**Clinical Definition:**

Heart failure (HF) is a complex syndrome characterized by the inability of the heart to supply sufficient blood flow to the body. HF is diagnosed clinically and further dichotomized by left ventricular ejection fraction (i.e. reduced or preserved). In 2010, HF affected 6.6 million Americans at a cost of 34.4 billion [1](#_ENREF_1), [2](#_ENREF_2).

**Human Readable Logic**

**1. All Heart Failure.** To identify the prevalence of heart failure: first, we include all records that have a SNOMED code including the keywords “heart failure” (90 total), with the exception of fetal heart failure. Then, we only include records that have a two encounters with a heart failure diagnosis, the second occurring at least 90 days after the first. This excludes patients who present acutely for “mixed pictures,” which are often ED presentations for shortness-of-breath that may be acute CHF, acute COPD, community-acquired pneumonia, or something similar. The cutoff of 90 days needs to be further tested empirically. Of note, this logic also excludes are patients with well-compensated heart failure, patients who leave the database, and decedents. Also of note, without a lookback from the index diagnois

These logic yielded a positive predictive value of 80-100% using Optum HER data, based on our review of 20 patient records (65000 total records identified). Given the relatively low prevalence of results in our dataset, it was not practical to calculate negative predictive value, sensitivity, or specificity.

**2. HF with Reduced EF.** To further identify heart failure with REDUCED ejection fraction (also called systolic heart failure): we modified the above population by identifying the subset who have EITHER one of a set of SNOMED codes for reduced EF, heart failure with reduced EF, or systolic HF (23 total).

These logic yielded a positive predictive value of 55-90% using Optum HER data, based on our review of 20 patient records (33000 records identified). Given the relatively low prevalence of results in our dataset, it was not practical to calculate negative predictive value, sensitivity, or specificity.

We further refined this definition to EXCLUDE codes for diastolic heart failure and to require two appearances of systolic heart failure separated more than 90 days. Adding this logic narrowed our sample to 13000, with a PPV of 90-100%. Of note, these logic would exclude patients whose EF was initially preserved but fell over time.

**3. HF with Preserved EF.** To further identify heart failure with PRESERVED ejection fraction (also called diastolic heart failure): we modified the above population by identifying the subset who have BOTH one of a set of SNOMED codes for diastolic heart failure (8 total), AND none of our previous codes for reduced EF.

These logic yielded a positive predictive value of 35-70% using Optum HER data, based on our review of 20 patient records (24000 records identified). Given the relatively low prevalence of results in our dataset, it was not practical to calculate negative predictive value, sensitivity, or specificity.

We further refined this definition to EXCLUDE codes for systolic heart failure and to require two appearances of diastolic heart failure separated more than 90 days. Adding this logic narrowed our sample to 8000, with a PPV of ~100%. Of note, these logic would exclude patients whose EF was initially preserved but fell over time.

**Next steps:**

- Clarify whether 90 days is the right window between the first and second diagnosis codes for heart failure

- Decide what to do with cases that begin with one type and end with another – eg, preserved EF that declines later in life, or mixed-picture cases that are resolved as systolic or diastolic later

- Evaluate whether searching directly for echo results yields a better definition of reduced or preserved EF cases