Key priorities for the implementation of the 2023 ESC Guidelines for the Management of Cardiomyopathies in low resource settings

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Abstract

ESC Guidelines provide best practice, evidence-based recommendations for diagnosing and treating patients with cardiovascular diseases. It is not always possible for best practices to be followed, however, particularly in low-resource settings. To address this issue, a set of guideline-related documents were created to identify key priorities for users in these settings. The documents highlight the related recommendations and describe key strategies for clinicians to approach implementation of these recommendations or discuss alternatives which are in line with the intention of the recommendations, if not having all of the same advantages. The suggestions cannot be used as exact substitutes for the original recommendations in the guidelines, which have not been altered and continue to reflect best practice.

This document on key priorities for low-resource settings was developed by the task force Chairs and other members of the task force which produced the 2023 ESC Guidelines for the management of cardiomyopathies, which are freely available on the ESC website (https://www.escardio.org/Guidelines). This

document also underwent external review including international experts from within and beyond Europe and included non-ESC associations. The non-ESC associations were The Interamerican Society of Cardiology (IASC), The Pan-African Society of Cardiology (PASCAR), The Asian Pacific Society of Cardiology (APSC) and The Asean Federation of Cardiology (AFC).

Introduction

The 2023 European Society for Cardiology Guidelines for the management of patients with cardiomyopathies made recommendations for the assessment and management of patients with all cardiomyopathy subtypes, based on the best scientific and medical evidence available at the time of writing(1). However, it is recognized that implementation of guideline recommendations varies based on local resource settings at centre, region and country levels(2). A previous analysis has suggested that the implementation of ESC Guideline recommendations is inversely related to the gross national income of a country(2). Recognition of this is important in order to increase awareness of the feasibility of current recommendations in settings of low technological and financial resources (3).

A case in point is cardiac magnetic resonance (CMR) imaging. Compared to high-income countries like Japan, USA or Germany (with 55, 34 and 34 units MRI/million population, respectively), the number of CMR scanners in some countries (e.g. Ghana, India, Sub-Saharan Africa, Colombia) may be as low as <1 unit per million population (4, 5). Data from the European Society of Cardiology EURObservational Research Programme Cardiomyopathy Registry show that the availability of cardiac magnetic resonance (CMR) imaging (6) and genetic testing(7) is also limited in some European countries. Importantly, the epidemiology, clinical characteristics and outcomes of cardiomyopathies may be different in many of these regions (8-10).

Cost-effectiveness considerations in local practice settings need to be considered along with cultural values which might impact on diagnostic algorithms and management strategies (e.g. acceptability and availability of genetic testing and family screening in certain geographic areas). It is beyond the scope of this document to provide concrete indications for the implementation of these recommendations in every setting, acknowledging that local and regional perspective and input are essential in this context. Rather, we summarize some key priorities for the management of patients with cardiomyopathies, based on the 2023 ESC Guidelines for cardiomyopathies, with the aim of providing suggestions for facilitating implementation of class I recommendations in low resource settings. Achievement of this goal requires coordination between different levels of care and, ideally, the creation of referral

cardiomyopathy units working within networks of care (1). These centres can enable competencies that may be difficult to provide in general cardiology practice (e.g. genetic counselling and testing, advanced imaging, cardiovascular surgery, etc.). In countries lacking expert referral centres, collaboration with established national/international networks, such as the European Reference Network (ERN) Guard-Heart (https://guardheart.ern-net.eu), or initiatives like the African Cardiomyopathy and Myocarditis Registry Program (IMHOTEP)(11), may enable access to highly specialised knowledge, and sometimes resources. Importantly, in many instances, telemedicine may be a useful tool both for patient evaluation and multidisciplinary team discussions (Figure 1). In addition to these 3 key interrelated aspects (networks of care centred on national or regional specialist centres to promote best care and to support non-specialist services; use of international initiatives to support regions without critical mass/resources; increased use of telemedicine), we highlight potential gaps in evidence that may have resource and cost implications (e.g. do all patients in all settings require cardiac MRI? should individuals without a family history of cardiomyopathy have genetic testing?).

