VCS/CSAG SCREENER GUIDE TO NEW FELINE SCREEN SCHEME : AIMS OF THE SCHEME & ECHO VIEWS AND MEASUREMENT METHODS

There has been a UK feline heart screening scheme since 2005. VCS/CSAG aim to improve the cardiac health of breeding cats, and it was felt that the screen scheme itself could be further developed, and the whole system modernised by using a digital screen form.

Valuable data was lost via the carbon paper system of recording the screen results and maintenance of an accurate negative HCM register has been highly problematic. Both these problems have been addressed by the development of a comprehensive and secure online portal for cat owners and screeners.
Standardisation of echocardiography measurement and interpretation of results forms the basis of a robust and workable new feline heart screening scheme. Provision of the following guidance for screeners aims to improve the quality and reproducibility of screening results and the ability to determine the presence or absence of hypertrophic cardiomyopathy. The anonymous data that will now be available for research will consequently be of better quality.

The panel who developed the new feline scheme and the guidance included highly qualified and experienced UK veterinary cardiologists (including 5 RCVS cardiology specialists). They are not considered definitive in terms of feline echocardiography measurement techniques or diagnosis of hypertrophic cardiomyopathy. They have been produced to provide clarity in many disputed areas and are based on study results currently available. To produce more consistent results between screeners and allow better quality data to be attained, it is important that all screeners are using the same methods to take measurements. In the light of new research, the panel will regularly review and may alter the advice.

Feline screen panel list:

- Professor **Jo Dukes-McEwan** BVMS (Hons), MVM, PhD, SFHEA, DVC, Dip.ECVIM-CA(Cardiology), FRCVS
- Professor **Virginia Luis Fuentes** MA VetMB PhD CertVR DVC MRCVS DipACVIM DipECVIM
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- **Emily Dutton** BVM&S DVC MRCVS
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- **Sue Roberts** BVMS CertVC MRCVS
- **Vicky Ironside** MA VetMB CertVC MRCVS

CSAG/VCS Feline screeners.

From now on, potential new feline screeners will be asked to attend a workshop for training & assessment, although new Cardiology Diplomats will still be invited to join the screening list without attendance. It is hoped that most of workshop attendees will have been successful at the canine echo exam. Those already listed as feline screeners on the VCS feline screener list and new Cardiology Diplomats are requested to familiarise themselves with the recommendations before using the new online screen form.
CSAG/VCS recommendations for the standardised measurement of the canine echocardiogram are available in the members section of the VCS website (Members Heart Screening. Documents-for-canine-screening-echo-accreditation-examination). These were developed for the canine echo accreditation examination (Main author Dave Dickson in association with Mark Rishniw, Hannah Stephenson & Liva Vatne).

When to Screen Cats.

The advice given to breeders on the new feline digital portal is as follows.

- Annual screening of all active breeding cats is encouraged (although active female cats will remain on the negative HCM register for 2 years after a normal screen result and males will on remain on the negative register for 1 year)
- Screens can be performed at any age.
- Screens performed on cats who are less than 2 years old and are normal, will not be added to the Negative HCM register.

Charging for Feline Screening.

CSAG cannot fix the costs of screening cats and respect that individual cardiologists must set their own prices.

A brief survey of some of the prices for canine and feline heart screening in the UK was recently performed and the following information gained. This may be of help if you are trying to set your own heart screening prices.

- Individual CKCS echo screens were commonly £150-£165.
- Other individual dog echo screens and feline screens were commonly £240-300.
- Some referral/hospital-based services may charge >£400
- Canine auscultation was commonly £65-£75.
- Prices could be lower for older cats.
- Prices could be lower when a whole day of screening was charged for. For example, at a dog show.

