**Rules Document for Heart Failure 2013**

**Assumptions to be made when evaluating offline HF test patients:**

* EF is the most recent one (ignore date) as is NYHA symptom class (consider as current status of pt)
* No intensification of therapy, optimal therapy means having prescriptions for drugs
* Ignore volume management (out of scope) of HF

**Eligibility**

* Presence of heart failure (ICD9 Codes – See Appendix A) AND
* Absence of heart transplant (ICD9 Codes – See Appendix A)

**Note about eligibility -** If values for the following variables are missing, all recommendations will be suppressed:

* Left ventricular ejection fraction
* Sex
* Systolic blood pressure
* Creatinine

There are additional missing values that will suppress recommendations only for certain drugs, and these are noted below.

**Goals**

* There are no specific goals for HF patients, unlike other CDS programs such as Glycemic Control.

**Behavior of the CDS**

Compelling Indications

* Absence of therapy then recommend therapy
* Presence of therapy then no action

Absolute Contraindications (absolute contraindication behavior trumps compelling indication behavior)

* Absence of therapy then do not recommend to start therapy
* Presence of therapy then recommend to stop therapy

Relative Contraindications

* Absence of therapy then recommend therapy (with a cautionary message)
* Presence of therapy then cautionary alert

There are, however, **special cases** (e.g. do not add, but do not remove if condition X exists) for some recommendations, and these are noted below.

There are also certain **messages** that we would like to test, which are noted below as well.

Of note, Diuretic therapy is beyond the scope of this project and a message will be issued to all eligible patients ‘HF with reduced EF with fluid retention is an indication for diuretic therapy, but is beyond the scope of this project recommendations.’

**ACE Inhibitors**

**Guideline: ‘ACE inhibitors** are recommended in patients with HF*r*EF and current or prior symptoms, unless contraindicated, to reduce morbidity and mortality (343, 412-414). (*Level of Evidence: A*)’ – Yancy 7.3.2.2 pg 49

Evaluated to add only if:

SBP>=110 and

Absence of angioedema ARB and

Absence of angioedema ACE and

Decision eGFR present and >30 and

Not 20% increase creatinine post ARB/ACE inhibitor

**Compelling indication:**

LVEF<=40

**Absolute contraindications**

* Angioedema as a past recorded reaction to ACE inhibitor

Note: while Pregnancy should be a strong contraindication, there is no way to determine pregnancy from the data we have, so we will instead issue a message to all women of childbearing age.

**Relative contraindications**

* Aortic stenosis
* Hypertrophic cardiomyopathy
* Renal artery stenosis
* Chronic kidney disease (CKD) stage3 or 4
* 30 <eGFR<60
* Active prescription for Aliskiren

Active prescription for Potassium-sparing diuretics

Active prescription for ARB and aldosterone antagonist

**Drug partner to avoid**

**ARB**

**Blocked recommendations**

Do not intensify conditions

* K>5
* Absence K in past month

Do not start conditions

* K>5
* Absence K in past month
* Decision eGFR present or eGFR<=30 or female and decision creatinine >=2.3 or male or decision creatinine >=2.5

**Special cases:**

Case 1) If patient has a prescription for an ACE inhibitor, do not stop prescription if:

* Most recent SBP<110 (issue strong cautionary message if SBP<80, and mild cautionary message if 80<SBP<110) OR
* Decision renal function:
  + (Decision Creatinine >=2.5 (male) OR creatinine>=2.3 (female) OR
  + Decision eGFR <=30 OR
  + Presence CKD stage 4 (ICD9)
  + Presence CKD stage 5 (ICD9))
  + 20% increase of creatinine after start ACEI/ARB (Any increase of more than 20% in creatinine AFTER prescription for an ACEi/ARB.  The comparison is FROM the baseline creatinine prior to initiation of ACEi/ARB (the most recent creatinine prior to first ACEi/ARB) TO the peak creatinine within 3 months after initiation of ACEi/ARB) OR
* Angioedema as a past recorded reaction to ARB and active prescription for ACEI

Case 2) If patient does not have a prescription for an ACE inhibitor, DO NOT evaluate adding ACE inhibitor if:

* Most recent SBP<110 (issue strong cautionary message if SBP<80, and mild cautionary message if 80<SBP<110) OR
* Decision renal function:
  + (Decision Creatinine >=2.5 (male) OR creatinine>=2.3 (female) OR
  + Decision eGFR <=30 OR
  + Presence CKD stage 4 (ICD9) OR
  + Presence CKD stage 5 (ICD9)) OR
  + 20% increase of creatinine after start ACEI/ARB (Any increase of more than 20% in creatinine AFTER prescription for an ACEi/ARB.  The comparison is FROM the baseline creatinine prior to initiation of ACEi/ARB (the most recent creatinine prior to first ACEi/ARB) TO the peak creatinine within 3 months after initiation of ACEi/ARB) OR
  + Presence angioedema ACE inhibitor
  + Presence angioedema ARB

Future Case 3) Any increase of more than 20% in creatinine AFTER prescription for an ACEi/ARB.  The comparison is FROM the baseline creatinine prior to initiation of ACEi/ARB (the most recent creatinine prior to first ACEi/ARB) TO the peak creatinine within 3 months after initiation of ACEi/ARB. **NOTE:** we are not currently capturing the data necessary to evaluate this criterion, so we will revisit this when we have the data.

