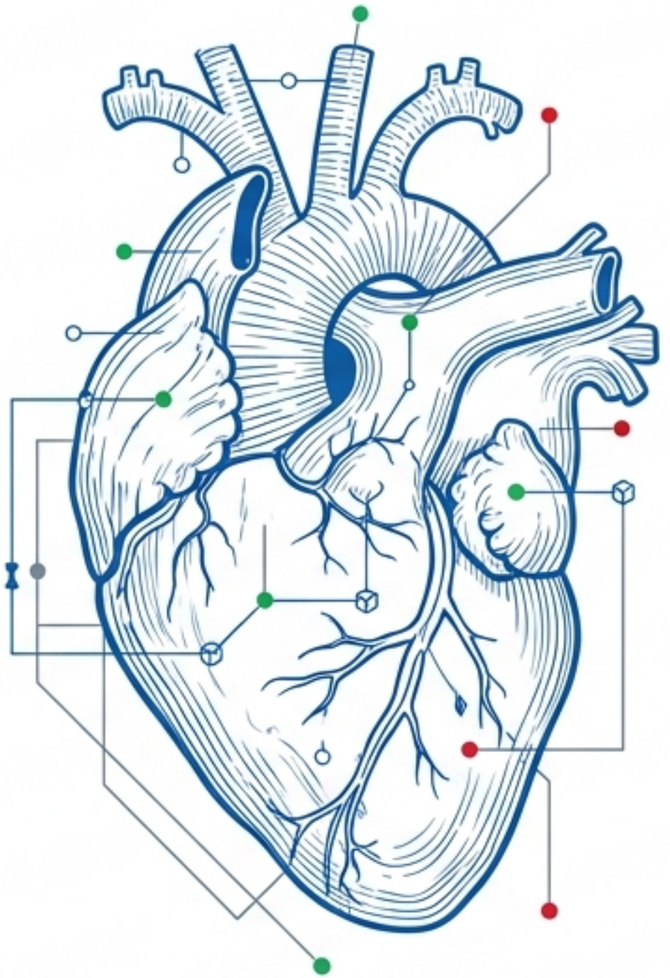
The Clinical Blueprint for Sudden Cardiac Death Prevention

Evidence-based algorithms, diagnostic matrices, and device pathways for the Australian healthcare context.



BASED ON CURRENT CSANZ, ESC, AND ACC/AHA GUIDELINES.

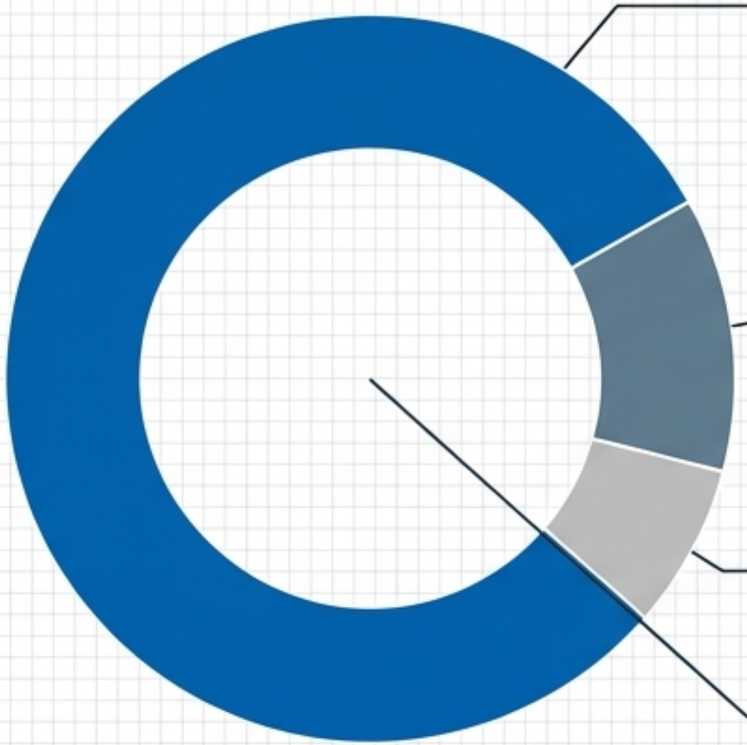
The Anatomy of an Unseen Epidemic

20,000–30,000

Annual Sudden Cardiac Deaths in Australia

- Accounts for 50% of all cardiovascular deaths
- 10–15% of all-cause mortality

Out of ~30,000 out-of-hospital cardiac arrests (OHCA) attended by ambulance, survival to hospital discharge remains exceptionally low.



75–80%:
Coronary Artery Disease (Ischaemic)

10–15%:
Non-Ischaemic Cardiomyopathies

5–10%:
Channelopathies and Inherited Arrhythmias

Insight:
ICD implantation remains the only proven intervention to reduce arrhythmic mortality in high-risk patients who have not yet arrested.

