Heart Valve Disease

Development of a Community Pathway for Aortic Stenosis

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Contents

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4. ICD-10 codes, terms and text. World Health Organization, 1992-2022

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Foreword

Heart valve disease (HVD) is a potentially serious condition involving damage to one of the four valves within the heart that ensure blood flows in a single, efficient direction. HVD can affect all age groups, but increases with age and so its population prevalence rises with an ageing population. While it is a common condition, it is treatable if detected in a timely manner and the treatment options available can both lengthen life and considerably improve or reverse a patient's symptoms.

Strange et al's recent study Uncovering the treatable burden of severe aortic stenosis in the UK[1] (2022) highlights the high burden of severe aortic stenosis (AS) in the UK requiring surgical or transcatheter intervention. The authors estimate a prevalence of 291,448 people aged ≥55 years in the UK who had severe AS in 2019, accompanied by an estimate that 59.3% of these will subsequently die within five years without proactive management. The data analysis in this report, which focuses on the incidence of severe AS in England among people aged ≥65 years, tells a similarly alarming story, indicating that over half of people with symptomatic severe AS in mid-2020 did not receive any treatment[2].

The NHS Long Term Plan[3] (2019) sets out, for the first time in a health policy document, to diagnose HVD earlier and make referral into specialist care a priority. One way to increase diagnoses is by improving detection in the community – supporting primary care to detect more HVD patients and by having a clear referral pathway for echocardiography.

With the introduction of Primary Care Networks (PCNs) in the NHS, with cardiology leads in place for implementing the goals of the NHS Long Term Plan, this provides an opportunity to embed HVD care pathways at a local level.

The challenges that need to be overcome in order to achieve this include:

- Limited patient awareness of the disease, symptoms, management and impact on quality of life.
- Primary healthcare professional (HCP) awareness of HVD, and their ability to detect patients clinically and identify those who need onward referral into specialist care and treatment.
- Low diagnosis rates due to limited proactive population management/screening of at-risk groups.
- Lack of shared-care protocols for those patients with mild/moderate HVD and who need ongoing surveillance.

All of these issues need to be addressed in order to improve the detection and treatment of HVD in the UK.

This integrated care pathway resource has been created in a collaborative effort by a team of experts to support primary care in its detection and care of patients with HVD. We hope it will be a useful resource locally for both healthcare professionals and commissioners, to map the HVD patient journey and ensure best practice care.

1. Strange GA, Stewart S, Curzen N, et al. Uncovering the treatable burden of severe aortic stenosis in the UK. Open Heart 2022;9:e001783.
2. Secondary care data is taken from the English Hospital Episode Statistics (HES) database produced by NHS Digital, the new trading name for the Health and Social Care Information Centre (HSCIC) Copyright© 2022, the Health and Social Care Information Centre. Re-used with the permission of the Health and Social Care Information Centre. All rights reserved.
3. NHS (2019) The NHS Long Term Plan. Available at: **www.longtermplan.nhs.uk** (accessed March 2022).

1 Executive summary

HVD has been made a clinical priority within the NHS Long Term Plan[3] (2019). Therefore, all health care systems need to put pathways into place to achieve the ambitions within it. This document has been developed primarily as a resource for Primary Care Networks (PCNs) and Integrated Care Systems (ICSs) when setting up HVD care pathways. HVD is a serious disease that is challenging to diagnose. Access to echocardiography to establish a diagnosis is often challenging and currently many people are not receiving treatment for their condition.

We have modelled the data of severe symptomatic AS incidence. Our analysis indicates that of the 10.5 million people in England age 65 years and older in mid-2020, 16,816 of these had severe symptomatic AS[4,5,6]. Only 7,895 received treatment (yearly average for the 5-year period 2016/17 to 2020/21) which means that 53.1% of people with symptomatic severe AS did not receive treatment, although at ICS level this ranged from 44.3% to 60.2%[2]. This illustrates not only size of the problem, but also the profound gap in detection and treatment that underlines the need for action. Our results are backed up by Strange et al's 2022 study[1]: Uncovering the treatable burden of severe aortic stenosis in the UK. It uses a slightly different methodology to model severe AS burden in the UK in people age 55 years and older in 2019, concluding a prevalence of 291,448 people who should be coming forward for treatment.