The ESC promotes equitable access to evidence-based clinical recommendations for the diagnosis and management of patients with cardiomyopathies worldwide. In this document, we present 11 key class I recommendations that we regard as priorities within this context.

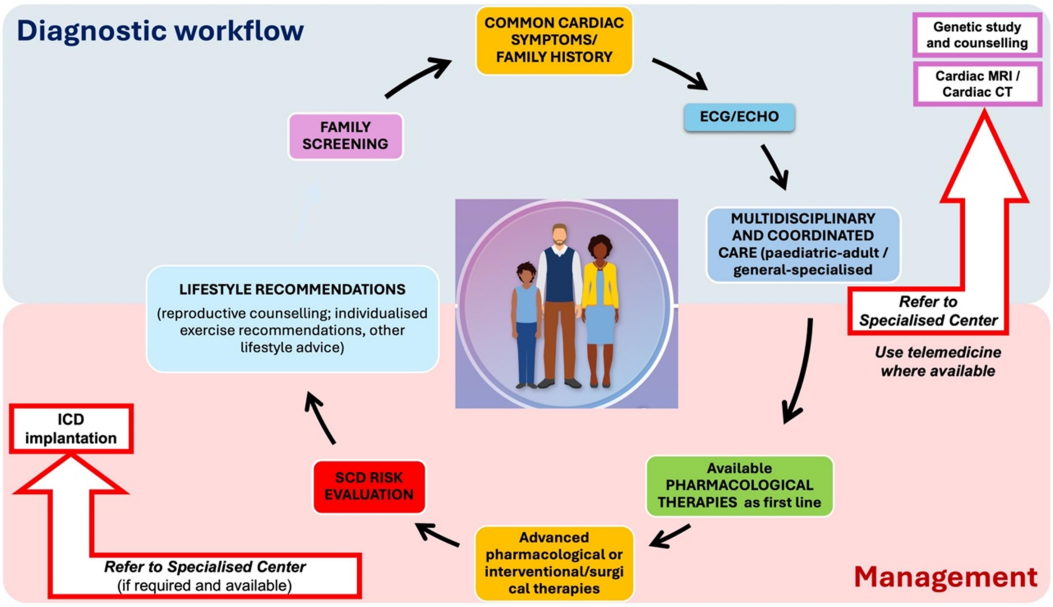
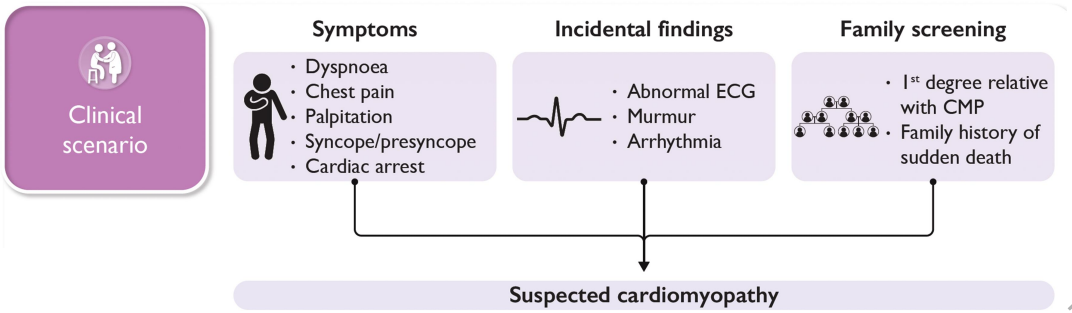


Figure 1. Structured evaluation and management of cardiomyopathies and "shared approach" between expert centres and general cardiology

PRIORITY 1. Raise awareness that common cardiac symptoms or incidental findings may be related to cardiomyopathy.



Key strategy for implementation of this priority in low resource settings

The first strategy to obtain good diagnostic and therapeutic yields in every geographical area is to raise the awareness of the clinical scenarios which can lead to a diagnosis of cardiomyopathy. This can be achieved by targeting a range of medical education tools (e.g. medical school, continuous medical education courses and conferences through national and regional scientific societies), as well as patient advocacy efforts. It is necessary to systematically develop a "cardiomyopathy mindset" realising that minor coronary disease, atrial fibrillation or a valvular defect may not be the only explanation for a patient's symptoms or findings, but a manifestation of an underlying cardiomyopathy.

