Worcestershire Acute Hospitals NHS Trust

Valvular Heart Disease

Transthoracic Echocardiography Surveillance Guidance 2023

This guidance does not override the individual responsibility of health professionals to make appropriate decision according to the circumstances of the individual patient in consultation with the patient and /or carer. Health care professionals must be prepared to justify any deviation from this guidance.

Introduction

The aim of this protocol is to rationalise surveillance intervals based on the latest evidence and international guidelines for VHD to provide a standard and reference document for clinical and diagnostic staff.

This guideline is for use by the following staff groups :

Cardiology Department

Lead Clinician(s)

Dr C.McAloon	Consultant Cardiologist with Specialist Interest in Imaging
Approved by Cardiology Directorate on:	19th May 2023
Review Date: This is the most current document and should be used until a revised version is in place	19th May 2026

Key amendments to this guideline

Date	Amendment	Approved by:
May 2023	New document approved	Cardiology Directorate

1.0 Introduction

Valvular heart disease (VHD) is a significant problem accounting for high proportion of recurrent cardiovascular hospital admissions and early patient mortality. VHD is an important cause of heart failure (HF), arrhythmia and reduced functional capacity. The aging population means that VHD has an expanding prevalence.

Patients with known VHD require regular surveillance to examine for progression in severity.[1,2] Surveillance is predominantly performed with transthoracic echocardiography (TTE). The demand on echocardiography services remains high and suffers from staff shortages, making meeting demand challenging. Cardiology is the largest source of requests for echocardiography of which valve surveillance is a common indication.

In 2021, the Office of National Statistics (ONS) national census estimated there were 140,472 people over the age of 65 in Worcestershire.[3] The OxValve[4] Population cohort study (2500 participants across 5 primary care trusts in Oxfordshire) identified that 4.9% of the population had established VHD, however undiagnosed VHD was an estimated 50.8%, of which 6.4% had moderate or worse valve disease. Extrapolation of this data to the Worcestershire population, means 6,883 have diagnosed VHD.[3,4] Moreover, there will be an estimated , 4,567 have at least moderate VHD.[4]

A unique aspect of VHD is once intervention has been performed a degree of surveillance will be required lifelong, to identify prosthetic valve dysfunction.[5] Therefore, once patients are identified as having VHD, they are required to have continued clinical and echocardiographic follow-up, forever increasing demand on the cardiology service.

The aim of this protocol is to rationalise surveillance intervals based on the latest evidence and international guidelines for VHD to provide a standard and reference document for clinical and diagnostic staff.

2.0 Objectives of Protocol

1. To provide standard time intervals based on current literature for repeat surveillance TTE in Worcestershire Acute Hospitals NHS Trust (WAHT) for both native VHD and prosthetic valve follow-up.

2. To standardise and rationalise demand for follow-up TTE for VHD patients.

3. To provide a resource for clinicians for deciding on time intervals between TTE's.

3.0 General Recommendations

1. Valve surveillance involves both clinical and echocardiography. Together they should form part of the assessment of patients with VHD.

2. If there is a significant clinical change in the patient and it is considered the VHD maybe a cause, an urgent transthoracic echocardiogram is indicated even if outside 'standard' surveillance interval. *Furthermore, these guidelines are suggestions to aid judgements regarding follow up, and other factors may influence timings, either shortening or increasing.* ***Clinical decision-making overrides this protocol.***

3. Native pulmonary VHD is not considered in these guidelines as it is rare and normally forms part of the adult congenital adult disease service.

4. **The native VHD surveillance recommendations are applied on the basis the patient will be for potential intervention. Surveillance should not be undertaken if the patient is not / will not be a surgical and /or a percutaneous intervention candidate.**

5. *Cross sectional imaging modality / biomarker profile recommendations are suggested in specific scenarios where severity assessment is discrepant.*

4.0 Terminology

Full study – A full British Society of Echocardiography standard study [level 2]

Focused study – A study that focuses on answering a specific question only e.g. '*What is the left ventricular function?'*

5.0 Native Valve Heart Disease

The native valve surveillance guidelines apply to time intervals between surveillance TTE in patients that have no change in symptoms that have a specific VHD. These surveillance guidelines assume no other significant structural cardiac abnormality that requires regular surveillance. The time interval between surveillance scans remains a clinical decision.