**Angiotensin Receptor Blockers (ARB)**

**Guideline: ARBs** are recommended in patients with HFrEF with current or prior symptomswho are ACE inhibitor intolerant, unless contraindicated, to reduce morbidity and mortality (108, 345, 415, 450). (*Level of Evidence:A*) – Yancy 7.3.2.3 pg 51

Evaluated to add only if:

SBP>=110 and

Absence of angioedema ARB and

Absence of angioedema ACE and

Decision eGFR present and >30 and

Not 20% increase creatinine post ARB/ACE inhibitor

**Compelling indication**

* LVEF<=40 AND
* (Adverse reaction to ACE inhibitor AND not on ACE inhibitor) AND
* Most recent SBP>=110

**Absolute contraindications**

* Angioedema as a past recorded reaction to ARB OR
* Most recent K>5

**Relative contraindications**

* Aortic stenosis OR
* Hypertrophic cardiomyopathy OR
* Renal artery stenosis OR
* Chronic kidney disease (CKD) stage3 or 4 OR
* 15 <=eGFR<60 OR
* 20% increase in creatinine after initiation of ACEi or ARB OR
* Active prescription for Aliskiren OR

Active prescription for Potassium-sparing diureticsActive prescription for ACE inhibitor and aldosterone antagonists

Drug partner to avoid

ACE inhibitor

**Blocked recommendations**

Add drug

* K>5
* Absence K in past month
* Decision eGFR;
  + (Decision Creatinine >=2.5 (male) OR
  + creatinine>=2.3 (female) OR
  + eGFRpresent and eGFR <=30

Intensify

* K>5
* Absence K in past month

**Special case:**

Case 1) If patient has a prescription for an ARB, do not stop prescription if:

* Most recent SBP<110 (issue strong cautionary message if SBP<80, and mild cautionary message if 80<SBP<110) OR
* Decision renal function:
  + (Decision Creatinine >=2.5 (male) OR creatinine>=2.3 (female) OR
  + Decision eGFR <=30 OR
  + Presence CKD stage 4 (ICD9)
  + Presence CKD stage 5 (ICD9))
  + 20% increase of creatinine after start ACEI/ARB (Any increase of more than 20% in creatinine AFTER prescription for an ACEi/ARB.  The comparison is FROM the baseline creatinine prior to initiation of ACEi/ARB (the most recent creatinine prior to first ACEi/ARB) TO the peak creatinine within 3 months after initiation of ACEi/ARB) OR
* Angioedema as a past recorded reaction to ACE inhibitor and active prescription for ARB

Case 2) If patient does not have a prescription for an ARB, DO NOT recommend adding ARB if:

* Most recent SBP<110 (issue strong cautionary message if SBP<80, and mild cautionary message if 80<SBP<110) OR
* Decision renal function:
  + (Decision Creatinine >=2.5 (male) OR creatinine>=2.3 (female) OR
  + Decision eGFR <=30 OR
  + Presence CKD stage 4 (ICD9) OR
  + Presence CKD stage 5 (ICD9)) OR
  + 20% increase of creatinine after start ACEI/ARB (Any increase of more than 20% in creatinine AFTER prescription for an ACEi/ARB.  The comparison is FROM the baseline creatinine prior to initiation of ACEi/ARB (the most recent creatinine prior to first ACEi/ARB) TO the peak creatinine within 3 months after initiation of ACEi/ARB) OR
  + Presence angioedema ACE inhibitor
  + Presence angioedema ARB

Note: while Pregnancy should be a strong contraindication, there is no way to determine pregnancy from the data we have, so we will instead issue a message to all women of childbearing age.

**Beta Blockers (carvedilol, metoprolol succinate, and bisoprolol)**

**Guideline:** Use of 1 of the **3 beta blockers** proven to reduce mortality (i.e., bisoprolol, carvedilol, and sustained-release metoprolol succinate) is recommended for all patients with current or prior symptoms of HF*r*EF, unless contraindicated, to reduce morbidity and mortality (346, 416-419, 448). (*Level of Evidence: A*) – Yancy 7.3.2.4 pg 53

**Compelling indication for metoprolol succinate or bisoprolol or carvedilol**

* LVEF<=40 AND
* (Presence of heart failure ICD9 code OR (NYHA II or NYHA III or NYHA IV or NYHA IV ambulatory)
* Not already on any of the 3 recommended beta blockers (note: if a patient is on a non-recommended beta blocker AND on a recommended beta blocker, there will be NO recommendation to substitute the non-recommended beta blocker)

**Absolute contraindications for metoprolol succinate, bisoprolol, and carvedilol**

* None

**Relative contraindications for metoprolol succinate, bisoprolol, and carvedilol**

* Aortic stenosis OR
* most recent SBP<110 OR
* Asthma OR
* most recent pulse<60 OR
* Prescription for verapamil
* Prescription for diltiazem
* Prescription for sotalol
* Prescription for beta blocker other than metoprolol succinate, bisoprolol or carvedilol

**Special cases**: patients with compelling indications for one of the three recommended beta blockers

* who have an active prescription for another beta blocker (except sotalol) 🡪 substitute for one of the 3 recommended beta blockers for heart failure
* who have an active prescription for sotalol 🡪 no action

**Aldosterone antagonists**

**Guideline: Aldosterone receptor antagonists** [or mineralocorticoid receptor antagonists] are recommended in patients with NYHA class II-IV and who have LVEF of 35% or less, unless contraindicated, to reduce morbidity and mortality. Patients with NYHA class II should have a history of prior cardiovascular hospitalization or elevated plasma natriuretic peptide levels to be considered for aldosterone receptor antagonists. Creatinine should be 2.5 mg/dL or less in men or 2.0 mg/dL or less in women (or estimated glomerular filtration rate >30 mL/min/1.73 m2), and potassium should be less than 5.0 mEq/L. Careful monitoring of potassium, renal function, and diuretic dosing should be performed at initiation and closely followed thereafter to minimize risk of hyperkalemia and renal insufficiency (425, 426, 478). (Level of Evidence: A) Yancy 7.3.2.5 pg 54