Prompt referral and diagnostic workup can reduce the use of resources due to diagnostic delay (e.g. repeated medical visits, hospitalizations etc).

PRIORITY 2. Establish national or regional referral centres or networks with diagnostic and management capabilities and a multidisciplinary team

Relevant recommendation

Recommendations for the provision of service of multidisciplinary cardiomyopathy teams		
It is recommended that all patients with cardiomyopathy and their relatives have access to multidisciplinary teams with expertise in the diagnosis and management of cardiomyopathies.	I	C

Key strategy for implementation of this priority in low resource settings

Advocate for the development of national or regional referral centres that incorporate a multidisciplinary team (including advanced cardiac imaging,

interventional cardiology, electrophysiology and cardiac surgery specialists, geneticist, psychologist, etc.) and the necessary technological capabilities (e.g. ambulatory ECG monitoring, echocardiography, cardiac MRI, laboratory biomarkers, etc.) to diagnose and manage cardiomyopathies.

Organize local multidisciplinary teams of trained healthcare professionals at peripheral levels of the health system who can screen and ensure follow-up of patients after confirmation of diagnosis. These teams should benefit from point-of-care diagnostic tools (e.g. hand-held ultrasound, ultrasound machines with artificial intelligence, etc) and management (e.g. INR, BNP) devices, as well as telemedicine capabilities.

If expert national or regional referral centres are lacking, collaboration with established national/international networks (e.g. ERN Guard-Heart) may be of use.

Expert education and support of cardiomyopathy patients and their families. In countries with limited resources, useful patient information may be also be accessible through professional associations and/or patient organisations (e.g. the Cardiomyopathy Patient Council of the Global Heart Hub, https://globalhearthub.org/patient-councils/cardiomyopathy-patient-council/).

PRIORITY 3. Highlight the importance of family history and implement family screening programs, including children.

Relevant recommendations

It is recommended that all patients with suspected cardiomyopathy undergo evaluation of family history and that a three- to four-generation family tree is created to aid in diagnosis, provide clues to underlying aetiology, determine inheritance pattern, and identify at-risk relatives.	I	C

Recommendations for family screening and follow-up evaluation of relatives		
Following cascade genetic testing, clinical evaluation using a multiparametric approach that includes ECG and cardiac imaging and long-term follow-up is recommended in first-degree relatives who have the same disease-causing variant as the proband.	I	B

Key strategy for implementation of this priority in low resource settings

Use medical education opportunities to teach how to collect a three- to four-generation family tree and implement it whenever the suspicion of genetic disease exists. Taking a thorough family history should include antecedents of early onset of heart failure, sudden cardiac death, stroke, arrhythmia, or other symptoms when comorbidities are part of a systemic or metabolic cardiomyopathy, as well as an assessment of parental consanguinity, particularly in areas with a higher prevalence of recessive disease. In this context, pre-conception counselling is of particular importance.

First-degree relatives should be clinically evaluated with a minimum of an ECG and echocardiogram, as an essential part of a proactive management strategy. Periodic screening using ECG and echocardiography should be implemented

for first degree relatives, including children. The proposed frequency of screening is every 1-3 years with ECG and echocardiography (plus additional tests where this is considered appropriate) before the age of 60 years, and then every 3-5 years thereafter(12). In families where there is only one affected individual, particularly if diagnosis is made in older age, rationalisation of screening programmes could be considered (e.g. reducing frequency of periodic screening or offering one-off screening) to optimise resource utilisation.

After sudden cardiac death in a young individual occurs, autopsy and 1st degree relatives screening with ECG and echocardiography should be offered.

PRIORITY 4. Encourage a diagnostic workflow that incorporates findings from different cardiac and extracardiac investigations to reach a specific aetiological diagnosis and rule out phenocopies that could change the prognosis and treatment of the cardiomyopathy.