The Geographic and Demographic Disparities in SCD

1

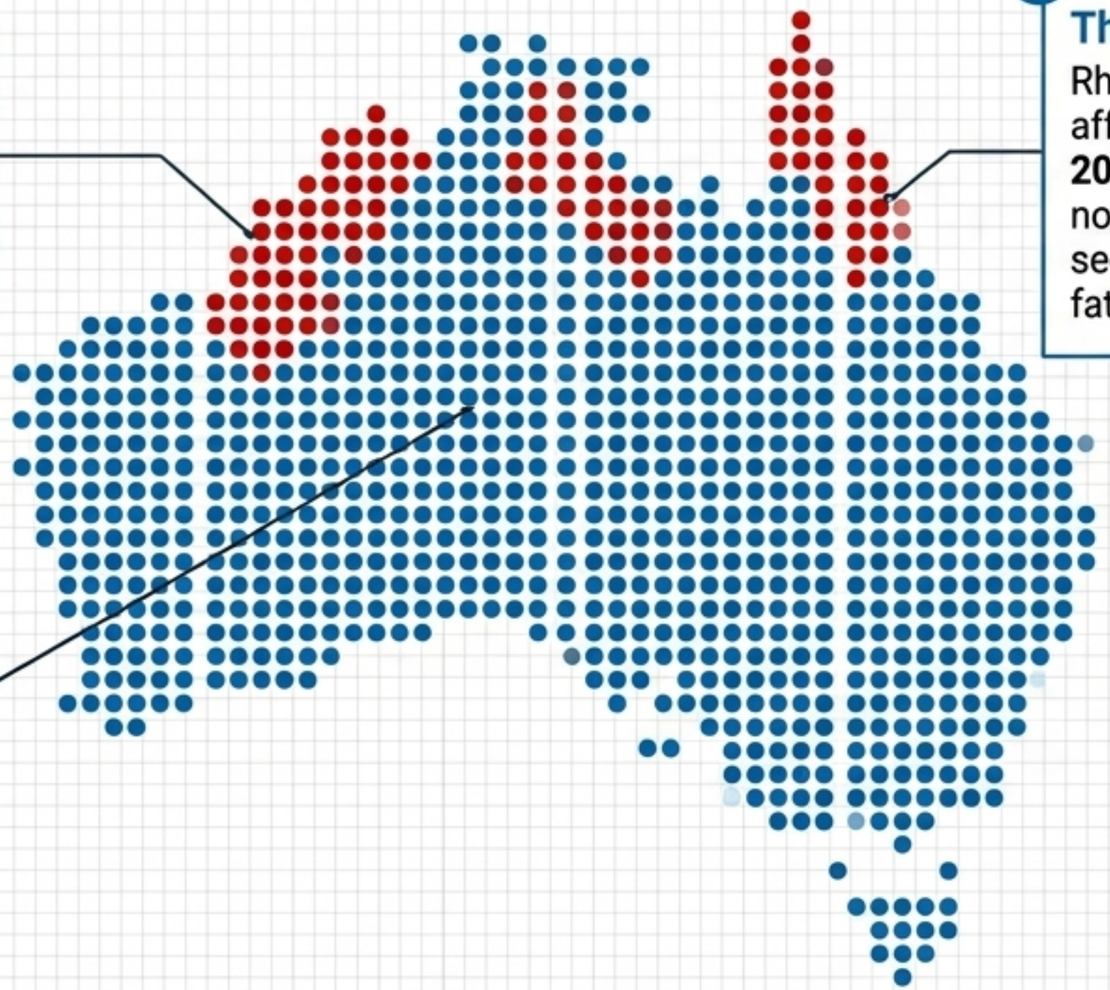
The Health Gap

Aboriginal and Torres Strait Islander peoples experience SCD at **2–3x the rate** of non-Indigenous Australians. Median age of SCD is **~10 years** younger.

2

The RHD Accelerator

Rheumatic Heart Disease (RHD) affects Indigenous Australians at **20–60x the rate** of the non-Indigenous population, driving secondary cardiomyopathies and fatal arrhythmias.



3

The Distance Barrier

Travel distances up to **3,000 km** to access specialist electrophysiology labs. Necessitates RFDS retrieval and remote home monitoring (TeleCheck).

Culturally safe models of care utilizing **Aboriginal Community Controlled Health Organisations** (ACCHOs) and community-based AED programs are mandatory public health interventions. With recorgnities and AED programs are public health interventions.

Left Ventricular Ejection Fraction (LVEF): The Core Arbiter of Risk

Spectrum of Risk

Efficacy Green — Medical Cobalt — Alert Crimson

>50% (Low Risk)

ICD not indicated.

Clinical focus: Assess for inherited channelopathies if structurally normal.

36–50% (Intermediate Risk)

DANISH post-hoc / MASTER trial.
ICD requires additional risk markers (CMR LGE, NSVT, genetics).

≤35% (High Risk)

MADIT-II, SCD-HeFT, DANISH.

Class I/IIa indication for primary prevention ICD (aetiology-dependent).

≤30% (Very High Risk)

MADIT-II subset, DINAMIT.

Strongest indication (must be >40 days post-MI).

Clinical Note: Transthoracic echocardiography (Simpson's biplane) is standard, but Cardiac MRI (CMR) offers superior prognostic capability via Late Gadolinium Enhancement (LGE).

The Preemptive Strike:
Optimizing Guideline-Directed Medical Therapy

25–40% of patients will demonstrate LVEF improvement to >35% under optimized GDMT, safely removing the primary prevention ICD indication and avoiding device complications.

The 3-Month Mandate:
ICD implantation must be deferred for ≥3 months of maximally tolerated GDMT.