**Aldosterone receptor antagonists** are recommended to reduce morbidity and mortality following an acute MI in patients who have LVEF of 40% or less who develop symptoms of HF or who have a history of diabetes mellitus, unless contraindicated (446). (Level of Evidence: B) Yancy 7.3.2.5 pg 54

**Compelling indications**

Case #1:

* LVEF<=35 AND
* Presence HF ICD9 code
* (Creatinine <2.5 (male) or creatinine<2.0 (female) OR eGFR>30) AND
* Most recent K<5 AND
* Presence of ACE-I or ACE-I contraindicated AND
* (Presence of one of the three recommended BB (metoprolol succinate, bisoprolol, carvedilol) OR beta blocker contraindicated) AND
* Either
  + (NYHA Class III/IV symptoms) OR
  + ((NYHA Class II symptoms AND (
    - Elevated BNP defined as (BNP>250)) or
    - ((NTproBNP>750 for female or NTproBNP>500 for male)) or
    - Prior cardiovascular hospitalization

Case #2:

* LVEF<=40 AND
* Presence HF ICD9 code AND
* Most recent K<5 AND
* (MI within last 6 months AND
* (NYHA Class II/ III/ IV symptoms) OR DM) AND
* Presence of stage C BB or contraindication to BB AND
* ACE or ARB or contraindication

Note: If a patient is missing values for the following variables, aldosterone antagonist recommendation will be suppressed:

* + NYHA Class Symptoms
  + Potassium
  + BNP or NTproBNP (if NYHA Class II symptoms. Otherwise, lack of BNP or NTproBNP value will NOT suppress a recommendation)

**Absolute Contraindications**

* + CKD Stage 5 (ICD9 code) OR presence CKD stage 4 icd9 code OR most recent eGFR<=30 OR most recent creatinine >=2.5 for men >=2.0 for women (lowest wins) OR
  + Addison’s disease

**Relative Contraindications**

* + CKD Stage 3 OR 30<eGFR<=60 OR
  + Prescription for Potassium supplements OR
  + Prescription for Other potassium-sparing diuretics OR
  + Prescription for Non-steroidal anti-inflammatory drugs (NSAIDs) OR
  + Prescription for Heparin OR
  + Prescription for Cholestyramine

**Hydralazine**

Note: should be given in combination with isosorbide dinitrates (unless one is contraindicated), but because they have different contraindications they are listed separately.

**Guideline:** The combination of **hydralazine and isosorbide dinitrate** is recommended to reduce morbidity and mortality for patients self-described as African Americans with NYHA class III–IV HFrEF receiving optimal therapy with ACE inhibitors and beta blockers, unless contraindicated (423, 424). (Level of Evidence: A) Yancy 7.3.2.6 pg 58

A combination of **hydralazine and isosorbide dinitrate** can be useful to reduce morbidity or mortality in patients with current or prior symptomatic HF*r*EF who cannot be given an ACE inhibitor or ARB because of drug intolerance, hypotension, or renal insufficiency, unless contraindicated (449). (Level of Evidence: A) Yancy 7.3.2.6 pg 58 (Class IIa)

**Special case:** If most recent SBP <110

* and patient NOT already on hydralazine 🡪 do not evaluate recommend start
* and patient IS already on hydralazine 🡪 do not recommend to stop, but issue warning message that patient has SBP<110.

**Compelling indications:**

Case #1:

* LVEF<=40 AND
* Self-identified African American AND
* NYHA Class III or IV symptoms AND
* (Presence of ACE-I or ACE-I contraindicated) OR (ARB or ARB contraindicated )
* Presence of one of the three recommended beta blockers (metoprolol succinate, bisoprolol, carvedilol) or beta blockers contraindicated

Case #2:

* LVEF<=40 AND
* NYHA Class III or IV symptoms AND
* Absence of ACE AND ARB AND either
  + (CDK Stage 4 or 5 or eGFR<30) OR
  + ADR to ACE AND ADR to ARB
  + SBP<110

Note: If a patient is missing values for the following variables, hydralazine recommendation will be suppressed:

* + NYHA Class Symptoms
  + Race (for Case #1)

**Absolute contraindications**

* Lupus-like symptoms as an ADR to hydralazine OR

**Relative contraindications**

* Lupus Erythematosus Systemic

**Isosorbide dinitrates**

Note: should be given in combination with hydralazine (unless one is contraindicated), but because they have different contraindications they are listed separately.

**Guideline:** The combination of **hydralazine and isosorbide dinitrate** is recommended to reduce morbidity and mortality for patients self-described as African Americans with NYHA class III–IV HFrEF receiving optimal therapy with ACE inhibitors and beta blockers, unless contraindicated (423, 424). (Level of Evidence: A) Yancy 7.3.2.6 pg 58

A combination of **hydralazine and isosorbide dinitrate** can be useful to reduce morbidity or mortality in patients with current or prior symptomatic HF*r*EF who cannot be given an ACE inhibitor or ARB because of drug intolerance, hypotension, or renal insufficiency, unless contraindicated (449). (Level of Evidence: A) Yancy 7.3.2.6 pg 58 (Class IIa)

**Special case:** If most recent SBP <110

* and patient NOT already on isosorbide dinitrate 🡪 do not evaluate recommend start
* and patient IS already on isosorbide dinitrate 🡪 do not recommend to stop, but issue warning message that patient has SBP<110.