HVD is potentially serious but treatable although it needs to be identified early so that the timing and type of interventions are optimal before irreversible cardiac damage occurs. Outcomes for patients who are left untreated are poor. In those people with serious AS who do not receive any effective treatment, around 50% do not survive two years[7]. Late treatment exposes such patients to higher risk during surgery, and increases the frequency of heart failure and failure to recover to pre-morbid physical capacity. This alarming mortality rate and the increased risk of heart failure are the major reasons behind the need for a structured HVD community pathway that enables primary care clinicians to effectively tackle the problem.

Central to this call for action is the strong recommendation to check for a heart murmur. This is a critical sign of HVD, yet is often missed in breathless patients in whom problems can often be attributed to other conditions, for example, chronic respiratory disease or heart failure.

There needs to be a more systematic approach to identifying these patients, which is a vital area of further discussion. This requires that both adequate resource and financial incentives are put into place. Primary care networks (PCNs) are the ideal place for this to happen and supported as directed enhanced services (DES). It would be a positive step if HVD checks were legislated into the national NHS Health Check programme as this would surely increase the opportunistic detection of HVD.

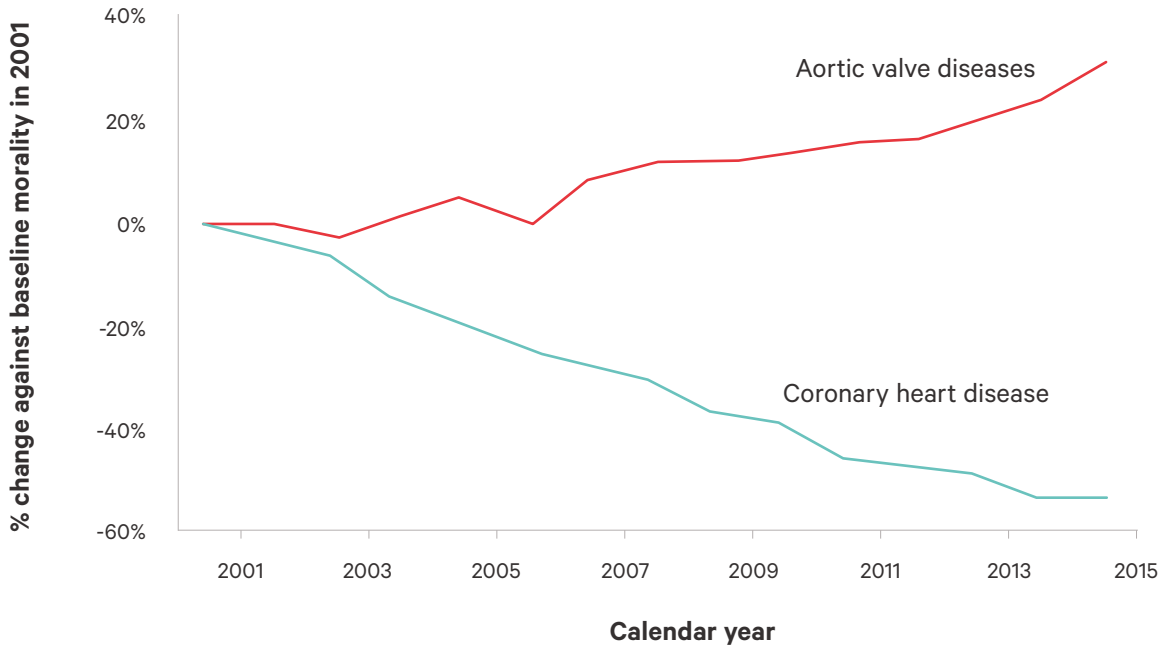
4. Office for National Statistics. ONS Mid-Year Population Estimates for Clinical Commissioning Groups (CCGs) in England by Single Year of Age and Sex. Available at: **https://www.ons.gov.uk/peoplepopulationandcommunity/ populationandmigration/populationestimates/datasets/clinicalcommissioninggroupmidyearpopulationestimates** (accessed March 2022).
5. Office for National Statistics. 2018-based Subnational Population Projections for Clinical Commissioning Groups in England. Available at: **https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/ populationprojections/datasets/clinicalcommissioninggroupsinenglandtable3** (accessed March 2022).
6. Strange G, Scalia GM, Playford D et al. (2021) Uncovering the treatable burden of severe aortic stenosis in Australia: current and future projections within an ageing population. BMC Health Serv Res 21, 790.
7. Heart Valve Voice (2016) Towards a Heart Healthy Future. A 2020 Vision for Heart Valve Disease. Available at: **https://www.heartvalvevoice.com/application/files/9514/7792/7992/Heart_Healthy_Future_Report.pdf** (accessed March 2022).Strange GA, Stewart S, Curzen N, et al. Uncovering the treatable burden of severe aortic stenosis in the UK. Open Heart 2022;9:e001783.