The native VHD guidelines reflect the European Society of Cardiology 2021[1] and American College of Cardiology/American Heart Association 2020,[2] VHD guidelines.

5.1 Aortic Stenosis[1,2]

1. Mild aortic stenosis (peak gradient < 30 mm Hg - AVA > 1.5 cm2) – follow-up 2 to 3 year
2. Moderate aortic stenosis (AV V Max 3.0-3.9 m/s, Mean PD 25-40 mmHg, DI 0.25-0.5, AVA 1.0-1.4cm2) with normal LV function – follow up 1 year

- Where LV function is impaired, consideration should be given to low flow low gradient impaired ejection fraction aortic stenosis ('*classic LF LG aortic stenosis'*)– consider a Low dose Dobutamine Stress Echocardiogram (DSE) – consideration should be given when EF is reduced (LVEF<50%), however evidence is for Low Dose DSE in impaired is LVEF<40%.[6]

3. Asymptomatic severe aortic stenosis with normal LV (AV V Max > 4.0 m/s, Mean PD > 40 mmHg, DI ≤0.25, AVA < 1.0 cm2) follow up at least 6 months
- Exercise treadmill test should be considered
- Biomarkers (NT-*pro*-BNP and high sensitivity Troponin (hs-Tn)) can be considered to risk stratify (Biochemistry form '*Valvular heart disease screen*').

5.1.1 General Considerations for AS

Where discrepant results are unable to characterise the AS severity, further imaging with cross sectional modalities can be considered. Specifically, transoesophageal echocardiography (TOE), CT Calcium score of AV, Low dose DSE depending on the precise scenario and biomarkers (NT-pro-BNP and hs-Tn).

5.2 Aortic Regurgitation[1,2]

1, Mild AR with normal aortic root measurements – does not require follow up
2, Mild AR and aortic root dilatation - follow up clinically every year and with TTE (and Aorta imaging) every 2 years
3, Moderate AR - follow up clinically every 1-2 years (clinically guided) and with TTE and every 2 years
4, Asymptomatic severe AR (RF > 50%, Pressure Half Time <200 msec, VC>0.6 cm) with a normal LV and aorta dimension in non-operative range - follow up 1 year
- Inconclusive cases NT-pro-BNP is a useful marker to indicate deterioration of LV
- Change in LV diameters (LVED > 50 mm, LVEDD >65 mm) or being close to impaired LV measurement (EF <50%), FU should be every 3 to 6 months

5.2.1 General considerations for AR

- Aortic dimensions can be monitored with TTE, however > 3 mm change should be validated by CT Aortogram/MRA.
- CMR can be utilised to monitor AR and Aorta dimensions.
- Cross sectional modality approach should be considered for inconclusive cases.
- The thoracic aorta needs to be considered as part of the follow-up decision.

5.3 Mitral Stenosis

MVA planimetry is the defining variable for MS severity, with mean mitral transvalvular gradient and pulmonary pressure reflecting its haemodynamic consequence.
1, Asymptomatic significant MS (MVA<1.5cm2) follow-up – 1 year
2, Asymptomatic MS (MVA >1.5 cm2) follow-up 2 -3 years
3, Post Percutaneous Mitral Commissurotomy follow-up is required and is similar to asymptomatic patients and more frequent if there is restenosis

5.3.1 General considerations in MS

- Consider a TOE and 3D MVA in cases where it cannot be reliably defined on TTE.
- Percutaneous mitral commissurotomy can be considered in patients with MVA > 1.5 cm2 where symptoms are not explained by other conditions.
- For significant MS patients with no symptoms consider a stress test (Exercise stress echocardiography is first choice where possible. .