**Compelling indications**

Case #1:

* LVEF<=40 AND
* Self-identified African American AND
* NYHA Class III or IV symptoms AND
* Presence of ACE-I or ACE-I contraindicated or ARB or ARB contraindicated AND
* Presence of one of the three recommended BB (metoprolol succinate, bisoprolol, carvedilol) OR beta blocker contraindicated

Case #2

* LVEF<=40 AND
* NYA Class III or IV symptoms AND
* Absence of ACE or ARB and either
  + (CDK Stage 4 or 5 or eGFR<30) or
  + ADR to ACE or ADR to ARB or
  + SBP <110

Note: If a patient is missing values for the following variables, isosorbide dinitrate recommendation will be suppressed:

* + NYHA Class Symptoms
  + Race (for Case #1)

**Absolute contraindications**

* Active prescription for phosphodiesterase inhibitors (sildenafil, vardenafil, or tadalafil)

**Relative contraindications**

none

**Implantable Cardioverter-Debibrillator (ICD)**

**Guideline: ICD therapy** is recommended for primary prevention of SCD to reduce total mortality in selected patients with nonischemic DCM or ischemic heart disease at least 40 days post-MI with LVEF of 35% or less and NYHA class II or III symptoms on chronic GDMT, who have reasonable expectation of meaningful survival for more than 1 year (355, 593). (Level of Evidence: A) Yancy 7.3.4 pg 70

**ICD therapy** is recommended for primary prevention of SCD to reduce total mortality in selected patients at least 40 days post-MI with LVEF of30% or less, and NYHA class I symptoms while receiving GDMT, who have reasonable expectation of meaningful survival for more than 1 year (362, 597, 598). (Level of Evidence: B) Yancy 7.3.4 pg 70

\*Note: See Appendix for our definition of Guideline-Directed Medical Therapy (GDMT)

**Compelling indications**

Case #1:

* LVEF<=35 AND
* NYHA Class II or III symptoms AND
* Presence of MI at least 40 days old (cannot encode non-ischemic dilated cardiomyopathy)AND
* Guideline Directed Medical Therapy:
* ACE-I or ARB or contraindications to ACE or ARB AND
* BB or contraindications to BB AND
* Aldosterone antagonist or contraindications to aldosterone antagonist AND
* GDMT defined as:
  + (1) Presence of hydralazine and isosobide dinitrate and (African American or cannot tolerate ACE/ARB(defined by Presence of CKD Stage 4 OR 5 OR eGFR<30)) OR
  + (2) Presence of hydralazine and (African American or cannot tolerate ACE/ARB(defined by Presence of CKD Stage 4 OR 5 OR eGFR<30)) and contra to isosorbide dinitrate OR
  + (3) Presence of isosorbide dinitrate and (African American or cannot tolerate ACE/ARB (defined by Presence of CKD Stage 4 OR 5 OR eGFR<30)) and contra to hydrlazine
  + (4) (4) absolute contraindications to hydralazine and isosorbide dinitrates
  + (5) Presence of ACE or ARB and absence of hydralazine and nitrates and not African American

Case #2:

* LVEF <=30 AND
* NYHA Class I AND
* Presence of MI at least 40 days old AND
* Guideline Directed Medical Therapy:
* ACE-I or ARB or contraindications to ACE or ARB AND
* BB or contraindications to BB AND
* Aldosterone antagonist or contraindications to aldosterone antagonist AND
* GDMT defined as:
  + (1) Presence of hydralazine and isosobide dinitrate and (African American or cannot tolerate ACE/ARB(defined by Presence of CKD Stage 4 OR 5 OR eGFR<30)) OR
  + (2) Presence of hydralazine and (African American or cannot tolerate ACE/ARB(defined by Presence of CKD Stage 4 OR 5 OR eGFR<30)) and contra to isosorbide dinitrate OR
  + (3) Presence of isosorbide dinitrate and (African American or cannot tolerate ACE/ARB (defined by Presence of CKD Stage 4 OR 5 OR eGFR<30)) and contra to hydrlazine
  + (4) (4) absolute contraindications to hydralazine and isosorbide dinitrates
  + (5) Presence of ACE or ARB and absence of hydralazine and nitrates and not African American

Note: If a patient is missing values for the following variables, implantable cardioverter-defibrillator recommendation will be suppressed:

* + NYHA Class Symptoms

**Absolute contraindications**

* Palliative care

**Cardiac Resynchronization Therapy (CRT)**

**Guideline: CRT** is indicated for patients who have LVEF of 35% or less, sinus rhythm, left bundle-branch block (LBBB) with a QRS duration of 150 ms or greater, and NYHA class II, III, or ambulatory IV symptoms on GDMT. *(Level of Evidence: A for NYHA class III/IV* (38, 78, 116, 594); *Level of* *Evidence: B for NYHA class II* (595, 596)) Yancy 7.3.4 pg 70

\*Note: See Appendix for our definition of Guideline-Directed Medical Therapy (GDMT)

**Compelling indication**

* LVEF <=35 AND
* NYHA Class II or III or IV ambulatory symptoms AND
* Guideline Directed Medical Therapy:
* ACE-I or ARB or contraindications to ACE or ARB AND
* BB or contraindications to BB AND
* Aldosterone antagonist or contraindications to aldosterone antagonist AND
* GDMT defined as:
  + (1) Presence of hydralazine and isosobide dinitrate and (African American or cannot tolerate ACE/ARB(defined by Presence of CKD Stage 4 OR 5 OR eGFR<30)) OR
  + (2) Presence of hydralazine and (African American or cannot tolerate ACE/ARB(defined by Presence of CKD Stage 4 OR 5 OR eGFR<30)) and contra to isosorbide dinitrate OR
  + (3) Presence of isosorbide dinitrate and (African American or cannot tolerate ACE/ARB (defined by Presence of CKD Stage 4 OR 5 OR eGFR<30)) and contra to hydrlazine
  + (4) (4) absolute contraindications to hydralazine and isosorbide dinitrates
  + (5) Presence of ACE or ARB and absence of hydralazine and nitrates and not African American