2 Why does HVD matter?

2.1 Heart disease kills

Heart and circulatory disease, also known as cardiovascular disease (CVD), causes a quarter of all deaths in the UK[8].
It remains the biggest cause of premature mortality and the rate of improvement has slowed[9] and therefore is the single biggest area where the NHS can save lives over the next 10 years. While significant improvements have been made addressing coronary heart disease mortality, mortality from aortic valve disease has seen a worrying upward trend (Figure 1) and severe AS has a poorer prognosis than many cancers (Figure 2)[10].

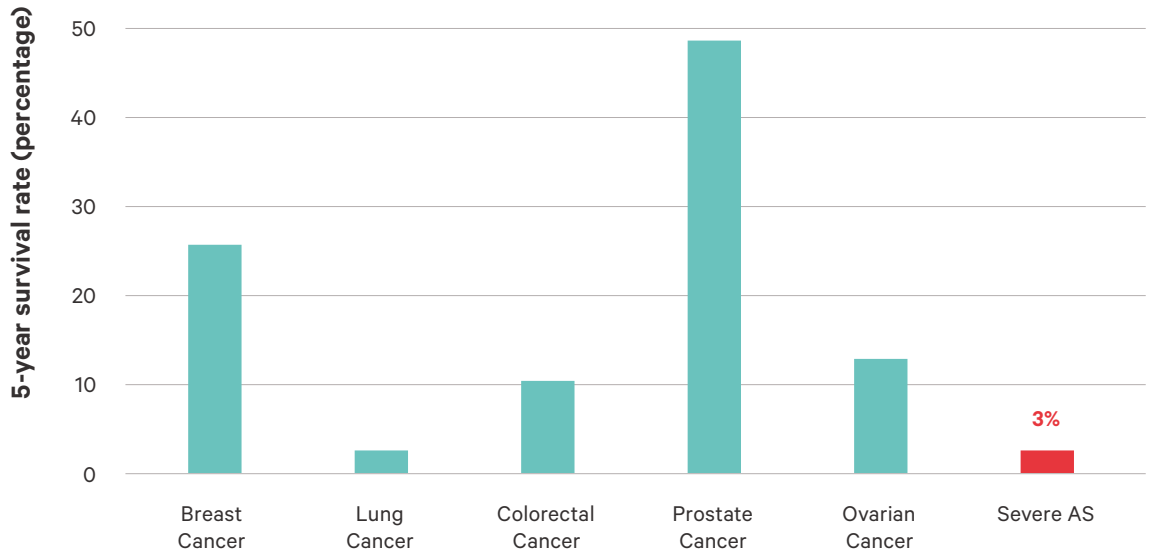
Figure 1.
Mortality in aortic valve disease and coronary artery disease in the over 65s[11]



8. British Heart Foundation (2022) Facts and figures. Available at: **https://www.bhf.org.uk/what-we-do/news-from-the-bhf/contact-the-press-office/facts-and-figures** (accessed March 2022).
9. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet 2020;396(10258):1204-1222. Available at: **www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30925-9/fulltext** (accessed March 2022).
10. Ali N, Faour A, Rawlins J, et al. 'Valve for Life': tackling the deficit in transcatheter treatment of heart valve disease in the UK. Open Heart. 2021 Mar;8(1):e001547.
11. World Health Organization Cause of Death Query online. Available at: **http://apps.who.int/healthinfo/statistics/mortality/causeofdeath_query/** (accessed March 2022).

Figure 2.