5.4 Mitral Regurgitation[1,2]

Based on ESC 2021 Valve guidelines *primary severe MR* (EROA [2D PISA, mm2] ≥40 mm2, Regurgitant volume ≥60 ml/beat, regurgitant fraction >50% and enlargement of LA/LV) and *secondary severe MR* (EROA [2D PISA, mm2] ≥4 0 mm2 [≥30 mm2 if low flow conditions], Regurgitant volume ≥40 ml/beat [≥30 ml/beat if elliptical regurgitant orifice area]).[1]

1, Mild MR with mitral valve prolapse / abnormal valve apparatus - follow up - 3 yearly
2, Mild MR without mitral valve prolapse – does not routinely require routine follow-up
3, Moderate MR; follow up – 1-2 yearly depending on clinical scenario
- Disproportionate symptoms consider exercise stress echocardiogram to look for dynamic changes in MR[1]
4, Severe asymptomatic primary MR with normal LV; follow up - 6 months
- More intense follow up if LV dilating or other ranges close to the threshold
- NT-*pro*-BNP to be considered for risk stratification purposes

5.4.1 General considerations for MR

- Exercise stress echocardiography should be considered if clinical concern exists about clinical symptoms and severity of MR
- CMR is an alternative to assess severity of MR (can be error prone in AF).
- TOE needs to be considered if mechanism and severity of MR are unclear.

5.5 Tricuspid Stenosis

- TS is rare.
- Severe TS is present on TTE when TVA < 1.0 cm2 and Mean pressure drop > 5 mmHg.
- No specific guidelines exist for specific FU intervals with TTE
- Clinical judgement would be required

5.7 Tricuspid Regurgitation[1,2]

There is no specific international guidance on the precise surveillance intervals for TR. In 20-30% of TR cases left heart valve disease is present (most commonly MR).[6] TTE follow-up should follow left heart VHD guidance where present. Older patients tend to predominant those with TR, application of follow-up guidelines depend on whether patient can be considered in the future. ***Follow-up should not be organised if there is no prospect of intervention.***

1, Mild TR with a structurally normal leaflet does not need follow-up as it is very likely to be normal variant.[7]
2, Isolated primary moderate TR – follow up 1-2 years depending on the RV size and function
3, Isolated pacemaker induced moderate TR – follow-up should be considered alongside the pacemaker team
3, Isolated primary severe asymptomatic TR (VC >0.7 mm, RV ≥ 45 ml, EROA ≥4 mm^2) - follow up 6 months -1 years depending on the RV size and function.

5.7.1 General Considerations for TR

- Defining primary and secondary TR important for follow-up and potential intervention. TTE should be reasonably placed to define a primary mechanism.

- Assessing RV size and function as part of TR assessment / surveillance to define potential timing of intervention.

5.8 Combined and Multiple-Valve Diseases

There is little evidence on the correct approach to surveillance of these patients. The general consensus is surveillance should follow the predominant valve problem, assuming the patient is asymptomatic.

5.9 Continuation of native VHD Surveillance

At each clinical evaluation a patient should be considered as to whether they remain a surgical / percutaneous intervention candidate as TTE surveillance should only be applied if this remains the potential destination therapy.

6.0 Replacement Heart Valves

Echocardiography is important in the surveillance of replacement heart valves, however there is significant variation in the international guidelines in the time intervals between surveillance scans.[5]

Follow-up intervals have been recommended in a joint statement from the British Heart Valve Society and British Society of Echocardiography.[5]

6.1 Baseline Routine Echocardiography

- A pre-discharge TTE may be performed to detect any an immediate problem requiring management

- A formal baseline TTE (6-8 weeks) after valve replacement is recommended to document function. Furthermore, it gives enough time post-surgery to assess left ventricular function.

- A further *focal* TTE will be indicated to assess resolution of complications (e.g. pericardial effusion).

- Clinical decision making is paramount in determining time interval between scans.

- Repeat echocardiography is required, if there is coexistent cardiac abnormalities (e.g. dilated ascending aortic root), acute clinical change (e.g. infective endocarditis) or complications with valve replacement.

6.2 Definition of Structural Valve Deterioration[5]

Thickening and reduced opening of the cusps associated with either (1) an increase in mean gradient from the last study by ≥10 mmHg associated with a fall in EOA or (2) an increase in regurgitation from baseline by one grade provided that the current grade is at least moderate.