Note: If a patient is missing values for the following variables, cardiac resynchronization therapy recommendation will be suppressed:

* + NYHA Class Symptoms

**Absolute contraindications**

* Palliative care

**Primary messages selected for testing:**

* **Combined use of ACE, ARB, and aldosterone antagonist**: “Routine combined use of an ACEI, ARB, and aldosterone antagonist is NOT RECOMMENDED for patients with current or prior symptoms of HF and reduced LVEF. (Level of Evidence: C)”
  + This message is triggered when a patient is on all three drugs.
* **Patient is taking drugs harmful to HF: “**Drugs known to adversely affect the clinical status of patients with current or prior symptoms of HF and reduced LVEF should be avoided or withdrawn whenever possible (e.g., nonsteroidal anti-inflammatory drugs (not aspirin), most antiarrhythmic drugs, most calcium channel blocking drugs (except amlodipine) and thiazolidinediones). (Level of Evidence: B)”
  + This message is triggered if a patient is on one of these harmful drugs:
    - Calcium-channel blockers with negative inotropic effects (nifedipine, nisoldipine, nicardipine, isradipine, diltiazem, verapamil)
    - Thiazolidinediones (rosiglitazone, pioglitazone)
    - Non-steroidal anti-inflammatory drugs (Aceclofenac, acemetacin, azapropazone, benoxaprofen, bromfenac, ibuprofen)
    - Dronedarone
* **Woman of child-bearing age:** “(message text has not yet been decided or encoded… but it will warn that women of childbearing age should not be on certain drugs (ACE, ARB…))”
  + This message will be triggered if a woman is age <=50.

**APPENDIX A: ICD9 Codes**

**Heart Failure:**

|  |  |
| --- | --- |
| **ICD9 code** | **Description** |
| 402.11 | Benign with Heart Failure |
| 402.91 | Unspecified with Heart Failure |
| 428 | Heart Failure |
| 428 | Congestive heart failure, unspecified |
| 428.1 | Left heart failure |
| 428.9 | Heart failure, unspecified |
| 429.3 | Cardiomegaly |
| 425.0 | Cardiomyopathy |
| 425.3 | Endocardial fibroelastosis |
| 425.4 | Other primary cardiomyopathies |
| 425.5 | Alcoholic Cardiomyopathy |
| 425.8 | CARDIOMYOPATHY IN OTHER DISEASES CLASSIFIED ELSEWHERE |
| 425.9 | SECONDARY CARDIOMYOPATHY UNSPECIFIED |
| 402 | Hypertensive Heart Disease |
| 402.01 | Malignant with Heart Failure |
| 404 | Hypertensive heart and Chronic Kidney Disease |
| 404.01 | Malignant, with HF and with CKD stage I through IV or unspecified |
| 404.03 | Malignant, with HF and CKD stage V or end stage renal disease |
| 404.11 | Benign, with HF and with CKD stage I through IV or unspecified |
| 404.13 | Benign, with HF and CKD stage V or end stage renal disease |
| 404.91 | Unspecified, with HF and CKD stage I through IV or unspecified |
| 404.93 | Unspecified, with HF and CKD stage V or end stage renal disease |
| 428.2 | Systolic heart failure, Unspecified |
| 428.21 | Systolic heart failure, acute |
| 428.22 | Systolic heart failure, chronic |
| 428.23 | Systolic heart failure, acute on chronic |
| 428.3 | Diastolic heart failure, unspecified |
| 428.31 | Diastolic heart failure, Acute |
| 428.32 | Diastolic heart failure, chronic |
| 428.33 | Diastolic heart failure, acute on chronic |
| 428.4 | Combined systolic and diastolic heart failure, unspecified |
| 428.41 | Combined systolic and diastolic heart failure, acute |
| 428.42 | Combined systolic and diastolic heart failure, chronic |
| 428.43 | Combined systolic and diastolic heart failure, acute on chronic |

**Heart Transplant:**

|  |  |
| --- | --- |
| **ICDCode** | **ICDDescription** |
| V42.1 | HEART REPLACED BY TRANSPLANT |
| 996.83 | COMPLICATIONS OF TRANSPLANTED HEART |
| 414.06 | CORONARY ATHEROSCLEROSIS, OF NATIVE CORONARY ARTERY OF TRANSPLANTED HEART |
| 414.07 | CORONARY ATHEROSCLEROSIS, OF BYPASS GRAFT (ARTERY) (VEIN) OF TRANSPLANTED HEART |

**APPENDIX B: Recommendations extracted from Circulation, Yancy, et al 2013**

ACE inhibitors

* **ACE inhibitors** are recommended in patients with HF*r*EF and current or prior symptoms, unless contraindicated, to reduce morbidity and mortality (343, 412-414). (*Level of Evidence: A*) – Yancy 7.3.2.2 pg 49

Angiotensin receptor blockers

* **ARBs** are recommended in patients with HFrEF with current or prior symptomswho are ACE inhibitor intolerant, unless contraindicated, to reduce morbidity and mortality (108, 345, 415, 450). (*Level of Evidence:A*) – Yancy 7.3.2.3 pg 51

Beta blockers

* Use of 1 of the **3 beta blockers** proven to reduce mortality (i.e., bisoprolol, carvedilol, and sustained-release metoprolol succinate) is recommended for all patients with current or prior symptoms of HF*r*EF, unless contraindicated, to reduce morbidity and mortality (346, 416-419, 448). (*Level of Evidence: A*) – Yancy 7.3.2.4 pg 53