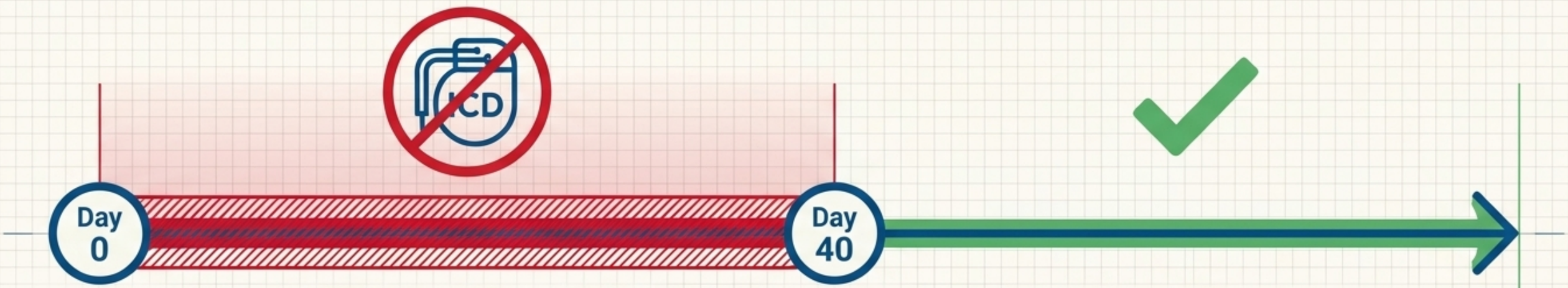
1. ARNI / ACEi / ARB
Sacubitril/valsartan (Entresto) preferred. (Target: 49/51mg BD or 97/103mg BD).

2. Beta-Blocker
Strict reliance on mortality-proven agents: Carvedilol, Bisoprolol, or Metoprolol succinate.

3. MRA
Spironolactone or Eplerenone. (Monitor K+ <5.0, eGFR >30).

4. SGLT2i
Dapagliflozin or Empagliflozin. (PBS listed for HFrEF regardless of diabetes status).

Primary Prevention in Ischaemic Cardiomyopathy: The Temporal Rules



Acute Myocardial Infarction

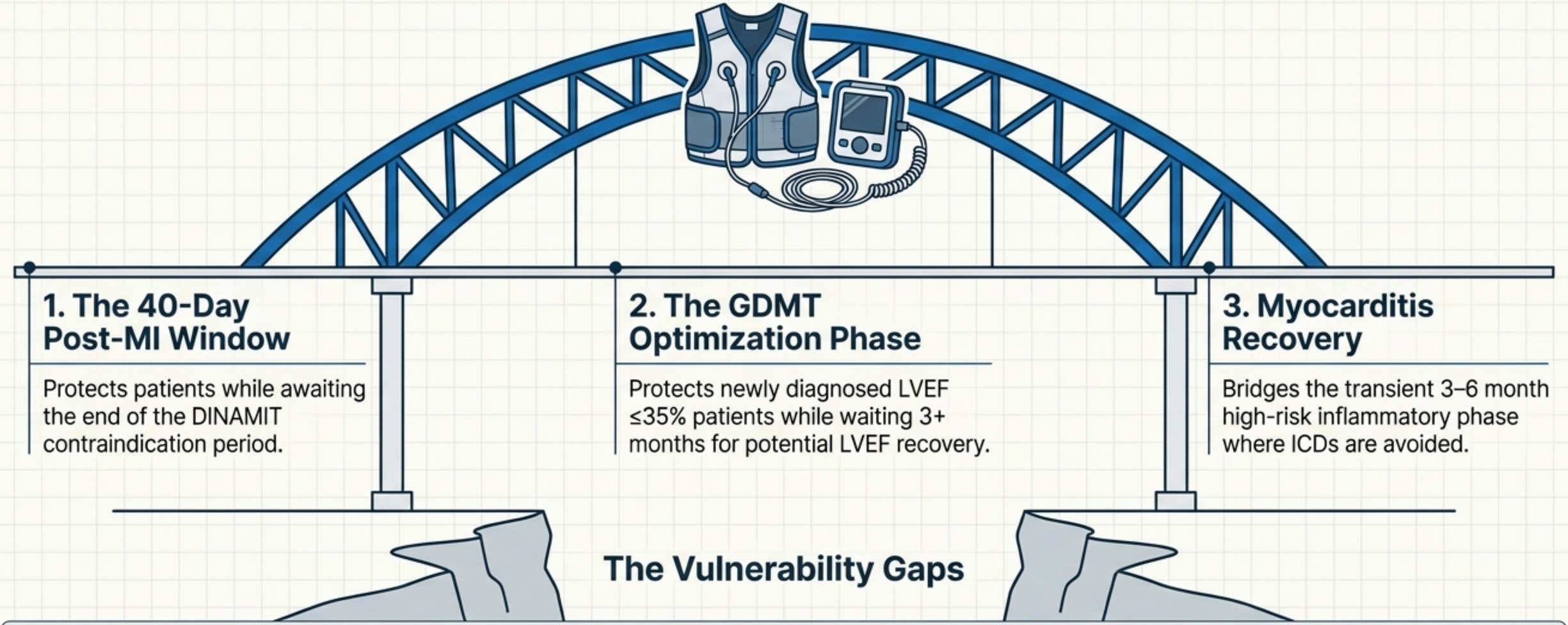
Day 0 to 40: ICD Contraindicated.
Trials (**DINAMIT, IRIS**) prove premature implantation **does not improve overall survival.**
Competing risks of non-arrhythmic death are too high.