Feline Screen Echocardiography: General Points

- There are pop up reminders of the standardised view, timing and border measurements (click on the '?' beside the measurement in the form)
- Views from right lateral recumbency only are required unless outflow tract velocities are required or other cardiac disease is suspected and views from the left are needed to clarify.
- Outflow tract velocities are only required if a murmur is auscultated or there is suspicion of dynamic outflow obstruction.
- Left atrial fractional shortening is only required if the screen result is likely to be equivocal or abnormal.
- **The final measurements entered on the screen form should be derived from the average over 3 cycles measured during echo.**
- **Simultaneous ECG recording is recommended** during the screening echocardiography.
- **Gabapentin c**an be used to increase compliance but should be prescribed by the referring veterinary surgeon.
- Whilst this is primarily a screen for HCM, 2D spectral and colour doppler should be used to screen for other cardiac disease. However, a comprehensive echo examination for other cardiac disease is not expected at the time of the screen & the owner will have accepted this in T & Cs.
- Left ventricular concentric hypertrophy in cats is usually assumed to be caused by HCM, providing that hyperthyroidism and hypertension have been excluded. Left ventricular hypertrophy could theoretically be noted in a cat recovering from transient myocardial thickening, but this should be excluded as the cats presented for screening ought to be healthy and not have a recent history of congestive heart failure (see second opinion advice

below). Other less common conditions that may be associated with increased LV wall thickness in cats include acromegaly, multicentric lymphoma and congenital aortic stenosis. Ref 7

Key to acronyms used in online feline screen form

ATE = arterial thrombo-embolism BTI = blood tissue interface. CAM = Systolic anterior motion of the chordae tendineae. CHF = congestive heart failure CW = continuous wave Doppler DUST = Discrete Upper Septal Thickening IAS = Interatrial septum. LA = left atrium LAA = Left auricular appendage. LAD = Left atrial diameter	LAFS = Left Atrial Fractional shortening LV = Left Ventricle LVOT = Left ventricular outflow tract. LVWT = Left ventricular wall thickness PA = Pulmonary Artery PW = pulsed wave Doppler RPLA = Right parasternal long axis view. RPSA = right parasternal short axis view. RVOT = Right ventricular outflow tract. SAM = Systolic anterior motion of the mitral valve.

Standardised Views and Measurements for VCS/CSAG Feline Cardiac Screen

Left Ventricular Wall Thickness

View

- Screeners are advised to obtain 2D measurements from the following still images: RPLA 5 chamber view, RPSLA 4 chamber view & RPSA (at the level of the papillary muscles).

When in cardiac cycle to measure.

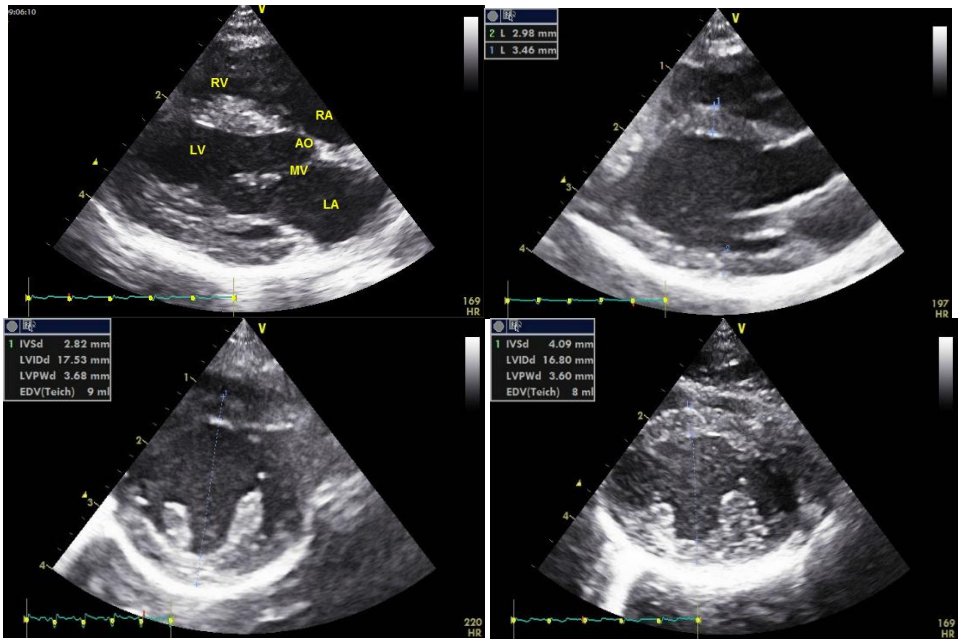
- Take measurements of diastolic LV wall thickness at the end of diastole (first frame after mitral valve closure when the mitral valve is visible or the greatest LV diameter if not, R wave peak if ECG present)

Where to take measurements.