Relevant recommendations

Recommendations for diagnostic work-up in cardiomyopathies		
It is recommended that all patients with suspected or established cardiomyopathy undergo systematic evaluation using a multiparametric approach that includes clinical evaluation, pedigree analysis, ECG, Holter monitoring, laboratory tests, and multimodality imaging.	I	C
Recommendations for laboratory tests in the diagnosis of cardiomyopathies		
Routine (first-level) laboratory tests are recommended in all patients with suspected or confirmed cardiomyopathy to evaluate aetiology, assess disease severity, and aid in detection of extracardiac manifestations and assessment of secondary organ dysfunction.	I	C

Key strategy for implementation of this priority in low resource settings

After the initial phenotyping of the cardiomyopathies, searching for additional clues present in the patient is instrumental to the diagnostic workflow. These can include search for extracardiac traits, pedigree analysis, ECG abnormalities including arrhythmia and conduction defects, laboratory markers and pathology results. Within medical education programs for cardiomyopathies, focus on awareness for a red flag approach to cardiomyopathy aetiology and phenocopies, with a particular focus on cheaper, more widely available investigations (e.g. family history, clinical assessment, 12-lead ECG, hand-held echocardiography). By using this approach, specific aetiologies with specific management strategies may be suspected and lead to an optimized use of diagnostic tests and therapies. If a phenocopy is suspected, the patient can be referred to a specialized centre for further workup if needed.

PRIORITY 5. Highlight that ECG and echocardiogram are fundamental for the diagnosis of cardiomyopathies

Relevant recommendations

It is recommended that all patients with suspected or established cardiomyopathy undergo systematic evaluation using a multiparametric approach that includes clinical evaluation, pedigree analysis, ECG, Holter monitoring, laboratory tests, and multimodality imaging.	I	C

Recommendation for echocardiographic evaluation in patients with cardiomyopathy		
A comprehensive evaluation of cardiac dimensions and LV and RV systolic (global and regional) and LV diastolic function is recommended in all patients with cardiomyopathy at initial evaluation, and during follow-up, to monitor disease progression and aid risk stratification and management.	I	B

Key strategy for implementation of this priority in low resource settings

An ECG, interpreted with a "cardiomyopathy mindset"(13) is mandatory in all patients with a suspected cardiomyopathy, and can inform both the diagnostic process and family screening. Ambulatory ECG Holter monitoring should also be part of the follow-up of patients with cardiomyopathy as part of the assessment of arrhythmic risk.

A detailed echocardiogram can establish the phenotypic diagnosis of cardiomyopathy; if it is not available at the time of suspicion, patients should be referred to a specialized centre. Portable cardiac ultrasound devices may help in the initial diagnosis if a comprehensive echocardiogram is not available.

Whenever needed, telemedicine should be considered for discussing findings with specialised centers.

PRIORITY 6. Establish referral pathways for cardiac magnetic resonance (CMR) to a specialized centre.

Relevant recommendation

Recommendations for cardiac magnetic resonance indication in patients with cardiomyopathy		
Contrast-enhanced CMR is recommended in patients with cardiomyopathy at initial evaluation.	I	B

Key strategy for implementation of this priority in low resource settings

Patients should be referred to a referral centre in all cases where the other more readily available imaging techniques (usually echocardiography) are not enough for phenotypic characterization, in which cardiac MRI would enable diagnosis (e.g. LGE distribution, T1 mapping and extracellular volume for amyloidosis cardiomyopathy in a hypertrophied heart; volumes and function with myocardial characterization for arrhythmogenic right ventricular cardiomyopathy [ARVC]) and may have prognostic or therapeutic implications (e.g. LGE presence or amount for arrhythmic risk; RVEF for ARVC arrhythmic risk stratification; precise measurements while planning septal reduction therapies in obstructive hypertrophic cardiomyopathy [HCM]) or follow-up.

New abbreviated CMR protocols were proposed and tested as a solution to low availability in low-resource settings, as they can be less expensive, faster, whilst maintaining accuracy, potentially leading to a higher utilization in this setting (14, 15). Telemedicine approaches in collaboration with regional and international networks could be considered to facilitate interpretation of CMR findings, where appropriate.

