factor was defined by the presence of any of the following ICD-10 codes before the CST date.
    - N18 Chronic kidney disease (CKD)
    - I13 Hypertensive heart and chronic kidney disease
    - I12 Hypertensive chronic kidney disease
    - E10.22 Type 1 diabetes mellitus with diabetic chronic kidney disease
    - E11.22 Type 2 diabetes mellitus with diabetic chronic kidney disease
7. Hyperlipidemia: This risk factor was defined as the following:
    - Low density lipoprotein (LDL) level > 100 mg/dL within a year before the CST date or within a month right after the CST date. LDL lab was identified via the variable "LDL (#2321)", which is available in the "Laboratory Tests (KUH Hierarchy) \ Chemistry (KUH) \ 190 – Lipid Profile" folder in HERON.

    OR

    - Anyone who received hyperlipidemia medications during hospitalization or received it as prescription via Surescripts, within a year before the CST date or within a month right after the CST. Hyperlipidemia medications were identified using "[CV350] ANTILIPEMIC AGENTS" variable, which is available in the "Medications \ Cardiovascular Medications" folder in HERON.
8. Diabetes mellitus: This risk factor was defined as the following:
    - Hemoglobin A1c level of => 6.5% within a year before the CST date or within a month right after the CST date. Hemoglobin A1c lab was identified via the variable "HEMOGLOBIN A1C (#2034)", which is available in the "Laboratory Tests (LOINC Hierarchy) \ Hematology \ Hematology \ Hemoglobin normal variant \ Hemoglobin A \ Hemoglobin A1 \ Hemoglobin A1c" folder.

      OR

- Anyone who received anti-diabetic medications during hospitalization or received it as a prescription via Surescripts, within a year before the CST date or within a month right after the CST. Antidiabetic medications were identified using the following variables, available in the "Medications \ Hormones-Synthetics-Modifiers \ Blood Glucose Regulating Agents" folder in HERON.
    - [HS501] INSULIN
    - [HS502] ORAL HYPOGLYCEMIC AGENTS, ORAL
    - [HS509] HYPOGLYCEMIC AGENTS, OTHER

9. Obesity: Obesity was defined as body mass index => 30 Kg/m2.
10. Smoking history: This risk factor was defined by the presence of any of the following variables, available in the "History \ Social History \ Tobacco Usage \ Smoking Tobacco Use" folder in HERON, within a year before the CST date or within a month right after the CST date.
    - Light Tobacco Smoker
    - Heavy Tobacco Smoker
    - Former Smoker
    - Current Some Day Smoker
    - Current Every Day Smoker