- From still images measure maximum end-diastolic septal and free wall thickness on the RPLA 5 chamber view (the 4-chamber view can be used to measure the free wall if it is unclear on the 5-chamber view) and the RPSA view.
  Regional thickening where a false tendon is attached should be excluded and care taken to exclude papillary muscles.
- Leading edge to leading edge method of LV wall thickness is advised for all views. This is to make this measurement more comparable with M-mode values from prior publications until other studies supportive of a better method become available.
- Ensure that wall thickness is measured perpendicularly to the wall interfaces of the section being measured. On the short axis view the measurement lines should drop straight down from the septum through the LV and free wall centrally between the papillary muscles.

Measurements for Screen Form.

- There will be 4 left ventricular wall measurements obtained, a septal wall measurement from the short and long axis views and a free wall measurement from the short and long axis views. The average of 3 for each measurement should be entered on the form. The maximum of these 4 ventricular wall measurements will automatically be used in results table at the end of the screen.



Right Parasternal long axis views to measure LV wall thickness.

Right Parasternal short axis views to measure LV wall thickness.

Left Ventricular Diameter in Diastole.

View

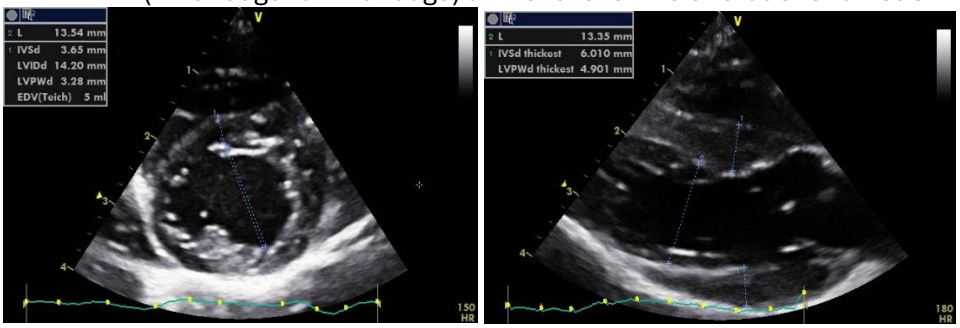
- Use the 2D images acquired for LVWT for measurement of the left ventricle in diastole in the short and long axis views.

When in cardiac cycle to measure.

- Measurements should be made at end-diastole.

Where to take measurements.

- BTI (inner edge to inner edge) at the level of the chordae tendineae.



Short axis and long axis views to measure left ventricular diameter in diastole

Left Atrium. Long Axis (LAD)

View.

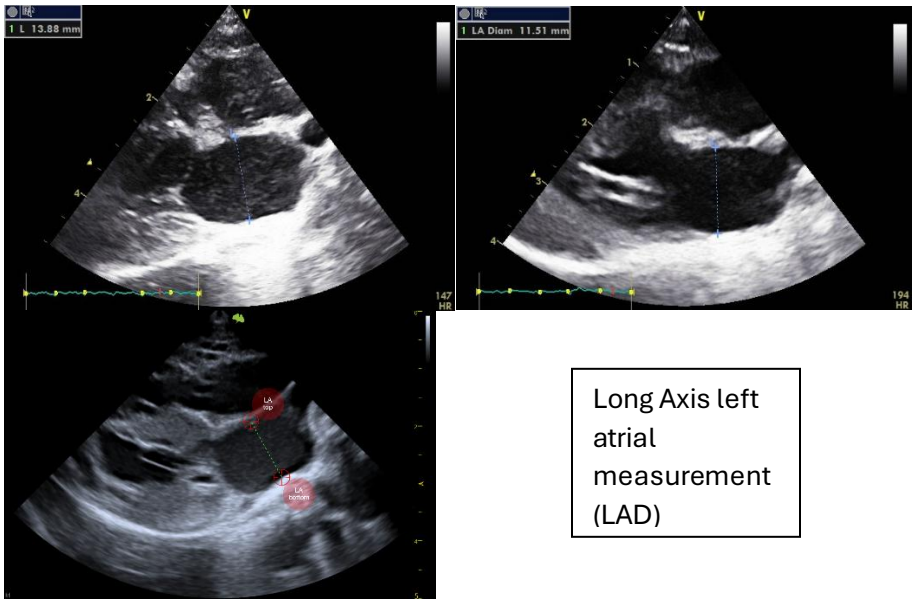
- Measure from RPLA 4 chamber view.