Acknowledging that availability of CMR in some regions is limited, prioritisation of those cases in which CMR is likely to have the highest yield diagnostically or prognostically needs to be considered. For example, patients with a mild nonobstructive HCM phenotype, no high-risk features and mild or no symptoms could potentially be managed without CMR to optimise resource utilisation.

Contrast-enhanced cardiac CT may be considered in patients with suspected cardiomyopathy who have inadequate echocardiographic images and where CMR is not available.

PRIORITY 7. Establish pathways for referral for genetic testing, particularly for cases more likely to have a positive yield and where the genetic test result can impact management decisions.

Relevant recommendation

Index patients		
Genetic testing is recommended in patients fulfilling diagnostic criteria for cardiomyopathy in cases where it enables diagnosis, prognostication, therapeutic stratification, or reproductive management of the patient, or where it enables cascade genetic evaluation of their relatives who would otherwise be enrolled into long-term surveillance.	I	B
Genetic testing is recommended for a deceased individual identified to have cardiomyopathy at *post-mortem* if a genetic diagnosis would facilitate management of surviving relatives.	I	C

Key strategy for implementation of this priority in low resource settings

Since genetic testing is key to establishing a correct diagnosis, facilitating family screening, enabling prognostic and therapeutic decisions, all patients fulfilling clinical diagnostic criteria for cardiomyopathy should be referred to a centre with genetic testing capabilities. Cases associated with familial SCD, extensive LGE, conduction disorders, or specific metabolic red flags should be evaluated as a priority.

Cases where the implications of the genetic test go beyond aetiological diagnosis should be prioritized (e.g. search for high-risk arrhythmic mutations in dilated cardiomyopathy (DCM) and non-dilated left ventricular cardiomyopathy (NDLVC) to modulate the ICD implantation indication; diagnosis of Fabry disease or ATTRv cardiomyopathy which could benefit from specific therapies).

Where available, phenotype- genotype correlations (e.g. presence of red flags suggestive for Fabry or ATTR cardiomyopathy could prompt to first test for these diseases) and predictive scores (e.g. Toronto and Mayo scores for HCM, Madrid score for DCM) (16-18) may be used to prioritize genetic testing in patients who may be more likely to have a positive genetic yield. In some cases, rationing of genetic testing to optimise resource utilisation could be considered (e.g. older patients with cardiomyopathy with no candidate relatives for family screening).

When genetic testing is performed, available guidelines should be implemented to ensure that testing includes only those genes with a definitive association for each cardiomyopathy phenotype(19).

Ideally, a single national or regional genetic lab should be identified for all tests to be performed, thereby ensuring the necessary sample volume for cost-effective timely results and optimizing the learning curve in interpretation.

PRIORITY 8. Ensure that genetic counselling by an appropriately trained professional within a multidisciplinary team is available to all families with a suspected inherited cardiomyopathy, especially (but not only) when genetic testing is being considered.

Relevant recommendations

Genetic counselling		
Genetic counselling, provided by an appropriately trained healthcare professional and including genetic education to inform decision-making and psychosocial support, is recommended for families with an inherited or suspected inherited cardiomyopathy, regardless of whether genetic testing is being considered.	I	B
Pre- and post-test genetic counselling is recommended in all individuals undergoing genetic testing for cardiomyopathy.	I	B

Key strategy for implementation of this priority in low resource settings:

Healthcare professionals should be trained in genetic counselling Depending on availability, genetic counselling activity may be centralized in a tertiary referral centre. All medical education tools available should be used (e.g. medical school, continuous medical education courses and conferences). Telemedicine approaches in collaboration with regional and international networks could be considered to facilitate genetic testing interpretation.