Aldosterone antagonists

* **Aldosterone receptor antagonists** [or mineralocorticoid receptor antagonists] are recommended in patients with NYHA class II-IV and who have LVEF of 35% or less, unless contraindicated, to reduce morbidity and mortality. Patients with NYHA class II should have a history of prior cardiovascular hospitalization or elevated plasma natriuretic peptide levels to be considered for aldosterone receptor antagonists. Creatinine should be 2.5 mg/dL or less in men or 2.0 mg/dL or less in women (or estimated glomerular filtration rate >30 mL/min/1.73 m2), and potassium should be less than 5.0 mEq/L. Careful monitoring of potassium, renal function, and diuretic dosing should be performed at initiation and closely followed thereafter to minimize risk of hyperkalemia and renal insufficiency (425, 426, 478). (Level of Evidence: A) Yancy 7.3.2.5 pg 54
* **Aldosterone receptor antagonists** are recommended to reduce morbidity and mortality following an acute MI in patients who have LVEF of 40% or less who develop symptoms of HF or who have a history of diabetes mellitus, unless contraindicates (446). (Level of Evidence: B) Yancy 7.3.2.5 pg 54

Hydralazine and nitrates

* The combination of **hydralazine and isosorbide dinitrate** is recommended to reduce morbidity and mortality for patients self-described as African Americans with NYHA class III–IV HFrEF receiving optimal therapy with ACE inhibitors and beta blockers, unless contraindicated (423, 424). (Level of Evidence: A) Yancy 7.3.2.6 pg 58
* A combination of **hydralazine and isosorbide dinitrate** can be useful to reduce morbidity or mortality in patients with current or prior symptomatic HF*r*EF who cannot be given an ACE inhibitor or ARB because of drug intolerance, hypotension, or renal insufficiency, unless contraindicated (449). (Level of Evidence: A) Yancy 7.3.2.6 pg 58 (Class IIa)

Implantable cardioverter defibrillator

* **ICD therapy** is recommended for primary prevention of SCD to reduce total mortality in selected patients with nonischemic DCM or ischemic heart disease at least 40 days post-MI with LVEF of 35% or less and NYHA class II or III symptoms on chronic GDMT, who have reasonable expectation of meaningful survival for more than 1 year (355, 593). (Level of Evidence: A) Yancy 7.3.4 pg 70
* **ICD therapy** is recommended for primary prevention of SCD to reduce total mortality in selected patients at least 40 days post-MI with LVEF of30% or less, and NYHA class I symptoms while receiving GDMT, who have reasonable expectation of meaningful survival for more than 1 year (362, 597, 598). (Level of Evidence: B) Yancy 7.3.4 pg 70