When in cardiac cycle to measure.

- Measure at the end of systole in the frame before mitral valve opening.

Where to take measurements.

- From interatrial septum to LA free wall. Measure the maximum diameter which is not necessarily exactly parallel to the mitral valve annulus.
- Measure from BTI at interatrial septum to BTI at left atrial free wall.



Long Axis left atrial measurement (LAD)

<u>Short Axis Left Atrial to Aortic Ratio</u>

View.

- RPSA view at the level of the aortic valve and left atrium just dorsal to the mitral valve annulus. Obtain 2D images optimising the left atrial size (should be able to see IAS, LAA and pulmonary vein when the left atrium is viewed as large as it can be).

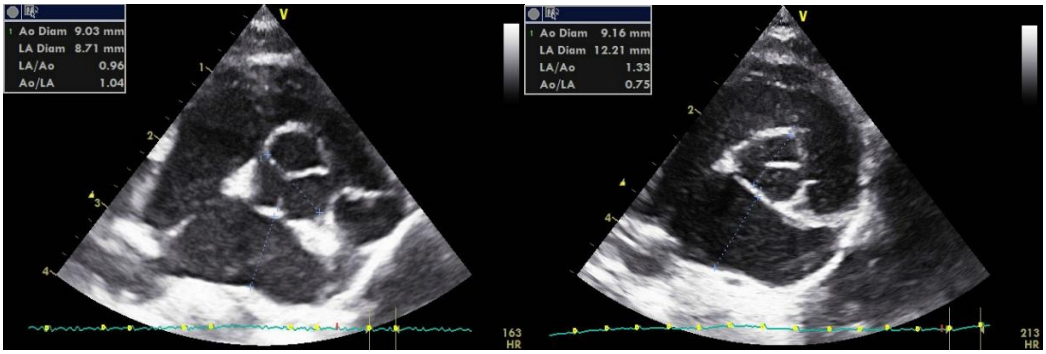
When in cardiac cycle to measure.

- Take measurements from the first clear frame after aortic valve closure (beginning of diastole when the left atrium is at its largest)

Where to take measurements.

Both the aorta and left atrium should be measured from and to BTI and not including walls.

- Measure the aortic dimension from the commissure of the non-coronary and right coronary cusps to the centre of the left sinus of Valsalva OR from the centre of the right sinus of Valsalva to the commissure of the left and non-coronary cusps.
- Measure the left atrium from the point at which the non-coronary and left aortic cusps meet and parallel to the commissure of these cusps. Pulmonary vein ostia should be avoided.
- From these measurements the dimension of the aorta, left atrium and LA/AO are obtained.



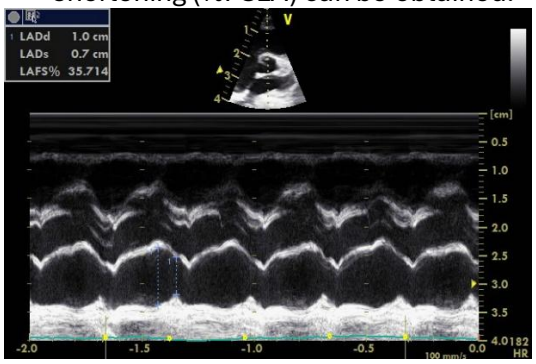
Short Axis LA/AO showing the 2 alternative points for measurement of the aorta.

Subjective Assessment of LA shape.

- Make a judgement about the size of the auricular appendage and judge the shape of the LA
- The left atrium may appear rounded in the long axis views as it begins to remodel due to the presence of HCM. The IAS may flare towards the right atrium so that the left atrium is no longer box shaped when the MV is closed.
- Note that the left atrium can be a normal size in many cats with HCM.

Left Atrial Fractional Shortening (short axis).

- This is not a mandatory measurement but can be included when a cats results appear inconclusive, and the number of minor criteria ticked becomes more important.
- The results of The Cat Scan 2 study (ref 6) show that cats with a baseline LAFS of > 25% are much less likely to develop overt HCM. In humans it is thought that LA dysfunction might reflect early myocardial fibrosis which could be a marker for early HCM.
- Use a 2D-guided M-Mode from a RPSA at the heart base. Measure the maximal and minimal left atrial dimensions, and from these measurements the percentage left atrial fractional shortening (%FSLA) can be obtained.