PRIORITY 9. Recommendations for prevention of sudden cardiac death in patients with a cardiomyopathy

Relevant recommendations

Key strategy for implementation of this priority in low resource settings

All patients who survived cardiac arrest due to VT or VF or who have severe

Primary prevention		
Comprehensive SCD risk stratification is recommended in all cardiomyopathy patients who have not suffered a previous cardiac arrest/sustained ventricular arrhythmia at initial evaluation and at 1–2 year intervals, or whenever there is a change in clinical status.	I	C
The use of validated SCD algorithms/scores as aids to the shared decision-making when offering ICD implantation, where available:		
• is recommended in patients with HCM.	I	B
• should be considered in patients with DCM, NDLVC, and ARVC.	IIa	B
If a patient with cardiomyopathy requires pacemaker implantation, comprehensive SCD risk stratification to evaluate the need for ICD implantation should be considered.	IIa	C

ventricular arrhythmias (spontaneous ventricular tachycardia with hemodynamic compromise) should be referred for ICD implantation.

Patients should be referred to a referral centre for assessment of indication for ICD implantation in primary prevention. Low resources could lead to a local standardization of prioritization for ICD implantation in primary prevention. In this setting the use of The use of SCD prediction algorithms/scores (HCM, HCM Risk-Kids, ARVC, Lamin and PLN cardiomyopathies) are strongly recommended for high-risk patients selection.

PRIORITY 10. Encourage individualised risk assessment for exercise prescription in patients with cardiomyopathies

Relevant recommendation

Exercise recommendations for cardiomyopathy patients		
All cardiomyopathies		
Regular low- to moderate-intensity exercise is recommended in all able individuals with cardiomyopathy.	I	C
An individualized risk assessment for exercise prescription is recommended in all patients with cardiomyopathy.	I	C

Key strategy for implementation of this priority in low resource settings

In settings where access to advanced healthcare resources, exercise facilities, and specialized medical guidance may be limited, it is critical for patients with cardiomyopathy to participate in safe physical activities that support cardiovascular health, with regular low- to moderate-intensity exercise.

Also important to collaborate with the national or regional sports medicine specialists, sports clubs and the education system to implement recommendations for competitive and recreational sports eligibility in patients with cardiomyopathies at all ages.

PRIORITY 11. Pregnancy management in patients with a known cardiomyopathy should be handled according to functional class and disease severity by a multidisciplinary cardio-obstetrics team.

Relevant recommendation

Recommendations for reproductive issues in patients with cardiomyopathy		
Pre-pregnancy risk assessment and counselling are recommended in all women using the mWHO classification of maternal risk.	I	C
Vaginal delivery is recommended in most women with cardiomyopathies, unless there are obstetric indications for caesarean section, severe heart failure (EF <30% or NYHA class III–IV), or severe outflow tract obstructions, or in women presenting in labour on oral anticoagulants.	I	C
It is recommended that medication be carefully reviewed for safety in advance of pregnancy and adjusted according to tolerability in pregnancy.	I	C
Therapeutic anticoagulation with LMWH or VKAs according to the stage of pregnancy is recommended for patients with AF.	I	C

Key strategy for implementation of this priority in low resource settings

Pre-pregnancy counselling on maternofoetal risk, genetic transmission should be offered to the couple who plans a pregnancy. Establishing a local cardio-obstetrics team for high risk pregnancies can be very helpful for such cases. Telemedicine can assist this process for geographical distant areas.

Vaginal delivery is associated with less blood loss and lower risk of infection, venous thrombosis, and embolism than caesarean section and should be advised for most women. Caesarean section should be considered for obstetric indications, patients with severe outflow tract obstruction, or in cases of severe acute/intractable heart failure, or in cases at high risk of threatening arrhythmia and for patients presenting in labour on oral anticoagulants.

Conclusion

Most of the priorities from the 2023 ESC Guidelines for the management of cardiomyopathies highlighted in this document are expected to be low resource-consuming with high clinical benefits in return (figure 2). Key aspects for a successful implementation are increasing awareness on cardiomyopathies ("Think cardiomyopathy!"), use a systematic multiparametric approach for their assessment and establish multidisciplinary coordinated care between general adult/paediatric cardiology and expert referral centres. These centres have the potential to facilitate the access to complex diagnostic and therapeutic options, which would otherwise be challenging to extend to all areas in low-resource settings. We are confident that the implementation of these recommendations will lead to improvements in outcomes for patients with cardiomyopathies globally.