A comparison of the prognosis of untreated severe AS to the most common metastatic cancers in the UK[10] (Ca, carcinoma)



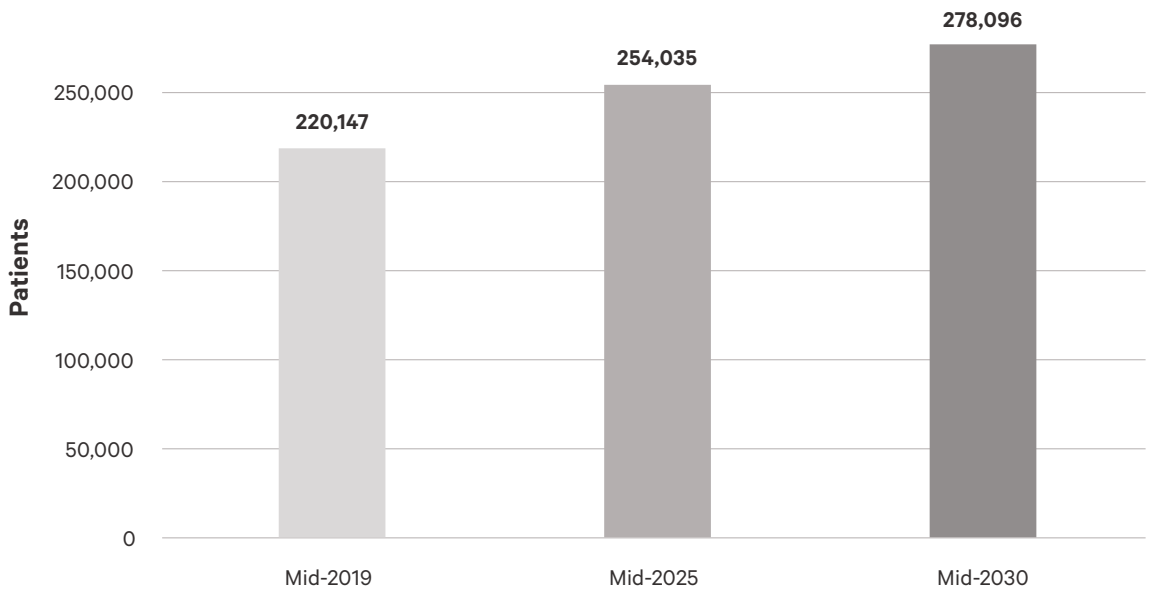
2.2 Valve disease is a huge problem

Disease of the heart valves, whereby there is damage to one of the four valves that ensure blood flows in a single, efficient direction, can affect anyone at any age and is an increasing problem in the UK and across the world. In addition to aortic, there are other valve diseases such as mitral and tricuspid valve disease and mitral regurgitation. Around 1.5 million people in the UK currently have moderate to severe HVD and, and as the population ages, this is expected to rise to 2.7 million by 2040[12]. Our data analysis shows how the number of people with severe AS aged 65 and over is set to increase over the next decade (see Figure 3)[4,5,6]. This will present a significant challenge to the NHS and is highlighted in The NHS Long Term Plan[3] as a priority that requires increased access to testing in primary care and the creation of multi-disciplinary networks that will serve to speed up appropriate care.

12. d'Arcy JL, Coffey S, Loudon MA et al. Large-scale community echocardiographic screening reveals a major burden of undiagnosed valvular heart disease in older people: the OxVALVE Population Cohort Study. Eur Heart J 2016; 37(47):3515–3522.

Figure 3.

Predicted prevalence of severe AS among people aged ≥65 years in England[4,5,6]



2.3 HVD is treatable if diagnosed early on

HVD is most often a chronic, insidious condition that progresses over years before causing symptoms, heart failure and premature death. Effective treatments are limited to surgery (surgical aortic valve replacement, SAVR) or intervention that replaces the damaged valve (transcatheter aortic valve implantation, TAVI). However, this must be done in a timely fashion before the health of the patient deteriorates. At that stage, peri-operative complications are more common and intermediate- and long-term outcomes are worse. The best course of action for the patient is to be diagnosed early and undergo prompt intervention when indicated but there is significant variation across the UK in care for patients with HVD.