6.3 Long-term Echocardiography Follow-up in Asymptomatic patients

The objective of routine long-term echocardiography in patients with prosthetic valves is to detect structural valve deterioration (SVD) as early as possible to help determine if further intervention (and what that might be) as quickly as possible. SVD rates vary between different types of valves. The modern mechanical valve have exceptionally low SVD rates. When it does occur, it tends to be sudden resulting in critical haemodynamic deterioration.[5] In contrast, SVD in bioprosthetic heart valves are more commonly due to slowly progressive calcification and fibrosis.[5] The SVD rates, however vary between different valve types.[5] Figure 1 (A and B) outline the main types of bioprosthetic heart valves.[5] Table 1 lists conditions that are associated with accelerated SVD rates.[5] The presence of these factors in individual patients should be accounted for in the follow-up plan. Timing of TTE surveillance and frequency is recommended on the basis of that type of valve developing SVD. Figure 2 is the British Heart Valve Society and British Society of Echocardiography recommended TTE frequency for normally functioning valves.[5]

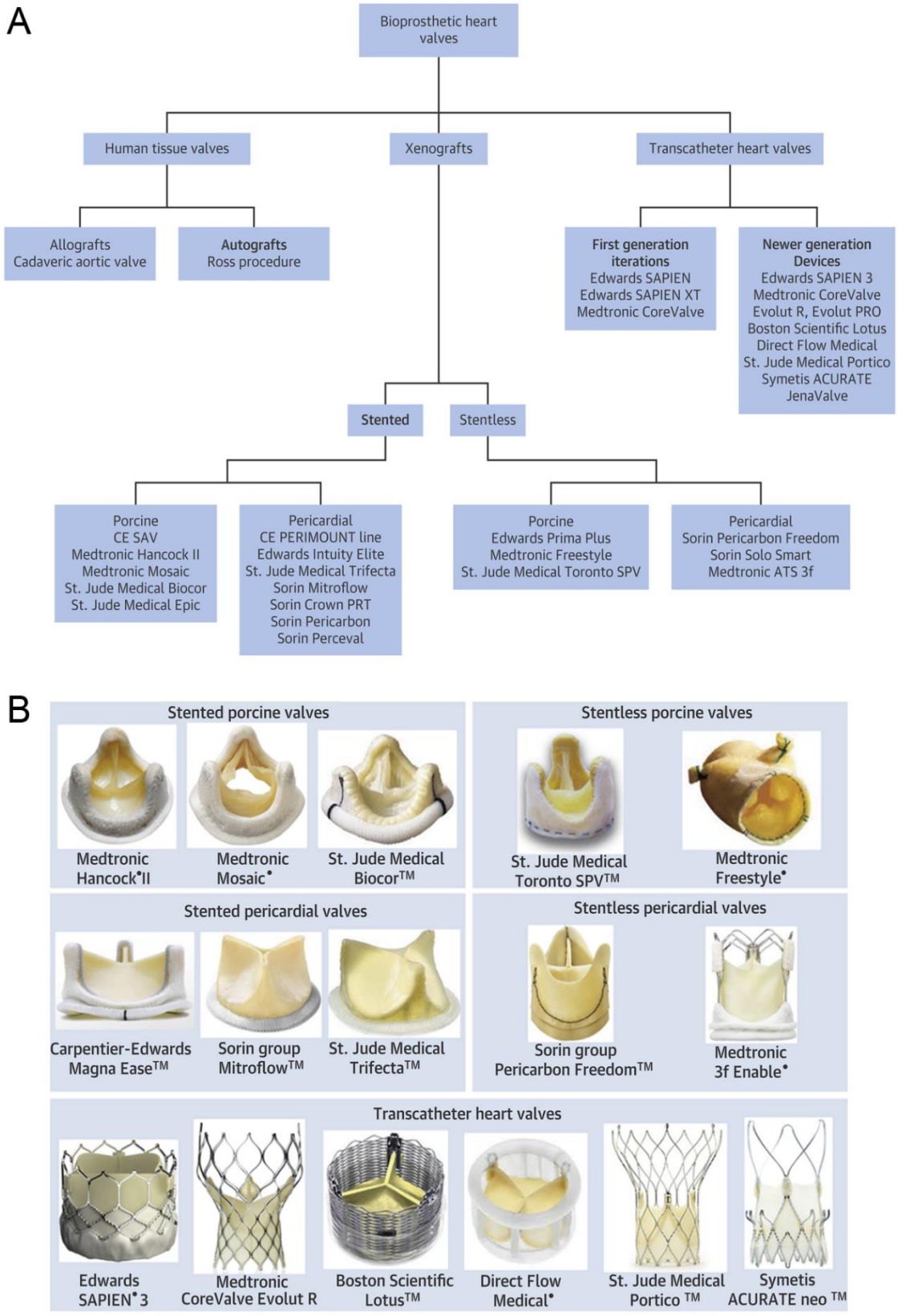

Figure 1: Main types of surgical and transcatheter bioprosthetic valve. Reproduced from *Journal of the American College of Cardiology*, vol **69**, Puri R, Auffret V & Rodés-Cabau J, Bioprosthetic valve thrombosis, pages 2193–2211