The Reassessment Node.
(Wait extends to 90 days if PCI/CABG performed)

Beyond Day 40: Class I Indication.
LVEF ≤35%, NYHA II-III, on GDMT.
Expected survival >1 year.

Evidence: Backed by MADIT-II (NNT 14 at 3 years) and SCD-HeFT.

The WCD Bridge: Securing the Vulnerability Gap



1. The 40-Day Post-MI Window

Protects patients while awaiting the end of the DINAMIT contraindication period.

2. The GDMT Optimization Phase

Protects newly diagnosed LVEF ≤35% patients while waiting 3+ months for potential LVEF recovery.

3. Myocarditis Recovery

Bridges the transient 3–6 month high-risk inflammatory phase where ICDs are avoided.

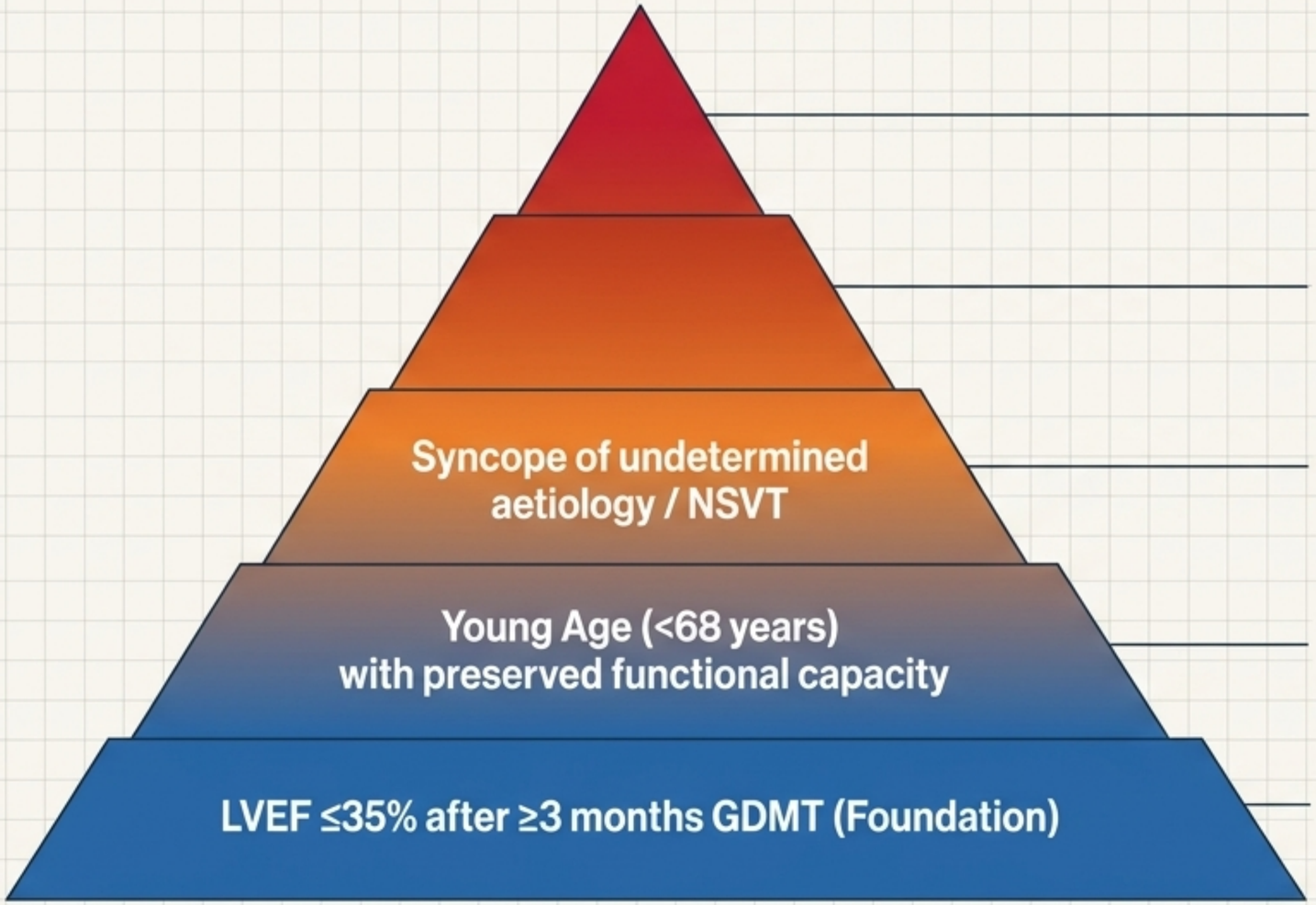
The Vulnerability Gaps

Clinical Realities

WCD (LifeVest) delivers 75–150 J biphasic shocks. Requires ≥20 hours/day continuous wear.
Reassessment pathways post-bridge: if LVEF remains ≤35%, proceed to ICD. If improved >50%, ICD not indicated.

Non-Ischaemic Cardiomyopathy: The Stacking Risk Model

The DANISH Nuance:
The DANISH trial (2016) showed ICDs in NIDCM reduced SCD, but did not significantly reduce all-cause mortality due to competing risks (pump failure). ICD candidacy here requires nuanced shared decision-making.



Pathogenic LMNA variants.
Extremely high arrhythmic risk, may warrant ICD even at higher LVEFs (36-49%).