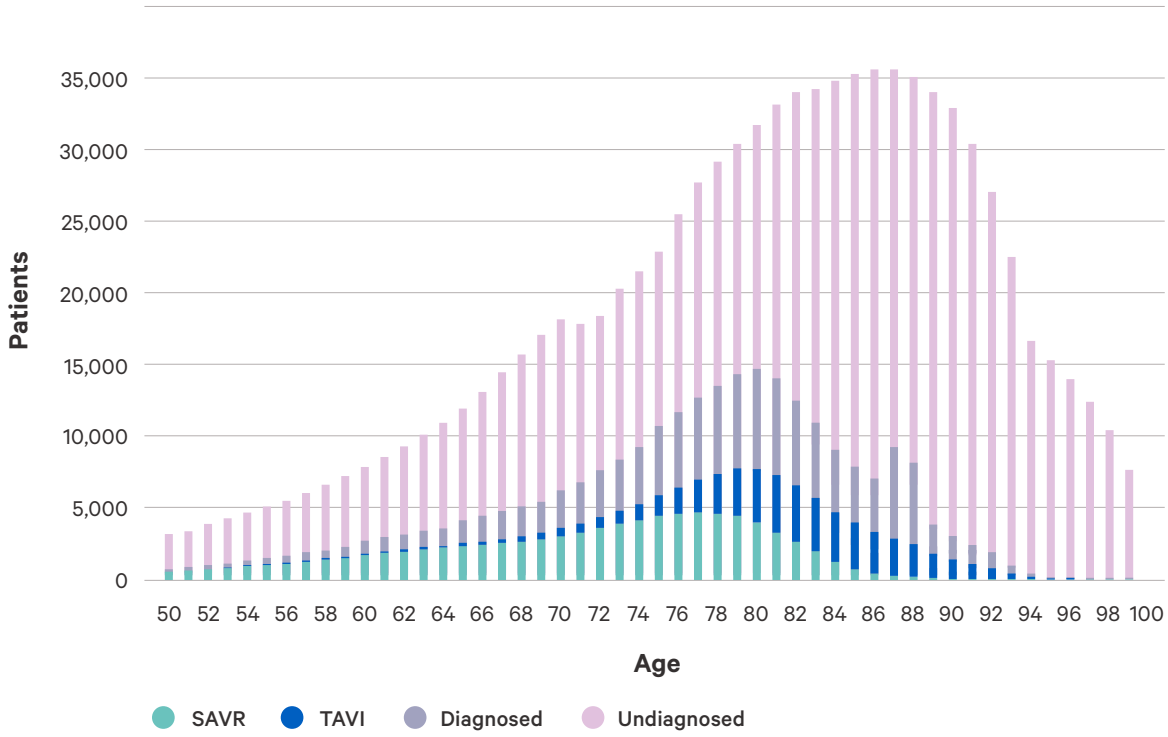
2.4 Too many patients go undiagnosed

A huge proportion of people with HVD go undiagnosed and remain 'invisible' to services. Without a prompt diagnosis, there can be no onward referral into specialist care for treatment and this may have dire consequences for patients. Figure 4 illustrates the striking number of people with severe symptomatic AS without a diagnosis[13]. This increases dramatically with age, a trend which is also seen in Figure 5 which shows the rising prevalence of severe AS by age group.

13. Adapted from: Thoenes M, Bramlage P, Zamorano P et al. Patient screening for early detection of aortic stenosis (AS)—review of current practice and future perspectives J Thorac Dis 2018; 10(9):5584–5594.

Figure 4.

Severe symptomatic AS population by age[13]



SAVR, surgical aortic valve replacement; TAVI, transcatheter aortic valve implantation.

Figure 5.

Severe AS prevalence by age group in England, mid-2020[4,5,6]

Age group	Population	Severe AS prevelance	% prevelance
≥65 years	10,464,019	223,555	2.1%
≥75 years	4,865,591	170,296	3.5%

2.5 The treatment gap

Figure 4 also shows that even in those with a diagnosis, a significant proportion remain untreated with either SAVR or TAVI[13]. The 2016 UK HVD survey found that 30% of people with HVD are left untreated[14]. This reflects data from a Europe-wide study, that over 40% of all patients are referred at a late stage in the course of their HVD, with advanced heart failure (NYHA III or IV[15]) and at least a third over 75 years are not referred at all[16]. This is thought to reflect a reluctance to refer older patients for consideration of intervention, even though outcomes remain good in the older cohorts.

As part of our data analysis we measured the difference between the incidence of patients in England with severe symptomatic AS in mid-2020 and the number of patients treated with TAVI or SAVR (yearly average for 2016/17 to 2020/21) (Figure 6)[2]. See the Methodology in section 10 for details on how the incidence rate was calculated (based on work by Strange et al 2021[6]).

14. Heart Valve Voice (2016) The 2016 UK Heart Valve Disease Survey. Available at: **https://www.heartvalvevoice.com/application/files/3614/9482/8596/Heart_Valve_Voice_UK_Survey_2016_.pdf** (accessed March 2022).
15. New York Heart Association classification.
16. Iung B, Delgado V, Rosenhek R, et al. Contemporary Presentation and Management of Valvular Heart Disease: The EURObservational Research Programme Valvular Heart Disease II Survey. Circulation. 2019 Oct;140(14):1156-1169.