Measurement of left atrial fractional shortening from RPSA view of heart base, M mode.

Aortic Flow.

- Not a mandatory measurement.
- Only measure if a murmur is present, there is suspicion of LVOT / aortic obstruction or SAM is present.
- Can be measured using PW/CW. If CW is used the flow is representative of the LVOT/Ao
- Check if the shape of the profile is normal or 'dynamic'

Pulmonic Flow

- Not a mandatory measurement.
- Only measure if a murmur is present, there is suspicion of RVOT obstruction.
- Can be measured using PW/CW. If CW is used the flow is representative of the RVOT/PA

Normal Reference Ranges for VCS Feline Heart Screening Echocardiography.

Parameter	Reference Intervals	Notes and Subjective Observations
Left Ventricular Walls in diastole	See categoristion Table under Results	Categorisation has been developed to provide clarity for UK feline heart screening using existing study results and the extensive experience of the highly qualified panel. It is not considered the definitive method of interpretation.
Long Axis LA (LAD mm)	14.1 (13.3-15.0)	For most cats < 16mm is considered normal Refs that cats are more likely to develop congestive heart failure when LAD > 16.5mm, 12 & 13. Can use allometric scaling for LAD in large cats, see table below from ref 16.
LA/Ao	<1.5 = normal	Ref 9
LAFS	>25%	< 25% suggests left atrial dysfunction. >25% are less likely to develop HCM, develop CHF or ATE. Ref 6
Aortic flow velocity	<2m/s at all heart rates	
Pulmonic flow velocity	<1.5m/s at all heart rates	

Table 3 Body weight–dependent reference interval (95% prediction interval) of the left atrial diameter in 303 healthy cats.

BW (kg)	LAD (mm)[a]
2	11.96 (9.73–11.96)
3	12.92 (10.52–15.88)
4	13.65 (11.11–16.36)
5	14.24 (11.59–17.51)
6	14.75 (12.00–18.13)
7	15.19 (12.36–18.67)
8	15.58 (12.68–19.15)
9	15.93 (12.96–19.58)
10	16.26 (13.23–19.98)
11	16.55 (13.47–20.34)

BW: body weight; LAD: left atrial diameter obtained from right parasternal long-axis image plane.
[a] Allometric equation with 95% prediction intervals: $Y = 8.53$ to $12.88 * M^{0.19}$.

Ref 16.

Findings strongly associated with HCM (minor criteria) Section of Form

These criteria are useful to provide additional weight to a normal, equivocal or HCM result. The number of these criteria present should be used in conjunction with the diastolic left ventricular wall thickness measured in the categorisation table below to produce the result.

SAM/CAM (ref 7 & 10)	Mid left ventricular obstruction (ref 4)
End Systolic left ventricular cavity obliteration	High aortic velocity or abnormal flow profile
Hypertrophied or abnormally long papillary muscles (ref 15)	Mild LA dilation WITH one or both of the following: prominent auricular appendage, rounded LA shape.
Hyperechoic areas of myocardium/papillary muscles	Mid left ventricular obstruction (ref 4)
Diastolic LV diameter < 12mm	Moderate or severe LA dilation
LA FS < 25%	

Other Echocardiography Findings of Interest. NOT used to determine HCM status.

These observations are useful for reference during future screens but do not contribute to an equivocal or HCM diagnosis.

DUST without any other associated abnormalities (ref 8)
Apically positioned papillary muscles
Mitral insufficiency
Long anterior mitral valve leaflet (subjective assessment only) Ref 14.
> 2 papillary muscles
False tendons (ref 2 & 3)
OTHER COMMENTS: for any other observations

The RESULT section of the form.

There are 2 sections to this.

1. **The HCM status** of the cat being screened will automatically be determined using the LVFW thicknesses measured and the number of ticks in the FINDINGS STRONGLY ASSOCIATED WITH HCM (minor criteria) section on the form. The categorisation table below will show a coloured box outlined in bold to categorise your result and then confirm in text below the table.
2. There will be a tick box below the results table which must be ticked if there is **other cardiac disease** present which should discourage breeding from the cat or is considered significant to the cat's health. Text should be added to describe the other cardiac disease (see portal use document).