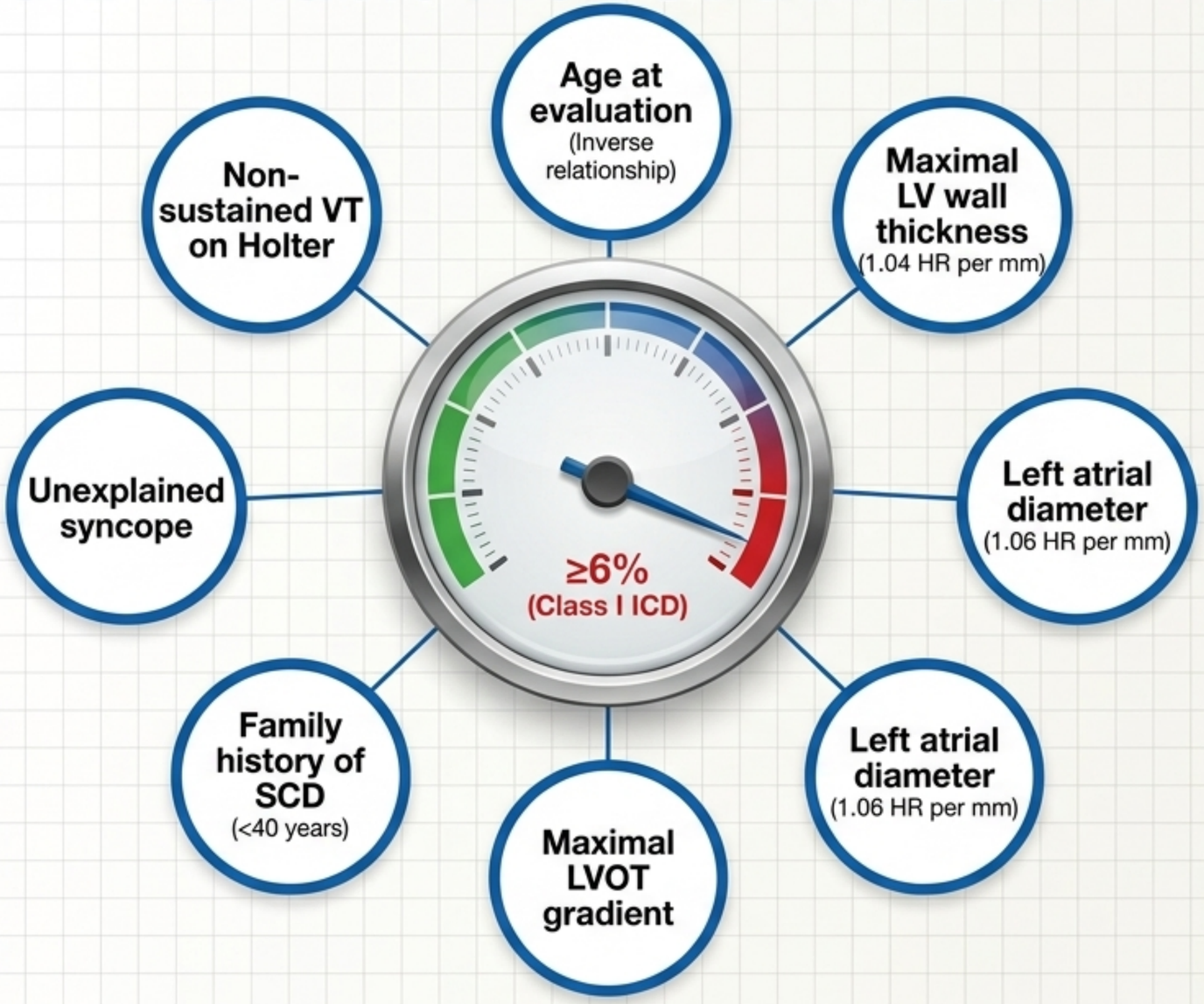
Mid-wall Fibrosis (LGE on CMR).
Strongest independent predictor (HR ~4.5).

Syncope of undetermined aetiology / NSVT

Young Age (<68 years) with preserved functional functional capacity

LVEF ≤35% after ≥3 months GDMT (Foundation)

Hypertrophic Cardiomyopathy (HCM): Multi-Variable Risk Stratification



The CMR Modifier

Late Gadolinium Enhancement (LGE).

An ESC Class IIa modifier.

LGE ≥15% of LV mass is associated with significantly elevated SCD risk.

It can push an intermediate risk patient (4-6%) into an ICD indication.

Structurally Normal Hearts:
The Channelopathy Matrix

	Long QT Syndrome (LQTS)	Brugada Syndrome	Catecholaminergic Polymorphic VT (CPVT)
Key Risk Factors	QTc >500 ms, LQT3 genotype, prior arrest.	Spontaneous Type 1 ECG, ECG, male, SCN5A mutation, prior syncope.	Bidirectional VT on exercise, RYR2 mutations.
First-Line Therapy	Nadolol or propranolol (Mexiletine adjunct for LQT3).	Quinidine (specifically for VF storms). Catheter ablation.	Nadolol + Flecainide adjunct.
ICD Indications	Recurrent syncope despite β-blockers, prior arrest, QTc >550 ms.	Prior VF (Class I), Syncope with spontaneous Type 1 (Class IIa).	Recurrent VT/syncope despite maximal medical therapy.

The Antiarrhythmic Arsenal: Adjunctive, Not Substitutive

Amiodarone (Class III)

Target: Broad VT/VF suppression; ICD shock reduction.

