Pathway to Success Guide

See the structure behind our evidence-aligned care pathway.

Vivio's Five Pillar Pathway to Success

Identify

Identify patients at risk for HF without a known diagnosis

- Adults with HF risk factors and no established HF diagnosis or recent testing
- Common signals: hypertension, diabetes, obesity, CKD, OSA, prior cardiotoxic exposure

Assess

Assess risk and symptom burden with pragmatic diagnostics

- Perform Ventric Vivio assessment
- Administer KCCQ to quantify symptom burden and functional impact
- Establish baseline physiologic and patient-reported status and consider PMH

Diagnose

Apply appropriate HF diagnosis based on findings

- Apply appropriate HF diagnosis based on findings:
  - I50.1 when Vivio findings align with HF and **KCCQ indicates evidence** of symptoms
  - I50.9 when Vivio findings suggest elevated filling pressure, but KCCQ is **negative** for symptoms
- Document diagnostic rationale to support longitudinal management

Manage

Initiate evidence-aligned management and care escalation as needed

- Initiate or escalate GDMT as indicated
- If indicated, refer to cardiology for diagnostic complexity, or escalation
- Evaluate and address underlying contributors
  - Hypertension
  - Obesity
  - Sleep apnea
  - CKD
  - Physical inactivity
  - Substance use history

Optimize

Reassess and refine management over time

- Annual re-evaluation for patients with HF risk or prior abnormal findings
- Reassess for ANY new or worsening symptoms
- Use Vivio to guide GDMT optimization, diuretic needs, or care escalation
- Support proactive management and avoidance of decompensation

LVEDP Elevation is the Hallmark of HF

HF is a ***hemodynamic disease*** that leads to structural changes and dysfunction

Risk Factors for HF Development:

- Age
- Known Cardiovascular Disease
  - Coronary artery disease
  - Stroke
  - Afib/AFL
  - Peripheral Arterial Disease
- Hypertension
- Diabetes
- Obesity or Metabolic Syndrome
- CKD/ESRD
- Cardiotoxic Medication Use
- Prior Thoracic Radiation Therapy
- Tobacco Use
- Family History
- Obstructive Sleep Apnea
- Other (e.g. HIV, COVID, Amyloid, etc.)

Worsening Heart Failure

Vivio®

- Myocyte hypertrophy
- Interstitial fibrosis
- Endothelial dysfunction
- Cardiomyocyte loss

Acquired Mitral Regurgitation

Progressive LV Remodeling

LV Strain (detectable by imaging)

Left Atrial Enlargement (detectable by imaging)

Left Ventricular Hypertrophy (detectable by imaging)

Valvular Heart Disease (detectable by imaging)

Natriuretic Peptide Lab Assays (widely variable based on cutoff and co-morbidities)

LVEDP Elevation: Gold Standard Physiologic definition of HF
regardless of cause HFpEF, HFrEF, and/or Valvular Heart Disease

KCCQ-12 Scores:	100		90	80	70	60	50	40	30	20	10	0
NYHA Classification:	Class I		Class I/II	Class II	Class II/III	Class III		Class III/IV			Class IV	
1-yr risk of Death or Hospitalization:	16%	25%		34%	42%	46%	48%	50%	51%	52%	53%	
ACC/AHA Heart Failure Stage	**Stage A HF** (At-risk for HF)		**Stage B HF** (Asymptomatic Structural Heart Disease)		**Stage C HF** (Symptomatic HF)			**Stage D HF** (Advanced HF)				

Early HF Detection and the Limitations of Echo

Early HF is a ***hemodynamic disease*** that Echo may lack sensitivity to detect

Resting Echo Misses a Large Fraction of True HFpEF

- Echo detects only 34–60% of invasively confirmed HFpEF
- 40–66% false negatives vs catheterization~33% labeled “normal” by ASE criteria despite confirmed HFpEF
- Among “normal/Grade 1”: >60% have elevated PCWP ≥15 mmHg