Categorisation for HCM screening								
Wall thickness	5mm or less		5.1-5.4mm		5.5-5.9mm		6mm or more	
Number of minor criteria	6-9	0-5	0-2	3-9	0-2	3-9	0-9	0-2 AND allometric scaling normal (ref 1)
Result	EQUIVOCAL	NORMAL		EQUIVOCAL		AFFECTED		EQUIVOCAL

Ref 1.

Table 3. Predicted cardiac dimensions and 95% prediction intervals for 18460 cats with normal echocardiograms according to specific, stated criteria (see materials and methods).

Weight (kg)	IVSd (mm)	LVIDd (mm)	LVFWd (mm)	IVSs (mm)	LVIDs (mm)	LVFWs (mm)	FS (%)	LA (mm)	Ao (mm)	LA:Ao
1.5	3.1 (2.3–4.0)	11.9 (9.5–15.0)	2.9 (2.2–3.8)	4.8 (3.5–6.7)	6.4 (4.2–9.6)	4.8 (3.6–6.5)	45 (28–62)	7.7 (5.8–10.2)	7.0 (5.5–8.8)	1.13 (0.85–1.40)
2.0	3.3 (2.5–4.3)	12.8 (10.2–16.0)	3.1 (2.4–4.1)	5.2 (3.7–7.2)	6.9 (4.6–10.5)	5.2 (3.9–7.1)	45 (28–62)	8.5 (6.3–11.2)	7.5 (6.0–9.5)	1.13 (0.85–1.40)
2.5	3.4 (2.6–4.5)	13.6 (10.9–17.0)	3.2 (2.5–4.4)	5.4 (3.9–7.6)	7.4 (4.8–11.2)	5.5 (4.1–7.5)	45 (28–62)	9.1 (6.8–12.0)	8.0 (6.3–10.1)	1.14 (0.86–1.41)
3.0	3.5 (2.7–4.7)	14.2 (11.4–17.8)	3.4 (2.6–4.5)	5.7 (4.1–7.9)	7.7 (5.1–11.7)	5.8 (4.3–7.9)	45 (28–62)	9.6 (7.2–12.7)	8.4 (6.7–10.7)	1.14 (0.86–1.42)
3.5	3.7 (2.8–4.9)	14.8 (11.9–18.5)	3.6 (2.7–4.7)	5.9 (4.2–8.2)	8.0 (5.3–12.2)	6.0 (4.5–8.2)	45 (28–62)	10.0 (7.6–13.4)	8.8 (7.0–11.1)	1.15 (0.87–1.42)
4.0	3.8 (2.8–4.9)	15.4 (12.2–19.2)	3.7 (2.8–4.8)	6.0 (4.3–8.4)	8.3 (5.5–12.6)	6.3 (4.6–8.5)	45 (28–62)	10.5 (7.9–13.9)	9.1 (7.2–11.6)	1.15 (0.88–1.43)
4.5	3.9 (2.9–5.1)	15.8 (12.7–19.8)	3.8 (2.9–5.0)	6.2 (4.4–8.7)	8.6 (5.7–13.0)	6.5 (4.8–8.7)	45 (28–62)	10.9 (8.2–14.5)	9.4 (7.5–11.9)	1.15 (0.88–1.43)
5.0	3.9 (3.0–5.2)	16.3 (13.0–20.3)	3.9 (3.0–5.1)	6.4 (4.6–8.9)	8.8 (5.8–13.4)	6.6 (4.9–9.0)	45 (28–62)	11.2 (8.4–14.9)	9.7 (7.7–12.3)	1.16 (0.88–1.43)
5.5	4.0 (3.0–5.3)	16.7 (13.4–20.9)	4.0 (3.0–5.3)	6.5 (4.7–9.1)	9.0 (6.0–13.7)	6.8 (5.0–9.2)	45 (28–62)	11.6 (8.7–15.4)	10.0 (7.9–12.6)	1.16 (0.89–1.44)
6.0	4.1 (3.1–5.4)	17.1 (13.7–21.4)	4.1 (3.1–5.4)	6.6 (4.7–9.3)	9.3 (6.1–14.1)	7.0 (5.1–9.4)	45 (28–62)	11.9 (8.9–15.8)	10.2 (8.1–12.9)	1.16 (0.89–1.44)