Warnings: Pulmonary fibrosis, thyroid dysfunction, hepatotoxicity. Requires 6-monthly TFTs, annual CXR/LFTs. No renal adjustment.

Sotalol (Class III / β-blocker)

Target: VT suppression (adjunct to ICD). Must initiate in-hospital with QT monitoring.

Warnings: Strictly dependent on CrCl. Avoid or monitor closely if CrCl <30.

Quinidine (Class IA)

Target: Brugada syndrome VF storm prevention. (Not first-line for general VT).

Warnings: Cinchonism, QT prolongation. (SAS/Hospital supply only).

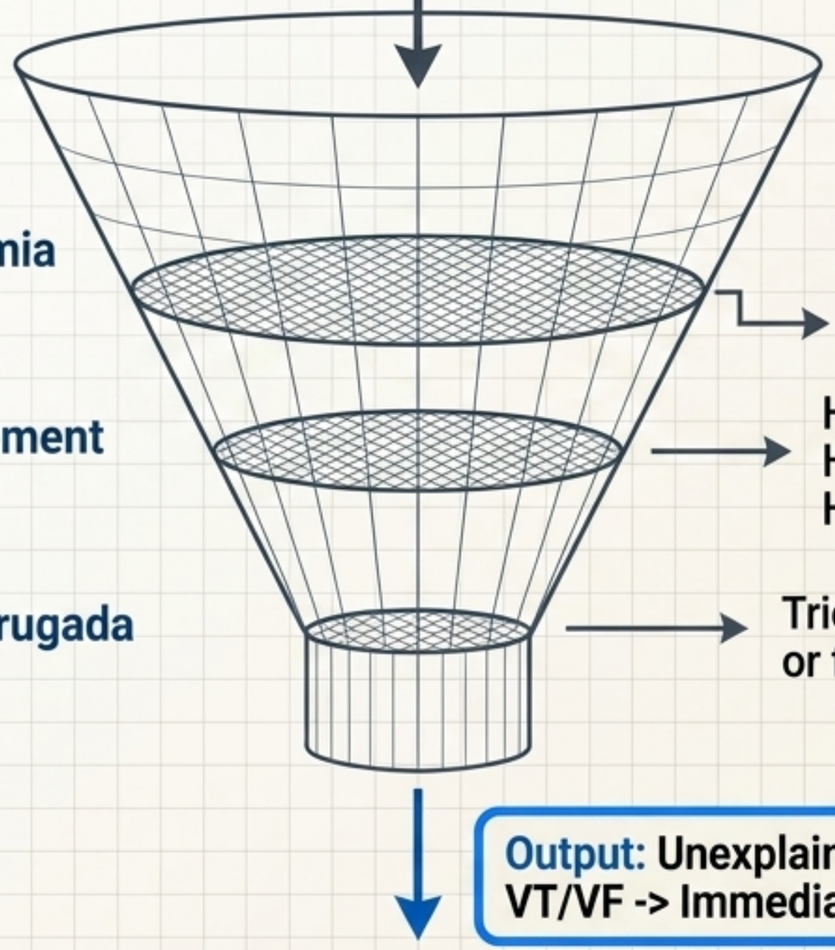
Nadolol (Non-selective β-blocker)

Target: First-line for LQTS and CPVT.

Warnings: Titrate to resting HR 50-60 bpm. Renal dosing adjustments required.

Secondary Prevention: The Reversible Cause Filter

Input: Cardiac arrest survivors (VF/Pulseless VT) or hemodynamically tolerated sustained VT with structural disease.



Filter 1: Acute Ischaemia

Acute MI (occurring within 48 hours). Treat with timely revascularisation; reassess LVEF later.

→ Treat Underlying Cause

Filter 2: Severe Electrolyte Derangement

→ Hypokalemia (<3.0), Hypomagnesemia (<0.5), Hyperkalemia (>6.5).

Filter 3: Drug Toxicity / Febrile Brugada

→ Tricyclic overdose, methamphetamine, or fever-induced Brugada Type 1.

Output: Unexplained/Irreversible structural VT/VF -> Immediate Secondary Prevention ICD

Key Distinction: Unlike Primary Prevention, there is NO mandatory 40-day or 3-month waiting period once reversible causes are cleared.

Core Dichotomy:
Primary vs. Secondary Prevention

Primary Prevention (The Preemptive Strike)

- **Definition: Prophylactic protection** for high-risk patients with no prior life-threatening arrhythmic event.
- **LVEF Dependence: Highly dependent** (Must be ≤35% or ≤30% based on etiology).
- **Timing: Strict mandatory delays** (≥40 days post-MI, ≥3 months GDMT).
- **Alternative:** WCD as a temporal bridge.

Secondary Prevention (The Second Chance)

- **Definition: Protection** for **survivors of VT/VF arrest** or **sustained structural VT.**
- **LVEF Dependence: Independent.** The index event itself justifies the ICD, regardless of LVEF >35%.
- **Timing: Immediate implantation** once reversible causes (MI <48h, toxins) are excluded. Delaying risks 10–30% 2-year recurrence.
- **Adjunct:** VT catheter ablation heavily considered to reduce device shocks.

Special Populations: Modifying the Pathway Across the Lifespan

Pregnancy

- **LQTS Type 2 risk spikes** post-partum (**40x higher risk**). Nadolol must be continued.
- **Amiodarone is Category D** (**Avoid**: fetal hypothyroidism/growth restriction).
- ICD implantation feasible with pelvic shielding/echo guidance.