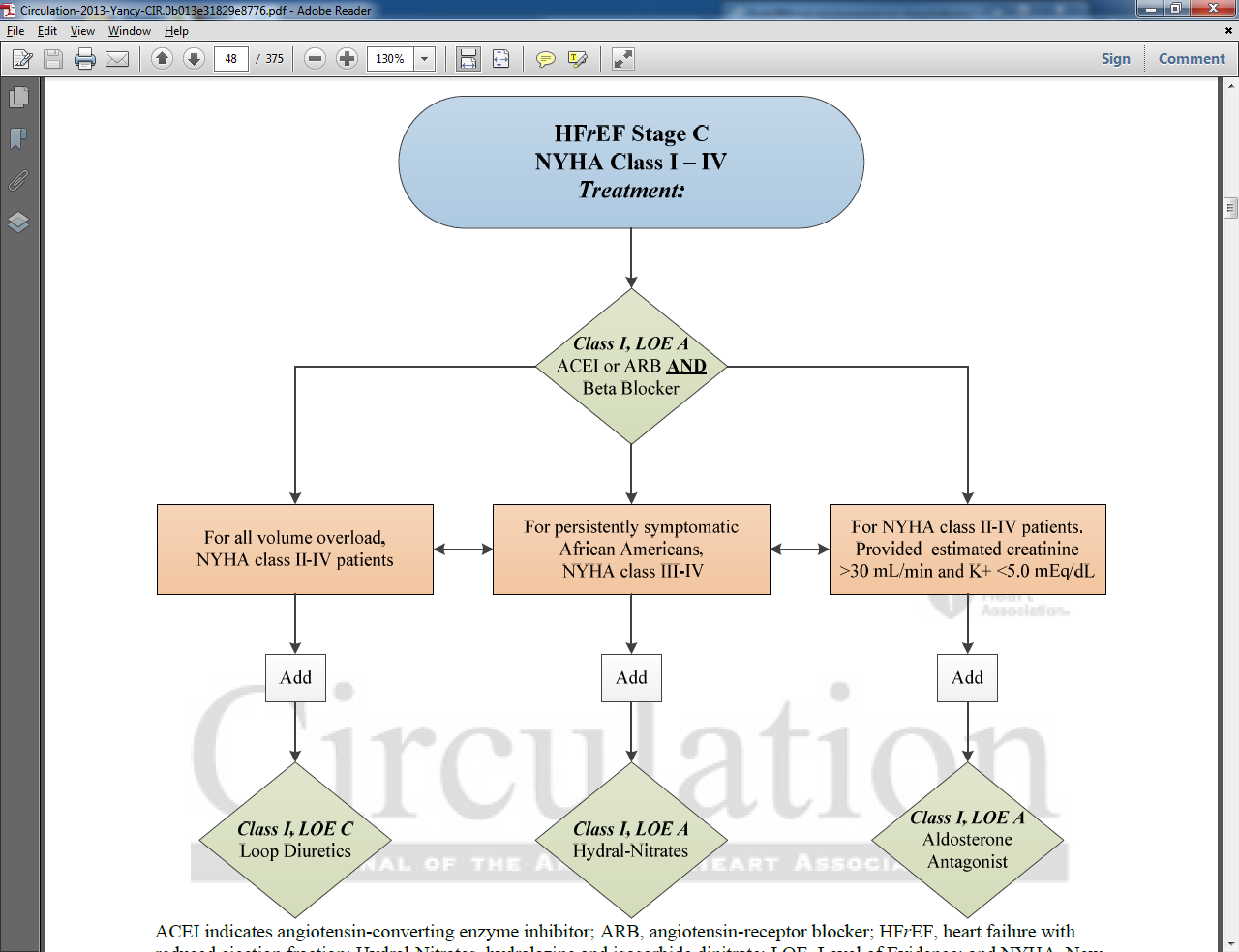
Cardiac resynchronization therapy

* **CRT** is indicated for patients who have LVEF of 35% or less, sinus rhythm, left bundle-branch block (LBBB) with a QRS duration of 150 ms or greater, and NYHA class II, III, or ambulatory IV symptoms on GDMT. *(Level of Evidence: A for NYHA class III/IV* (38, 78, 116, 594); *Level of* *Evidence: B for NYHA class II* (595, 596)) Yancy 7.3.4 pg 70

Other

* Routine *combined* use of an ACE inhibitor, ARB, and aldosterone antagonist is potentially harmful for patients with HF*r*EF. (*Level of Evidence: C*) Yancy 7.3.2.3, pg 51
* Drugs known to adversely affect the clinical status of patients with current or prior symptoms of HF*r*EF are potentially harmful and should be avoided or withdrawn whenever possible (e.g., most antiarrhythmic drugs, most calcium channel blocking drugs (except amlodipine), NSAIDs, or thiazolidinediones) (546-557). *(Level of Evidence: B) Yancy 7.3.2.9*

Figure 1 Guideline-directed medical therapy (GDMT) from Yancy et al. 2013



**NOTE:** Diuretic therapy is beyond the scope of this project. Therefore, this project uses an adaptation of the GDMT chart above. This project’s version of GDMT assumes that diuretics are prescribed if indicated, and that diuretics are absent when not indicated.

**WISHLIST**

* Rules document needs description of how to discontinue a medication and then restart an alternative. For example, if discontinuing ACEI for angioedema, do we recommend ARB at the same time?
* Remove dependency of eGFR from hydralazine, nitrates and BB
* (for ADD ACEI, ARB, AA) Lack of eGRF in past 30 days - very stringent. Add as blocked recommendation in drug usage and remove from higher level action choice rule in criteria.
* For patients with active prescriptions for ACEI, ARB and AA and eGFR<30 (timeframe?) issue alert for provider.
* Reevaluate action choice with low SBP (SBP<110)- currently evaluating BB and AA. Add low SBP restriction as blocked recommendation to BB, AA, ACEI, ARB (not hydralazine and nitrates?). For patients on drugs and low SBP should we issue an alert?
* Case 500961- change rules doc (if ADR not angioedema to ACEI, add blocked ACEI rec, and recommend ARB)
* Add explicit alerts about missing data that is required to evaluate recommendations, per Samson in rules document: EF, sex, SBP, creatinine, eGFR (update rules doc with eGFR).
* 500162- patient has old eGFR but has CKD stage 4 - why is action choice evaluated and not suspended

From 7/30/15 (KY)

* Unknown race should "block" hyd/nit rec, not totally rule it out.

* Want to add a message saying "order new creat" if it's too old (MA didn't specify what "too old" is)

* ald ant rec should be blocked if K older than 1 month, similar to ACE and ARB
  + Status: ? Might have been fixed by Susana already

* Adding angioedema to ACE as rel contra to ARB, and angioedema to ARB as rel contra to ACE
  + Status: fixed? Need to re-check
  + New status: not sure if we actually want to do this… instead, we need to clarify the rules doc to say that special cases should be evaluated first. Also need to fix the encoding to match the rules doc, since it does not currently match it (but we think the rules doc is what we want)

* ICD9 code "412." is "OLD MI" - need to remove this from the list of codes recognized by ATHENA as an MI

* MI w/in 6 months is not currently being computed by the KB for ald ant rec..

**Non-HF-specific thing to fix:**

* Acyclovir KB name is misspelled as "aciclovir"

From 2/2015 (After first effort for offline testing)

* Add warning about low DBP (<60?)
* Updated formulary - losartan and valsartan are restricted, these are preferred drugs in current KB.
* Should we do a blocked recommendation for Hydralazine if race is 'unknown', since this data could be updated
* We use most recent creatinine/eGFR. Should have time constraint when adding a drug - do a blocked recommendation. Less than 1 year? Less than 6m? Less than 3m? Applies for ACE, ARB, AA, Nitrates and Hydralazine
* Should 747.22 CONGENITAL ATRESIA AND STENOSIS OF AORTA be categorized as aortic stenosis for BB relative contra?
* What to do with ICD description 'aortic valve disorder' (424.1)- for bb relative contra? Add message about using clinical judgment?
* Patient on 4 drugs not at max dose , should recommend increase dose and option to refer
* Add tamsulosin as a alpha blocker (add super class)
* Issue warning message when patient on dose higher than max recommended - across all the kbs
* Double check that 20% increase of creatinine after ACER/ARB is working as expected. Last ACE start, any ACE start?
* HF and HTN
  + 10/7/14: Regarding ACE, to have contraindications shared across multiple domains

From 10/2014 (prior to patient testing)

* 12/2/14 Clinical meeting: HF , add messages regarding diuretics

Add CO, per MA 12/2/14: While we recognize that diuretics are an important therapeutic options, we did not encode any recommendations for these drugs because we do not have structured data to detect fluid overload (a requirement for diuretics). We have, on our “wish list”, to add messages to all HF patients: “If patient has fluid overload, then consider diuretics (xyz)”. For patients with hypertension, a different list of diuretics would be listed.. Patients already on a diuretic would not get this message.