Implication

Structural/diastolic grading lags underlying hemodynamics

Stress Echo Improves Sensitivity, but Falls Short

- Sensitivity ↑ to ~90% but:
  - Specificity drops to ~71%
  - Overall discrimination weak (C-stat ~0.65)
- In mild disease (Grade 1 DD): ~90% false-negative rate with stress criteria

Implication

Even “optimized” echo fails in early disease where decisions matter

Echo Parameters may not Reflect LVEDP

- E/e' correlation with LVEDP:

  r ≈ 0.56 (modest)
- Diagnostic accuracy: AUC 0.5–0.7 (low) for most parameters
- Best-case (LAVI, E/e'): 0.7–0.9 (moderate)

Implication

Echo precision lacks reliable measurement for early detection

Hemodynamics Reveal Disease Earlier Than Imaging

- ~1/3 of HFpEF patients have normal resting pressures with abnormalities only with exertion
- Early HFpEF often presents as:
  - “Unexplained dyspnea”
  - Normal echo + elevated LVEDP

Implication

Echo appears “normal” precisely when intervention opportunity is highest

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Assess & Diagnose

Assess risk and symptom burden with pragmatic diagnostics

Perform Vivio test on Patients with HF Risk Factors

		Assessment	Diagnostic Interpretation and Action
Normal Vivio <18		Has HF risk factors, **NO objective evidence of elevated LV filling pressures** and **NO symptom burden**	• Remains Stage A HF (ICD-10 Z91.89) • Continue to optimize management of HF risk factors
Abnormal Vivio ≥18	+ KCCQ = 100	**MILD FINDINGS** **Objective evidence of elevated LV filling pressures**, and **NO evidence of symptom burden**	• Consistent with **Stage B HF** (ICD-10 I50.1) • Initiate GDMT • See **PCP Management Guide** for more detail
Abnormal Vivio ≥18	+ KCCQ 80-99	**MODERATE FINDINGS** **Objective evidence of elevated LV filling pressures**, and **evidence of MILD symptom burden**	• Consistent with NYHA Class I, **Stage C HF** (ICD-10 I50.1) • Initiate GDMT (• See **PCP Management Guide** for more detail) • Optional: Consider non-urgent referral to cardiology
Abnormal Vivio ≥18	+ KCCQ 60-79	**MODERATE-TO- SIGNIFICANT FINDINGS** **Objective evidence of elevated LV filling pressures**, and **evidence of MODERATE symptom burden**	• Consistent with NYHA Class II, **Stage C HF** (ICD-10 I50.1) • Initiate GDMT (• See **PCP Management Guide** for more detail) • Consider non-urgent referral to cardiology for optimization and further work-up
Abnormal Vivio ≥18	+ KCCQ <60	**SIGNIFICANT FINDINGS** **Objective evidence of elevated LV filling pressures**, and **evidence of SIGNIFICANT symptom burden**	• Consistent with NYHA Class III/IV, **Stage C or D HF** (ICD-10 I50.1) • Consider **urgent referral to cardiology** (e.g., within 2 weeks)

Manage and Optimize | "PCP Management Guide"

Initiate evidence-aligned management and care escalation as needed

Mild Findings | Stage B HF Management

Abnormal Vivio ≥18 + KCCQ = 100

1 Prevent progression to symptomatic HF

Initiate cardioprotective therapy as indicated

A. SGLT2 inhibitor if T2DM or CKD present

Consider adding/optimizing:

B. ARB or ACEi, particularly in T2DM and/or CKD

C. nsMRA especially in T2DM and CKD

Reinforce lifestyle modification and risk factor reduction

2 Consider *referral to Pharmacy or Focused Disease Management Programs for support*

- Hypertension control
- CKD management
- Obesity management and weight reduction strategy
- Educate on daily weights and sodium awareness
- Physical activity counseling and structured exercise

3 Follow-Up Optimization Strategy

- Reassess with Vivio **annually or sooner** if symptoms emerge
- Maintain **proactive surveillance, GDMT optimization** and **lifestyle changes.**

Additional Considerations:

- ***Optional*** *echocardiography*[$*] in next 12 months, or if clinical suspicion of other cardiac pathology
- ***Optional*** Sleep apnea assessment

Mild to Moderate Findings | Stage C HF Management

Abnormal Vivio ≥18 + KCCQ 80-99

1 Initiate GDMT by starting three pillars without delay:

A. SGLT2 inhibitor

B. ARB or ACEi

C. nsMRA especially in T2DM and CKD

Reinforce lifestyle modification and risk factor reduction

2 Refer to *Pharmacy or Focused Disease Management Programs for support*:

- Hypertension control
- CKD management
- Obesity management and weight reduction strategy
- Educate on daily weights and sodium awareness
- Physical activity counseling and structured exercise

3 Follow-Up Optimization Strategy

- Reassess with Vivio **annually or sooner** if symptoms change
- Maintain **proactive surveillance, GDMT optimization** and **lifestyle changes.**
- Achieve GDMT maximally tolerated target dosage within 3–6 months

Additional Considerations:

- ***Consider*** *echocardiography* [$*] in next 12 months, or sooner if clinical symptoms change or based on clinical suspicion of other cardiac pathology
- ***Consider*** Sleep apnea assessment
- ***Consider*** Cardiology referral if:
  - Symptom progression despite therapy
  - Suspected or confirmed new cardiac pathology
  - Desired to initiate beta blocker therapy (LVEF determination required)
  - Potential conversion current ARB/ACEi therapy to ARNI+ARB regimen

[$] **Limitation of Echo**: Early HF is a hemodynamic disease that Echo may lack sensitivity to detect

[*] **Diagnostic Value of Echocardiograms and advanced testing**: To characterize other contributing factors including valvular disease, distinguish potential pEF vs rEF trajectory, evaluate for infiltrative cardiomyopathy (e.g., amyloid), right heart dysfunction, obstructive cardiomyopathy, wall motion abnormality or great vessel disease

Manage and Optimize | "PCP Management Guide"

Initiate evidence-aligned management and care escalation as needed

Moderate to Significant Findings | Stage C HF Management

Abnormal Vivio ≥18 + KCCQ 60-79

1 Initiate/Optimize GDMT among three pillars without delay:

A. **SGLT2 inhibitor**
B. **ARNI preferred** or **ACEi or ARB,** if ARNI not feasible
C. **nsMRA especially in T2DM and CKD**

Reinforce lifestyle modification and risk factor reduction

2 Stabilize Volume and Symptom Burden

- **Consider** Loop Diuretic for congestion
- Educate on daily weights and sodium awareness

3 Refer to Cardiology, *Pharmacy or Focused Disease Management Programs for support*:

- Hypertension control
- CKD management
- Obesity management and weight reduction strategy
- Physical activity counseling and structured exercise
- ***Consider*** *echocardiography* [$*] in next 3-6 months, or sooner if clinical symptoms change or based on clinical suspicion of other cardiac pathology
- ***Consider*** beta-blocker based on LVEF determination

4 Follow-Up Optimization Strategy

- **Reassess** with Vivio **annually or sooner** if symptoms change
- **Maintain** proactive surveillance, GDMT optimization and lifestyle changes.
- **Achieve** GDMT maximally tolerated target dosage within 3–6 months

Additional Considerations:

- ***Consider*** Sleep apnea assessment
- ***Consider*** Cardiology escalation if:
  - Symptom progression despite therapy
  - Suspected or confirmed new cardiac pathology
- ***Consider*** referral and qualification for cardiac rehabilitation

Significant Findings | Stage C or D HF Management

Abnormal Vivio ≥18 + KCCQ <60

1 Consider Cardiology referral for evaluation and management

2 Stabilize Volume and Symptom Burden

- **Consider** Loop Diuretic for congestion
- Educate on daily weights and sodium awareness

Initiate/Optimize GDMT among three pillars without delay:

A. **SGLT2 inhibitor**
B. **ARNI preferred** or **ACEi or ARB,** if ARNI not feasible
C. **MRA** (nsMRA or sMRA)

Reinforce lifestyle modification and risk factor reduction

3 Refer to Cardiology, *Pharmacy or Focused Disease Management Programs for support*:

- ***Recommend*** *echocardiography* [$*] as soon as possible
- ***Initiate*** beta-blocker therapy based on LVEF determination
- Ensure alignment with cardiology
- Control risk factors and comorbid conditions

4 Follow-Up Optimization Strategy

- **Maintain** alignment with cardiology
- **Reassess** with Vivio **annually or sooner** if symptoms change
- **Maintain** proactive surveillance, GDMT optimization and lifestyle changes.
- **Achieve** GDMT maximally tolerated target dosage within 3–6 months
- Adjust diuretics based on volume status and response

Additional Considerations:

- ***Consider*** Sleep apnea assessment
- ***Consider*** Cardiology escalation if:
  - Symptom progression despite therapy
  - Suspected or confirmed new cardiac pathology
- ***Consider*** referral and qualification for cardiac rehabilitation

[$] **Limitation of Echo**: Early HF is a hemodynamic disease that Echo may lack sensitivity to detect

[*] **Diagnostic Value of Echocardiograms and advanced testing**: To characterize other contributing factors including valvular disease, distinguish potential pEF vs rEF trajectory, evaluate for infiltrative cardiomyopathy (e.g., amyloid), right heart dysfunction, obstructive cardiomyopathy, wall motion abnormality or great vessel disease

GDMT Reference Table

Evidence-Based Therapies in Patients with Elevated LVEDP with Common Comorbidities

Drug Class	CKD	T2DM	Obesity	HTN	ASCVD	Worsening HF Risk
SGLT2i	✓ ✓	✓ ✓	✓	✓	✓	✓ ✓
nsMRA	✓ (monitor K⁺)	✓				✓ ✓
sMRA (alternative if nsMRA not tolerated)	✓ (monitor K⁺)			✓		✓ ✓
ARNi	✓ (HFrEF only)	✓ (HFrEF only)		✓ ✓ (HFrEF only)	✓ (HFrEF only)	✓ ✓ (HFrEF only)
ARB	✓	✓		✓ ✓	✓	✓
ACEi	✓	✓		✓ ✓	✓ ✓	✓
Adjunct Therapies if Indicated:						
GLP-1 RA	✓	✓ ✓	✓ ✓	✓	✓ ✓	
Loop diuretic	✓					✓ ✓
Beta-Blockers				✓	✓	✓ (HFrEF only)

Drug Class	Drug Name	Initial Dose	Target Dose	Titration Comments
SGLT2 Inhibitors	**Dapagliflozin (Farxiga®)**	10 mg daily	10 mg daily	Titration not required
	Empagliflozin (Jardiance®)	10 mg daily	10 mg daily	
nsMRA	**Finerenone (Kerendia®)**	10-20mg daily*	40 mg daily	Titration to goal every 4 weeks dependent on potassium levels and renal function
sMRA	**Spironolactone**	12.5-25 mg daily*	25-50 mg daily	
	Eplerenone	25 mg daily	50 mg daily	
ARNI	**Sacubitril/Valsartan (Entresto®)**	24/26 mg twice daily	97/103 mg twice daily	Titrate every 2-4 weeks
ARBs	**Candesartan**	4-8 mg daily	32 mg daily	Titrate as tolerated to goal BP
	Valsartan	40 mg twice daily	160 mg twice daily	
	Irbesartan	75-150 mg daily	300 mg daily	
ACE Inhibitors	**Enalapril**	2.5 mg twice daily	10-20 mg twice daily	Titrate as tolerated to goal BP
	Lisinopril	2.5-5 mg daily	40 mg daily	
	Ramipril	1.25-2.5 mg daily	10 mg daily	
Adjunct Therapies if Indicated:				
GLP-1 RAs (Obesity-related HFpEF only with BMI ≥30)	**Tirzepatide (Zepbound®)**	2.5 mg weekly	15 mg weekly	Titrate every 4 weeks
	Semaglutide (Wegovy®)	0.25 mg weekly	2.4 mg weekly	
Loop Diuretics	**Furosemide, Bumetanide, Torsemide, and Furoscix® (subQ)**	varies	varies	Titrate to euvolemia
Beta-Blockers	**Not recommended unless concurrent AF, CAD, or post-MI**	----	----	NA