6.5	4.2 (3.1–5.5)	17.4 (14.0–21.8)	4.2 (3.1–5.5)	6.7 (4.8–9.4)	9.4 (6.2–14.3)	7.1 (5.3–9.6)	45 (28–62)	12.2 (9.2–16.2)	10.5 (8.3–13.2)	1.17 (0.90–1.45)
7.0	4.2 (3.2–5.6)	17.8 (14.2–22.2)	4.3 (3.2–5.6)	6.9 (4.9–9.6)	9.6 (6.3–14.6)	7.3 (5.4–9.8)	45 (28–62)	12.5 (9.4–16.6)	10.7 (8.4–13.5)	1.18 (0.90–1.46)
7.5	4.3 (3.2–5.7)	18.1 (14.5–22.6)	4.3 (3.3–5.7)	7.0 (5.0–9.7)	9.8 (6.5–14.9)	7.4 (5.5–10.0)	45 (28–62)	12.7 (9.6–16.9)	10.9 (8.6–13.8)	1.18 (0.91–1.46)
8.0	4.3 (3.3–5.8)	18.4 (14.7–23.0)	4.4 (3.3–5.8)	7.1 (5.1–9.9)	10.0 (6.6–15.1)	7.5 (5.6–10.2)	45 (28–62)	13.0 (9.8–17.3)	11.1 (8.8–14.0)	1.19 (0.91–1.47)
8.5	4.4 (3.3–5.8)	18.7 (15.0–23.4)	4.4 (3.4–5.9)	7.2 (5.1–10.0)	10.1 (6.7–15.4)	7.6 (5.6–10.3)	45 (28–62)	13.2 (10.0–17.6)	11.3 (8.9–14.3)	1.19 (0.92–1.47)
9.0	4.4 (3.3–5.9)	19.0 (15.2–23.7)	4.5 (3.4–5.9)	7.3 (5.2–10.2)	10.3 (6.8–15.6)	7.7 (5.7–10.5)	45 (28–62)	13.5 (10.1–17.9)	11.5 (9.1–14.5)	1.20 (0.92–1.47)
9.5	4.5 (3.4–6.0)	19.3 (15.4–24.0)	4.6 (3.4–5.9)	7.4 (5.3–10.3)	10.4 (6.9–15.8)	7.9 (5.8–10.6)	45 (28–63)	13.7 (10.3–18.2)	11.6 (9.1–14.7)	1.20 (0.92–1.48)
10.0	4.5 (3.4–6.0)	19.5 (15.6–24.4)	4.6 (3.5–6.1)	7.4 (5.3–10.4)	10.5 (6.9–16.0)	8.0 (5.9–10.8)	45 (28–63)	13.9 (10.5–18.5)	11.8 (9.3–14.9)	1.21 (0.92–1.48)
10.5	4.6 (3.5–6.1)	19.8 (15.8–24.7)	4.7 (3.5–6.2)	7.5 (5.4–10.5)	10.7 (7.1–16.3)	8.1 (6.0–10.9)	45 (28–63)	14.1 (10.6–18.8)	11.9 (9.5–15.1)	1.22 (0.94–1.49)
11.0	4.6 (3.5–6.1)	20.0 (16.0–25.0)	4.7 (3.5–6.2)	7.6 (5.4–10.6)	10.8 (7.2–16.5)	8.1 (6.0–11.0)	45 (28–63)	14.3 (10.8–19.1)	12.1 (9.6–15.3)	1.22 (0.94–1.50)

HR, heart rate; IVSd, interventricular septum diastole; LVIDd, left ventricular internal diameter diastole; LVFWd, left ventricular free wall diastole; IVSs, interventricular septum systole; LVIDs, left ventricular internal diameter systole; LVFWs, left ventricular free wall systole; FS%, fractional shortening; Ao, aortic diameter; LA, left atrial diameter; and LA:Ao, left atrial-to-aortic ratio.

This article was published online on 30 Aug 2016. An error was subsequently identified by the author. This notice is included in the online version to indicate that both have been corrected on 1 Sep 2016.