Paediatrics

- Higher transvenous complication rates (**lead fractures 15-20%, inappropriate shocks**).
- Subcutaneous ICD (S-ICD) preferred in children >25 kg.
- **HCM SCD risk is higher** in children (1-3% annually) than adults.

The Elderly (>75 years)

- Absolute benefit attenuates significantly due to competing mortality risks (**NNT rises from 14 to 25+**).
- Generator replacements (7-10 years) are not automatic.
- Proactive deactivation discussions essential for palliative care planning.

Special Populations: Navigating Complex Comorbidities

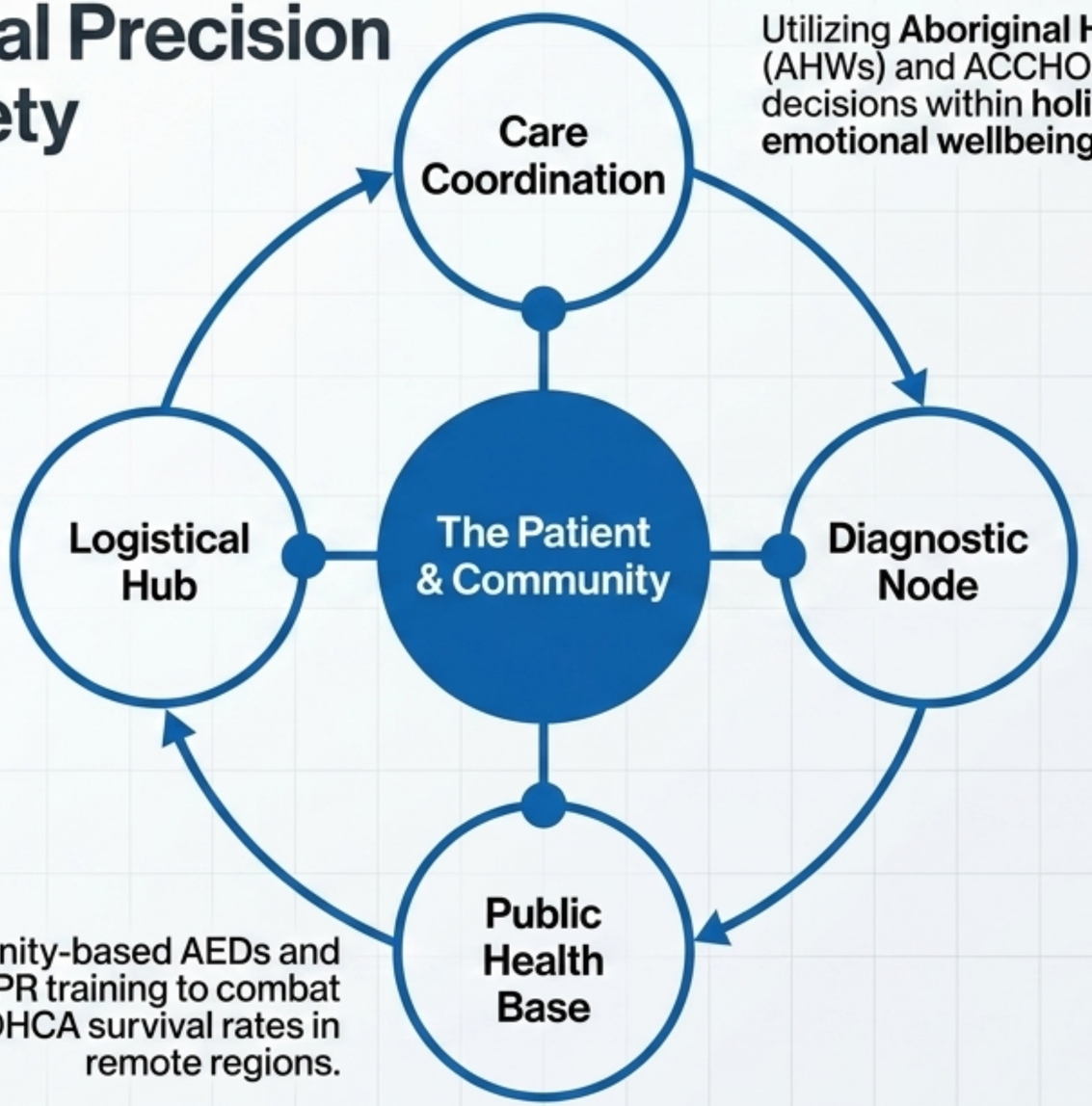
Chronic Kidney Disease (Stages 4-5 / Dialysis)

- **The Risk:** 5-10x higher **SCD risk**, but compounded by 2-3x higher procedural **infection rates**. Attenuated overall survival benefit.
- **Procedural:** Must preserve dialysis access arm (avoid ipsilateral subclavian leads).
- **Pharmacology:** Sotalol requires strict renal dosing. Spironolactone contraindicated if **eGFR <30**. SGLT2i currently not PBS listed for HF if **eGFR <20**.

Immunocompromised & Transplant

- **The Risk**: Denervated hearts present arrhythmias atypically. Exceptionally **high hardware infection risk**.
- **Procedural Protocol**: Mandatory antibiotic prophylaxis (Cefazolin 2g IV, or Vanc for MRSA risk). Strong consideration for **S-ICD** to eliminate **endovascular infection risk**.