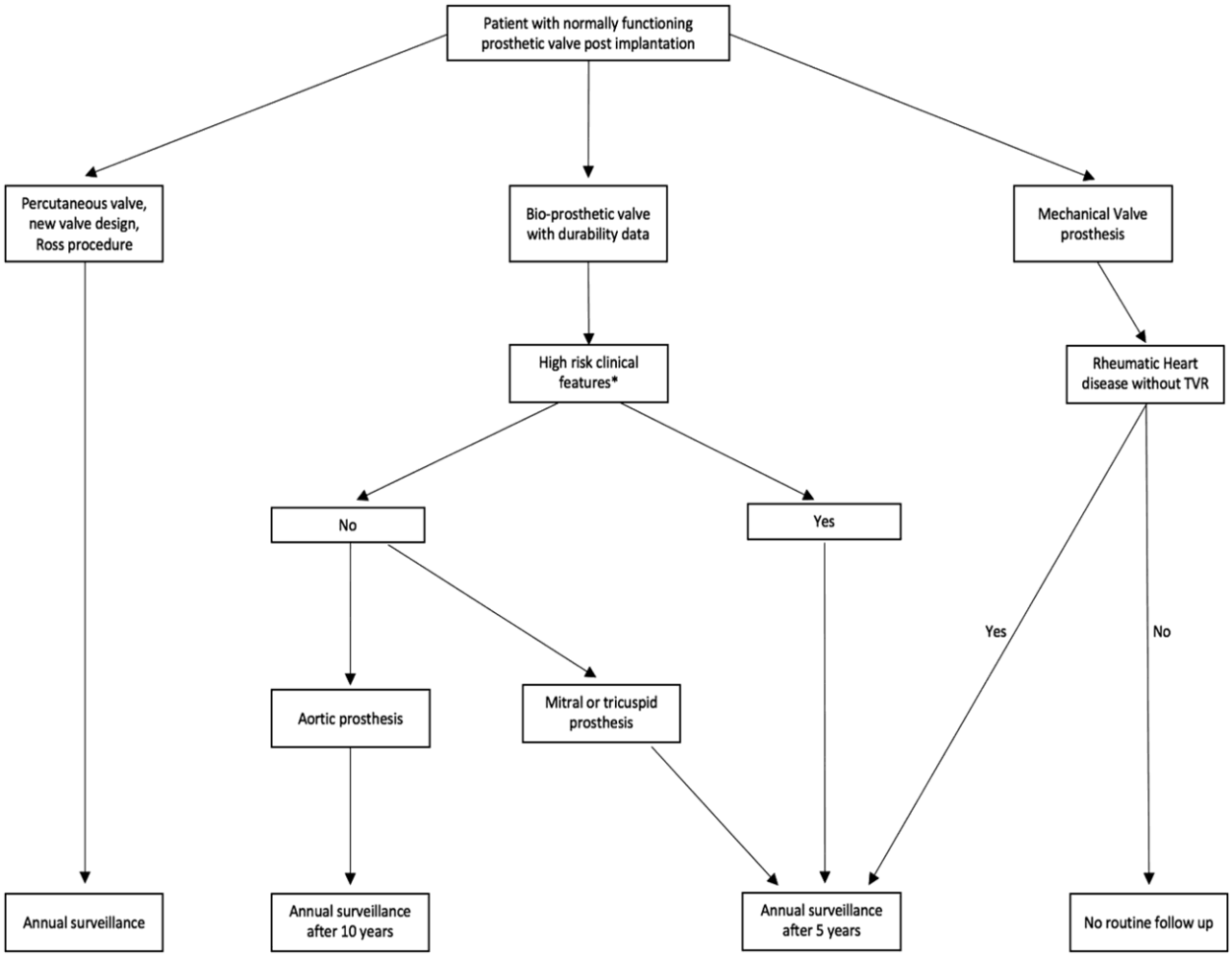

Figure 2: British Heart Valve Society and British Society of Echocardiography TTE Surveillance Strategy for Artificial Valve Prostheses [6]

Table 1: High Risk Features for SVD in Bioprosthetic valves [5]

Valve	Patient
Valve design	Age
Patient prosthetic mismatch	Diabetes
	HTN
	Renal dysfunction
	Smoking

6.4 Long Term Echocardiography in Mechanical Valve Prosthesis in Asymptomatic Patients (Figure 2)

- Routine surveillance of mechanical valve prostheses with no coexistent pathology is not required
- Mechanical mitral valve prostheses without concomitant TV repair should have routine echocardiography at 5 years for tricuspid regurgitation and worsening RV dysfunction

6.5 Long Term Echocardiography in Bio-Prosthetic Valve in Asymptomatic Patients (Figure 2)

- Those biological valves without durability data, percutaneous valves and Ross procedures should have annual surveillance echocardiograms
- Biological valves in the mitral/tricuspid position, aortic xenograft in patients < 6o years old at implantation or patients with risk factors from table 1 should have annual echocardiograms from 5 years after implantation
- Biological valves with proven longevity (e.g. Edwards Perimount, Medtronic Hancock II) in patients aged > 60 years old at implant require annual echocardiograms from 10 years after implantation

6.6 Indications for Non-Routine Serial Echocardiography in Asymptomatic Patients (Figure 2)

- Development of symptoms suggestive of SVD is an indication for echocardiography (TTE/TOE)
- Once SVD develops 6 monthly echocardiograms are indicated – even if asymptomatic.
- Suspected Endocarditis

6.7 Special Considerations: St Jude Trifecta^{M} Valve

The ST Jude (now Abbott) first generation Trifecta^{TM} bioproesthetic valve placed in the aortic position previously lacked long-term durability and it is recommended these historical patients remain on annual echocardiographic surveillance

7.0 Audit

Adherence to scanning intervals will be audited to tract adherence and usefulness of these guidelines.

8.0 Conclusion

These guidelines are recommendations for minimum intervals between TTE studies for VHD and post intervention. The echocardiography department will apply them to referrals. Clinical judgement remains central and if TTE deemed to be needed, this overrides the guideline.

9.0 Guideline Update

Guidelines will be revisited in January 2026.