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Recommendations Section of Form

The advice printed on the owner's certificate for each of the possible recommendations on the form is given below.

Normal result: Male breeding cat.

Annual screening advised.

Normal result: Female breeding cat and neutered or retired male or female.

Screen every other year.

Equivocal result.

Provided the screened cat has no siblings, parents or direct offspring diagnosed with HCM,

- Equivocal cats younger than 2 years should not be bred from & screening repeated when older than 2 years
- Equivocal cats 2-3 years old. If these cats are mated their kittens should not be bred from, unless that parent has a subsequent normal result or remains equivocal after 3 years old
- Equivocal cats > 3 years old can be bred with cats who have a normal screening result

Other Cardiac Disease.

This cat has cardiac disease and should not be used for breeding. Should be monitored or treated as a cardiac patient.

ADDITIONAL ADVICE for EQUIVOCAL cats: it may be helpful to remind owners that these cats do not necessarily go on to develop HCM. Some of the abnormalities found during screening today may be precursors of HCM but can also be seen in normal cats.

It may also be important to emphasise to breeders that HCM is progressive and genetic.

CSAG Advice re Second Opinions.

Following is the information given to owners in 'Instructions and Information' which they can clearly see in their account.

The date of previous screens for each cat can be seen when a new screen form commences. Please adhere to this advice so that consistency is maintained between CSAG screening cardiologists.

1.Second Opinions should be more than 3 months after the initial screen has shown HCM or is equivocal.

The main reason for this time interval is the existence of a condition called transient myocardial thickening (TMT). This condition is associated with an inflammatory process in the heart muscle which leads to thickened left ventricle walls which can be mistaken for the appearance of HCM. It would be extremely unlikely that a cat would be presented for screening when suffering from TMT as affected cats are normally markedly unwell. However, cats can appear to recover from this condition (although our knowledge of any lasting effects on the heart muscle is currently limited). It is not known to be a congenital or inherited condition. Future studies and research may change guidance regarding cats who have been diagnosed with TMT. Currently cardiologists may advise breeders not to breed from a cat who has suffered from this condition, but theoretically a fully recovered cat may have a heart that appears normal on testing. If this condition resolves, it is likely to have done so by 3 months post initial echocardiography & diagnosis.

2. Second Opinions should not be more than 6 months after a screen result of HCM phenotype.

Cats who have thickened left ventricular walls due to HCM may develop fibrosis (scar tissue) in the heart muscle which leads to the wall becoming thinner and the measurements reducing to 'normal'. This is extremely unlikely to occur within 6 months of initial HCM positive screening, which is why the second opinion screens should be performed within this time frame. There will be other abnormalities present in an echocardiogram that are consistent with the previous diagnosis of HCM, so an HCM positive cat with thinner walls due to fibrosis would not be likely to pass a future screen.

CSAG advice re genetically tested cats

DNA tests for HCM causing genes have been validated in Maine Coon and Ragdoll cats. Even in these breeds or in any other breeds who may have unvalidated DNA tests available (ref 11), echocardiography is strongly recommended as the basis of heart screening

Breeders are advised by CSAG to follow the guidelines outlined in the ACVIM consensus (ref 5). These are precisely quoted below

"Genetic testing for the MyBPC3-A31P mutation and the MyBPC3 R820W mutation is recommended in Maine Coon and Ragdoll cats (respectively) intended for breeding (level of evidence [LOE] high), with the aim of decreasing the incidence of these mutations and HCM in

these breeds.29,30,44 It is recommended that cats homozygous for either mutation not be used for breeding, but heterozygous cats can be bred to genotype-negative cats if they have other outstanding characteristics (LOE low). The same genetic tests can be considered in nonbreeding Maine Coon or Ragdoll cats to determine the relative risk of developing HCM (LOE medium). In Maine Coon cats it is primarily individuals that are homozygous for the A31P mutation that develop clinically relevant HCM.44 Maine Coon and Ragdoll cats that test negative for these MYBPC3 mutations have been reported with HCM (LOE high),44,45 and thus regular echocardiographic screening should be considered even in Maine Coon and Ragdoll cats without these mutations (LOE low). Genetic testing for the A31P and R820W MYBPC3 mutations in non-Maine Coon or non-Ragdoll cats is not recommended, because these 2 mutations are almost completely specific to Maine Coon”

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