12/1/2015 email from Susana at 10:33 AM:

Here is a summary of things we discussed today based on HF KB:

Notes from conference call with team 12/8/2015

1. Make explicit what to do when data is missing and system ‘hangs’ (i.e., does not generate drug recommendations). Create action choices that, even when data is missing, generate recommendations and/or issue messages that recs not generated or blocked because data is missing.
   1. System currently generates no recommendations if there is old or missing eGFR.
   2. Currently the system has criteria requiring patient data to proceed. Desired behavior is to compute the recommendations and present as “blocked recommendations”, if things are missing still have recommendations.
   3. Samson: OK, so for HF we want creatinine and eGFR and BP, if missing, to lead to blocked recommendations rather than stop processing.
   4. Mike: for ACEi and ARB, if SBP < 110 we don’t make a recommendation of those drugs. Desired behavior is to have “blocked” because BP is too low. (BP could later be OK). If BP is missing it is also OK to give blocked recommendation.
   5. For beta blocker, SBP< 110 is relative contraindication (already in the system) (this one should be fine because it would not stop the processing; doesn’t need a blocked recommendation)
   6. for aldo antagonist we don’t have BP referenced. Geoff suggests we use same SBP criterion of 110
   7. for hydralazine we have special cases for isosorbide (nitrates) (see rules above). Desired behavior is that we don’t stop the drug but if BP <110. This can also be a “blocked recommendation” that is we will show what the recommendation would have been except for the low BP
2. How to better model situations where you don’t want to make recs to add (and possibly increase) a drug but you do NOT want to stop a drug if active. Example: ACE Inhibitor and ARB and presence of 20% increase creatinine after start ACEI/ARB (?). This should be a change in model since these drugs are used in HTN, HF, CKD and DM. Also define if there are clinical differences when dealing with these drugs across domains.
3. Apply blocked recs for HF: labs(K and eGFR) and SBP
4. To confirm – angioedema to ACEI/ARB – should be absolute contraindications to ACEI and ARB? Right now only angioedema to drug is absolute contraindication to it, for example only angioedema to ACEI is absolute contraindication to ACEI
5. 20% increase in creatinine after start ACEI/ARB – generate primary message and eliminate from algorithm criteria?
6. Better understand what decision creatinine/decision eGFR criteria are. In my understanding it is a way to use the most recent lab – eGFR or creatinine and if multiples on the same day to use the min for eGFR and max for creatinine. What is clinically warranted?
7. Example of scenario criteria in HF:
   1. LVEF <=40 AND SBP>=110 AND ((decision eGFR<30 or creat>=2.5male, 2.3 female) OR CKD stage 4/5) OR (angioedema as ADR to ARB and using ACEI) or (angioedema to ACEI and using ARB) or (20% increase in creatinine after ACEI/ARB): evaluate BB, AA, Hydralazine, nitrates
   2. LVEF<=40 and SBP>=110 AND NOT angioedema ARB AND NOT angioedema ACE AND NOT (20% increase creat after ARB/ACE): ): evaluate ACEI, ARB, BB, AA, Hydralazine, nitrates

Implementation notes 2015-12-09, Samson Tu:

1. Removed “presence of HF” from precondition of the “Stage C HF (ICD or sugns/symptoms and EF<=40)” scenario, and relabeled the scenario as LVEF<=40. Rationale: “presence of HF is redundant as that is in the eligibility criteria of the encoded guideline. Its removable makes clear that the two scenarios (LVEF<=4 and “Absence of LVEF or LVEF>40” are mutually exclusive and exhaustive.
2. Consolidated 3 action choice nodes (“LVEF<=40 and SBP<110”, “LCEF < = 40 and SBP>=110…” and “Stage C HR rec …”) into one “Drug recommendation” action choice with rule-in criterion of “true.” Except for actions related to CRT and ICD in “LVEF<=40 and SBP<110”, which duplicate those of the CRT and ICD action choices, migrated the actions of the three nodes to the new “Drug recommendation” action choice node.
3. Removed links from CRT and ICD action choices to the “PMs after generating recommendations” scenario because the primary messages (PMs) in the following node have nothing to do with CRT and ICD. Having multiple entry links to “PMs after generating recommendations” has the potential of executing “PMs after generating recommendations” multiple times.
4. Angioedema reaction to ACE or ARB are made into absolute contraindications of ACEI and ARB (see point 4 above). This can be reversed if the decision is not to make reaction to ACEI a contraindication of ARB and vice versa.
5. Low decision eGFR and decision creatinine is made into a non-changeable “do not start condition” of ACEI and ARB. If this condition is true, ACEI and ARB will not be recommended. Absence of decision eGFR and decision creatinine was made into controllable/changeable “do not start condition.” If the condition is true, the recommendation to use ACEI or ARB will be blocked.
6. The conditions SBP<110 and absence of SBP within last 30 days were made into controllable/changeable “do not start condition of ARB, Aldosterone antagonist, ACEI, Hydralazine, and Isosorbide dinitrate.
7. The condition absence of SBP within last 30 days was made into controllable/changeable “do not start condition of Beta blocker. SBP<110 is a relative contraindication of BB.
8. “20% in creatinine afater ACE/ARB” was made into a primary message in “PMs after generating recommendations.” The message text is “The patient’s creatinine appears to increate by more than 20% after initiation of ACE inhibitor or ARB. Evaluate clinical significance.”

Mike and Geoff, please add your comments….

Susana

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