Indigenous Health:
Integrating Clinical Precision with Cultural Safety



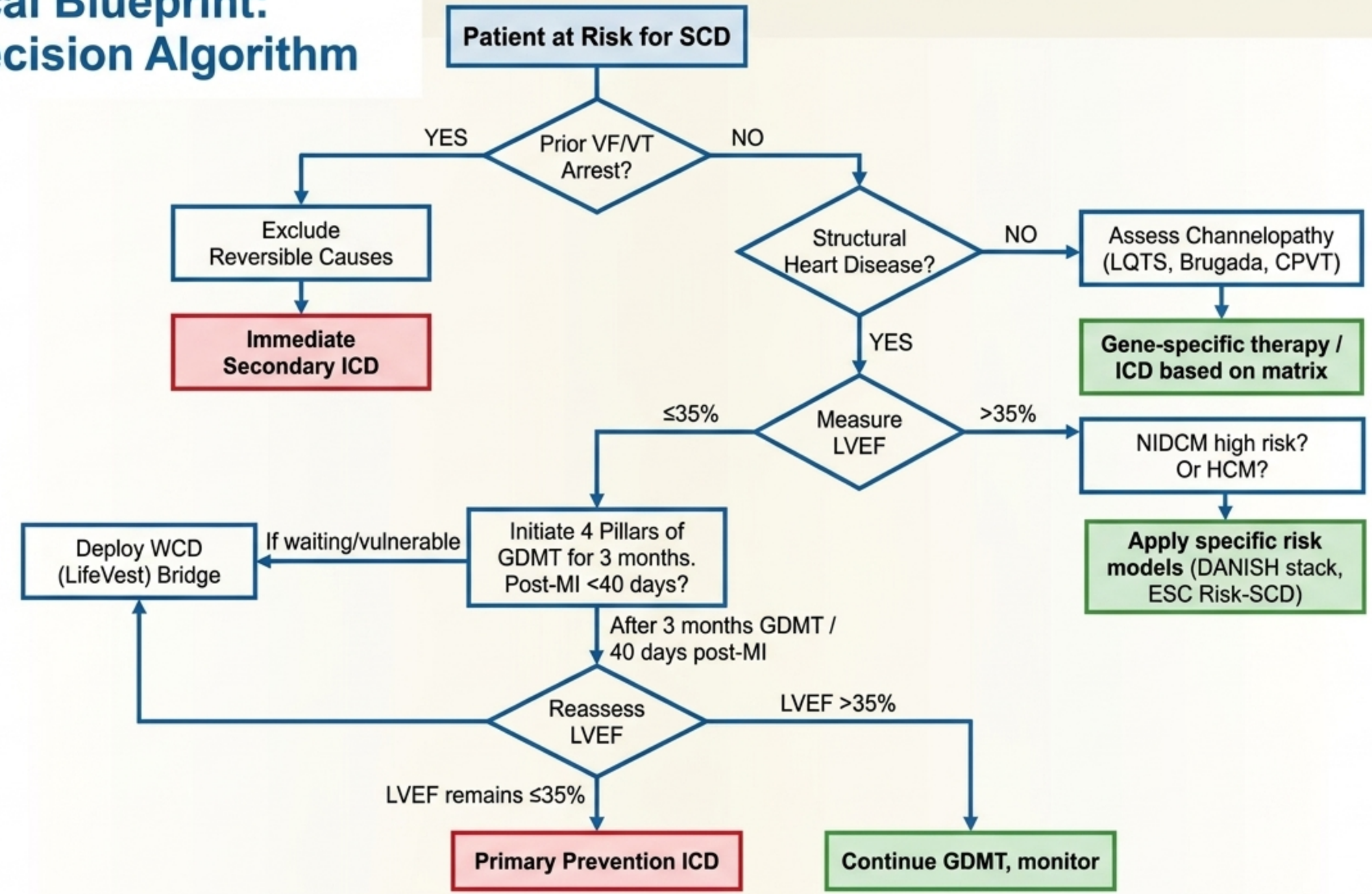
Utilizing **Aboriginal Health Workers** (AHWs) and ACCHOs to frame device decisions within **holistic social and emotional wellbeing.**

Overcoming the **geographic** barrier by integrating **Royal Flying Doctor Service** (RFDS) retrieval and expanding remote device **interrogation** (TeleCheck).

Aggressive **local screening** for **RHD-related valvular dysfunction** and **inherited conditions** (facilitating molecular autopsies for young SCD).

Deploying community-based AEDs and culturally appropriate CPR training to combat the abysmal OHCA survival rates in remote regions.

The Clinical Blueprint: Master Decision Algorithm



Foundational Evidence Base

Primary Prevention (Ischaemic)	**MADIT-II** (LVEF ≤35%), **SCD-HeFT** (NYHA class III), **DINAMIT / IRIS** (The 40-day waiting rule).
Primary Prevention (Non-Ischaemic)	**DANISH** (Modest absolute benefit, shared decision-making requirement).
Secondary Prevention	**AVID** (NNT 10 at 3 years), **CIDS, CASH** meta-analysis.
Bridge Therapy	**VEST trial** (WCD post-MI), **WEARIT-II** registry.
Guidelines Referenced	**2022 ESC** Guidelines for Ventricular Arrhythmias and SCD Prevention; **2020 AHA/ACC** HCM Guidelines; **CSANZ** and Heart Foundation National Guidelines; **RHD**Australia 2020 Guidelines.