* Consider renal dose adjustments and close monitoring especially in patients with GFR <60 mL/min

GDMT Reference Table | HFrEF

Drug Class	Drug Name	Initial Dose	Target Dose	Titration Comments	Hospitalization Relative Risk Reduction	Mortality Relative Risk Reduction	Other Notable Outcomes
SGLT2 Inhibitors (COR I)	**Dapagliflozin (Farxiga®)**	10 mg daily	10 mg daily	Titration not required	**28-31%**	**13%**	• Renal protection: 38% decrease in composite endpoint • KCCQ improvement: +2–3 pts
	Empagliflozin (Jardiance®)	10 mg daily	10 mg daily				
ACE Inhibitors (COR I)	**Enalapril**	2.5 mg twice daily	10-20 mg twice daily	Titrate as often as weekly	**30%**	**16%**	• Prevents LV remodeling • Modest LVEF improvement • Decrease in progressive HF death
	Lisinopril	2.5-5 mg daily	40 mg daily				
	Ramipril	1.25-2.5 mg daily	10 mg daily				
ARBs (COR I)	**Candesartan**	4-8 mg daily	32 mg daily	Titrate as often as weekly	**24%**	**NS**	• Alternative to ACEi AND ARNi not feasible • Similar remodeling prevention to ACEi
	Valsartan	40 mg twice daily	160 mg twice daily				
	Losartan	25-50 mg daily	150 mg daily				
ARNI (COR I)	**Sacubitril/valsartan**	24/26 mg twice daily	97/103 mg twice daily	Titrate every week	**21%***	**20%** (CV Death) 16% (All-cause)	• Decrease in sudden cardiac death by 20% • Decrease in Ventricular arrhythmias by 24% Superior in reverse LV remodeling vs ACEi • KCCQ improvement +3–5 pts
MRAs (COR I)	**Spironolactone***	12.5-25 mg daily*	25-50 mg daily	Titration to goal every 4 weeks dependent on potassium levels and renal function	**37%**	**27%**	• Decrease in sudden cardiac death by 23% Antifibrotic effects • *Caution*: hyperkalemia risk 2X increase
	Eplerenone	25 mg daily	50 mg daily				
	Finerenone (Kerendia®)*	10-20mg daily*	40 mg daily	Ongoing trials (FINALITY-HF) in HFrEF patients who cannot tolerate steroidal MRAs			
Beta-Blockers (COR I)	**Carvedilol**	3.125 mg twice daily	25-50 mg twice daily	Titrate as often as every 2 weeks	**35%**	**34%**	• Decrease in sudden cardiac death by 31% • Superior in reverse LV remodeling • Decrease in Ventricular arrhythmias
	Metoprolol succinate	12.5-25 mg daily	200 mg daily				
	Bisoprolol	1.25 mg daily	10 mg daily				
QUADRUPLE THERAPY (SGLT2i + ARNI + BB + MRA)					**68%**	**50%** (CV Death) 47% (All-cause)	
Loop Diuretics (COR I)	**Furosemide, Bumetanide, Torsemide, and Furoscix® (subQ)**	varies	varies	Titrate to euvolemia	----	----	----
Other Notables	**Hydralazine/Isosorbide Dinitrate (COR 1)**	20/37.5 mg three times daily	40/75 mg three times daily	Titrate as tolerated	**33%**	**43%**	• Self-identified Black patients with NYHA III–IV OR for ACEi/ARB/ARNi intolerance
	Ivabradine (Corlanor®) (COR IIa)	2.5–5 mg twice daily	7.5 mg twice daily	Titrate to HR 50–60 bpm	**26%**	**NS**	• Requires sinus rhythm + HR ≥70 bpm on max blocker
	Vericiguat (COR IIb)	2.5 mg daily	10 mg daily	Titrate every 2 weeks	**10%**	**NS**	• GDMT adjunct in high-risk patients with recent worsening HF
GLP-1 RAs	**Not part of GDMT (Semeglutide, Tirazepatide)**	----	----	----	Under investigation in clinical trials, but direct role not established for HFrEF treatment		