Monitoring

Page/ Section of Key Document	Key control:	Checks to be carried out to confirm compliance with the Policy:	How often the check will be carried out:	Responsible for carrying out the check:	Results of check reported to: *(Responsible for also ensuring actions are developed to address any areas of non-compliance)*	Frequency of reporting:
	WHAT?	**HOW?**	**WHEN?**	**WHO?**	**WHERE?**	**WHEN?**
	These are the 'key' parts of the process that we are relying on to manage risk. We may not be able to monitor every part of the process, but we MUST monitor the key elements, otherwise we won't know whether we are keeping patients, visitors and/or staff safe.	What are we going to do to make sure the key parts of the process we have identified are being followed? (Some techniques to consider are; audits, spot-checks, analysis of incident trends, monitoring of attendance at training.)	Be realistic. Set achievable frequencies. Use terms such as '10 times a year' instead of 'monthly'.	Who is responsible for the check? Is it listed in the 'duties' section of the Policy? Is it in the job description?	Who will receive the monitoring results? Where this is a committee the committee's specific responsibility for monitoring the process must be described within its terms of reference.	Use terms such as '10 times a year' instead of 'monthly'.
Evidence presented	Check evidence / guidelines are up-to-date	Compare to latest guidelines	January 2026	Imaging Cardiologists	Imaging Cardiologists	January 2026
Guidelines being applied	Check surveillance intervals are being followed	Looking at FU valve guidelined and comparing interval to guidelines	Once per year	Cardiologists or physiologists	Imaging cardiologist / clinical lead	Once per year

References

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2. Nishimura R *et al.* 2014 AHA/ACC Guidelines for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation. 2014;129:e521–643.

Catherine M. Otto *et al*. 2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. JACC:2021;77(4):e25-e197; https://doi.org/10.1016/j.jacc.2020.11.018.

3. Office of National Statistics. Accessed 18th January 2023. https://app.powerbi.com/view?r=eyJrIjoiYWZkNmM2ZDktMGFkOC00YjljLThhNjUtZDUxZTgyMDg3NjJiIiwidCI6ImFjZjQxODg3LWJkMzctNDVkMy05ZTY1LTQ3Y2RlNDhkYzg1YSIsImMiOjh9

4. D'Arcy JL *et al*. Large-scale community echocardiographic screening reveals a major burden of undiagnosed valvular heart disease in older people: the OxVALVE Population Cohort Study. EHJ; 2016.37(47),3515–22.https://doi.org/10.1093/eurheartj/ehw229

5. Chambers JB et al. Indications for echocardiography of replacement heart valves: a joint statement from the British Heart Valve Society and British Society of Echocardiography. Echo Res Pract. 2019 Mar 1;6(1):G9-G15. doi: 10.1530/ERP-18-0079.

6. Annabi MS *et al.* Dobutamine Stress Echocardiography for Management of Low-Flow, Low-Gradient Aortic Stenosis. J Am Coll Cardiol. 2018 Feb 6;71(5):475-485. doi: 10.1016/j.jacc.2017.11.052. PMID: 29406851.

7.Arsalan M *et al* Tricuspid regurgitation diagnosis and treatment. EHJ March 2017; 38,:9,(1)634–638, https://doi.org/10.1093/eurheartj/ehv487

Contribution List

Contribution List

This key document has been circulated to the following individuals for consultation;

Designation
Dr Chris McAloon – Consultant Cardiologist
Dr Francesco Formisano – Consultant Cardiologist Dr Jasper Trevelyan – Divisional Director and Consultant Cardiologist Mrs Nicola Smith – Lead Echo physiologist

This key document has been circulated to the chair(s) of the following committee's / groups for comments;

Committee
Dr Helen Routledge – Clinical Lead for Cardiology – Divisional meeting

Supporting Document 1 - Equality Impact Assessment Tool

To be completed by the key document author and included as an appendix to key document when submitted to the appropriate committee for consideration and approval.

Herefordshire & Worcestershire STP - Equality Impact Assessment (EIA) Form
Please read EIA guidelines when completing this form

Section 1 - Name of Organisation (please tick)

Herefordshire & Worcestershire STP		Herefordshire Council		Herefordshire CCG	
Worcestershire Acute Hospitals NHS Trust	Y	Worcestershire County Council		Worcestershire CCGs	
Worcestershire Health and Care NHS Trust		Wye Valley NHS Trust		Other (please state)	

Name of Lead for Activity	**Dr Chris McAloon**

Details of individuals completing this assessment	**Name**	**Job title**	**e-mail contact**
	Dr Chris McAloon	**Consultant Cardiologist**	**Christopher.mcaloon@nhs.net**
Date assessment completed	**29th May 2023**		