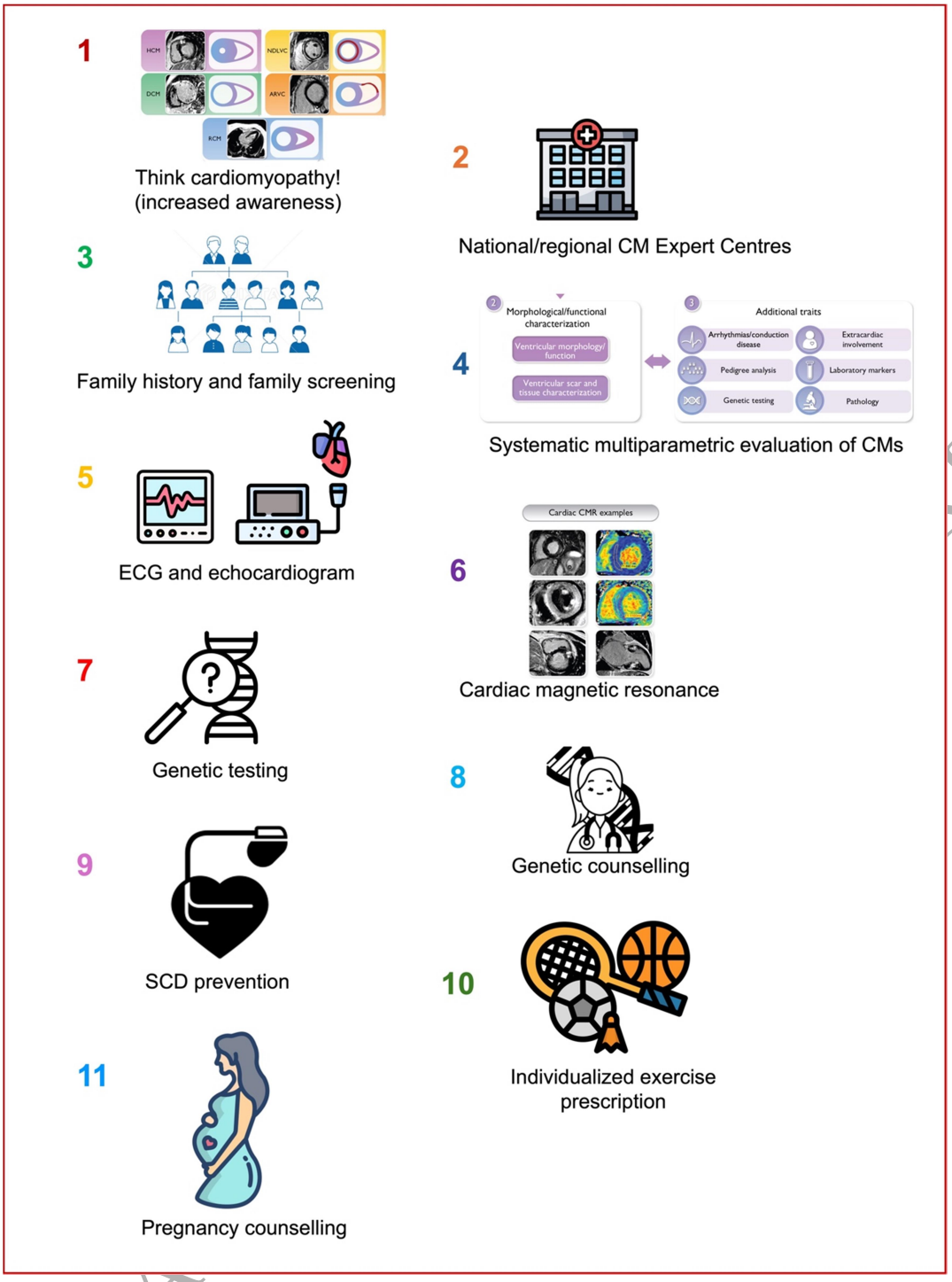


Figure 2. Key priorities for the implementation of the 2023 ESC Cardiomyopathy guidelines in low-resource settings. CM, cardiomyopathy; ECG, electrocardiogram; SCD, sudden cardiac death.

Conflict of Interest: none declared

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