* Consider renal dose adjustments and close monitoring especially in patients with GFR <60 mL/min

GDMT Reference Table | HFpEF

Drug Class	Drug Name	Initial Dose	Target Dose	Titration Comments	Hospitalization Relative Risk Reduction	Mortality Relative Risk Reduction	Other Notable Outcomes
Loop Diuretics (COR 1)	**Furosemide, Bumetanide, Torsemide, and Furoscix® (subQ)**	varies	varies	Titrate to euvolemia	----	----	----
SGLT2 Inhibitors (COR I)	**Dapagliflozin (Farxiga®)**	10 mg daily	10 mg daily	Titration not required	**26%**	**NS (12%)**	• CV death + HF hospitalization reduction by 18-21%
	Empagliflozin (Jardiance®)	10 mg daily	10 mg daily				
ARBs (COR 2b)	**Candesartan**	4-8 mg daily	32 mg daily	Titrate as tolerated to goal BP	**NS**	**NS**	No HFpEF benefit, but key for comorbidity & risk factor mgmt.: • HTN (first-line) • DM + albuminuria: 18% reduction in kidney failure, 56% reduction in progression to macroalbuminuria
	Valsartan	40 mg twice daily	160 mg twice daily				
	Irbesartan	75-150 mg daily	300 mg daily				
ARNI (COR 2b)	**Sacubitril/Valsartan (Entresto®)**	24/26 mg twice daily	97/103 mg twice daily	Titrate every 2-4 weeks	**15%***	**NS**	Subgroup benefit: • Women and LVEF ≤57% (e.g., HFmrEF); • 40% reduction in renal composite *Caution*: Increased hypotension risk
MRAs (COR 2b)	**Spironolactone***	12.5-25 mg daily*	25-50 mg daily	Titration to goal every 4 weeks dependent on potassium levels and renal function	**NS**	**NS**	• CV death + HF hospitalization reduction by 18%
	Finerenone (Kerendia®)*	10-20mg daily*	40 mg daily		**18%**	**NS (7%)**	• CV death + Worsening HF reduction by 16% • Decreased urgent HF visits by 37% • **FDA approved for HFpEF**
ACE Inhibitors (COR No Recommendation)	**Enalapril**	2.5 mg twice daily	10-20 mg twice daily	Titrate as tolerated to goal BP	**NS**	**NS**	No HFpEF benefit, but key for comorbidity & risk factor mgmt.: • HTN (first-line) • DM + albuminuria: 39% reduction in kidney failure • CAD/Post-MI: 22% reduction in CV events
	Lisinopril	2.5-5 mg daily	40 mg daily				
	Ramipril	1.25-2.5 mg daily	10 mg daily				
Beta-Blockers (COR No Recommendation)	**Not recommended in isolated HFpEF unless concurrent AF, CAD, or post-MI**	----	----	NA	**Uncertain**	**Uncertain**	
GLP-1 RAs (Obesity-related HFpEF only with BMI ≥30) **(COR No Recommendation)**	**Semaglutide (Wegovy®)**	0.25 mg weekly	2.4 mg weekly	Titrate every 4 weeks	**41%**	**NS**	• KCCQ improvement by 7.8 pts
	Tirzepatide (Zepbound®)	2.5 mg weekly	15 mg weekly	Titrate every 4 weeks	**38%**	**NS**	• CV death + worsening HF reduction by 38%

* Consider renal dose adjustments and close monitoring especially in patients with GFR <60 mL/min

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Bring Clarity to Heart Failure Management:

Join clinicians across the country using Vivio to close the diagnostic gap and transform outcomes for their highest-risk patients.

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