Section 2

Activity being assessed (e.g. policy/procedure, document, service redesign, policy, strategy etc.)	**Title: Policy document - Valvular Heart Disease Transthoracic Echocardiography Surveillance Guidance 2023**			
What is the aim, purpose and/or intended outcomes of this Activity?	Policy document for surveillance intervals for echocardiography for heart valve disease			
Who will be affected by the development & implementation of this activity?	❑ ❑ ❑ ❑	Service User Patient Carers Visitors	❑ ❑ ❑ ❑	Staff Communities Other _____

Is this:	❑ Review of an existing activity ❑ New activity ❑ Planning to withdraw or reduce a service, activity or presence?
What information and evidence have you reviewed to help inform this assessment? (Please name sources, eg demographic information for patients / services / staff groups affected, complaints etc.	Reviewed policy document that is informed by demographic data.
Summary of engagement or consultation undertaken (e.g. who and how have you engaged with, or why do you believe this is not required)	Discussed the policy with clinical teams. There is no change in standard care so no public engagement undertaken as deemed not to be required.
Summary of relevant findings	No change or equality impact anticipated.

Section 3

Please consider the potential impact of this activity (during development & implementation) on each of the equality groups outlined below. **Please tick one or more impact box below for each Equality Group and explain your rationale**. Please note it is possible for the potential impact to be both positive and negative within the same equality group and this should be recorded. Remember to consider the impact on e.g. staff, public, patients, carers etc. in these equality groups.

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Age				No impact is anticipated
Disability				No impact is anticipated
Gender Reassignment				No impact is anticipated
Marriage & Civil Partnerships				No impact is anticipated
Pregnancy & Maternity				No impact is anticipated
Race including Traveling Communities				No impact is anticipated
Religion & Belief				No impact is anticipated
Sex				No impact is anticipated
Sexual Orientation				No impact is anticipated

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Other Vulnerable and Disadvantaged Groups (e.g. carers; care leavers; homeless; Social/Economic deprivation, travelling communities etc.)				No impact is anticipated
Health Inequalities (any preventable, unfair & unjust differences in health status between groups, populations or individuals that arise from the unequal distribution of social, environmental & economic conditions within societies)				No impact is anticipated

Section 4

What actions will you take to mitigate any potential negative impacts?	Risk identified	Actions required to reduce / eliminate negative impact	Who will lead on the action?	Timeframe
		.		
How will you monitor these actions?	**We will monitor the guidelines by auditing requests for echocardiograms for valve patients**			
When will you review this EIA? (e.g in a service redesign, this EIA should be revisited regularly throughout the design & implementation)				

Section 5 - Please read and agree to the following Equality Statement

1. Equality Statement

1.1. All public bodies have a statutory duty under the Equality Act 2010 to set out arrangements to assess and consult on how their policies and functions impact on the 9 protected characteristics: Age; Disability; Gender Reassignment; Marriage & Civil Partnership; Pregnancy & Maternity; Race; Religion & Belief; Sex; Sexual Orientation

1.2. Our Organisations will challenge discrimination, promote equality, respect human rights, and aims to design and implement services, policies and measures that meet the diverse needs of our service, and population, ensuring that none are placed at a disadvantage over others.

1.3. All staff are expected to deliver services and provide services and care in a manner which respects the individuality of service users, patients, carer's etc, and as such treat them and members of the workforce respectfully, paying due regard to the 9 protected characteristics.

Signature of person completing EIA	C.McAloon
Date signed	29/5/2023
Comments:	
Signature of person the Leader Person for this activity	C.McAloon
Date signed	29/5/2023
Comments:	

Supporting Document 2 – Financial Impact Assessment

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

	Title of document:	Yes/No
1.	Does the implementation of this document require any additional Capital resources	No
2.	Does the implementation of this document require additional revenue	No
3.	Does the implementation of this document require additional manpower	No
4.	Does the implementation of this document release any manpower costs through a change in practice	No
5.	Are there additional staff training costs associated with implementing this document which cannot be delivered through current training programmes or allocated training times for staff	No
	Other comments:	

If the response to any of the above is yes, please complete a business case and which is signed by your Finance Manager and Directorate Manager for consideration by the Accountable Director before progressing to the relevant committee for approval.