Our analysis indicates that of the 10.5 million people in England age 65 years and older in mid-2020, 16,816 of these had severe symptomatic AS[4,5,6]. Only 7,895 received treatment (yearly average for the 5-year period 2016/17 to 2020/21) which indicates a large national treatment gap of 8,921 people (53.1%) who have severe symptomatic AS but have not received any treatment (TAVI or SAVR)[2]. At ICS level the gap between incidence and treatment varies from 44.3% to 60.2% (see Figure 7)[2].

Full data tables at ICS level can be found at the back of this report.

Figure 6.

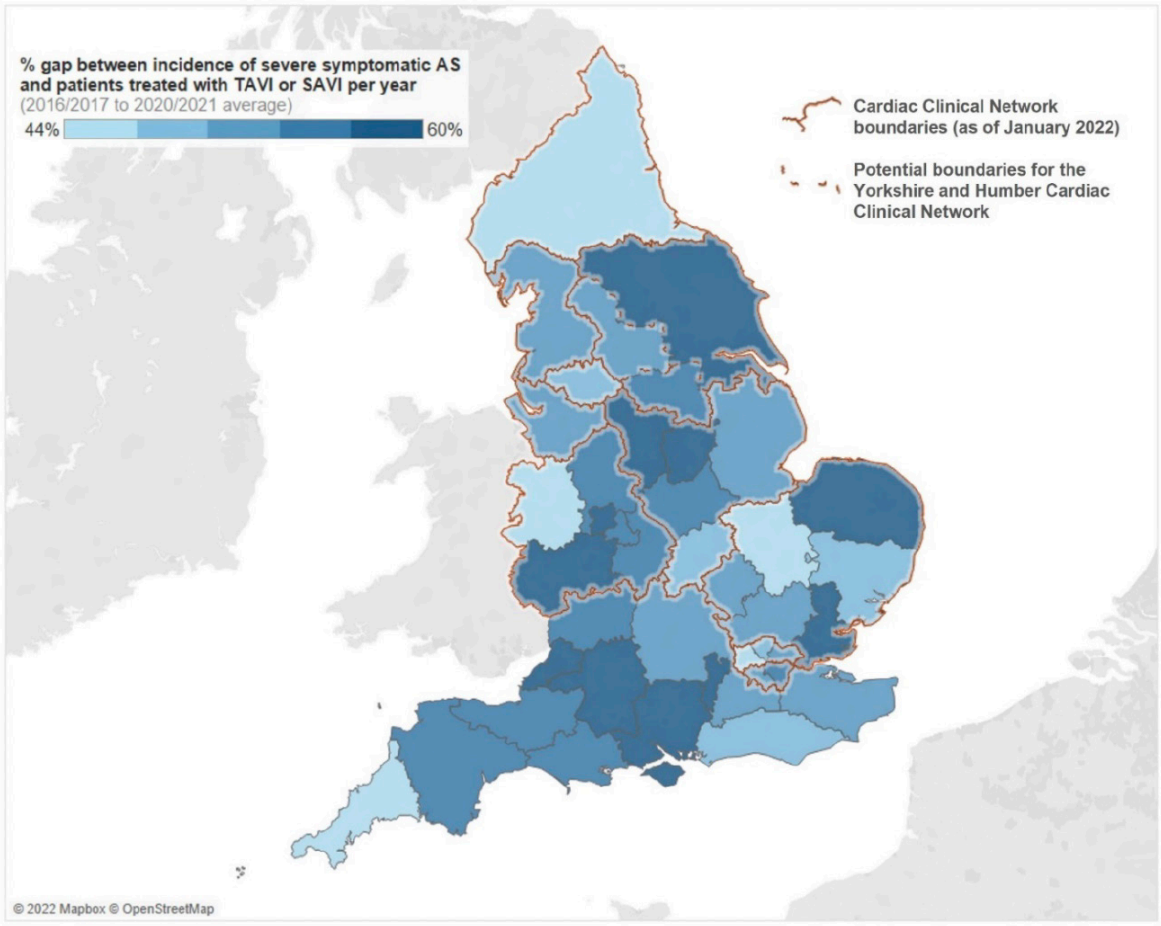
AS incidence and treatment among people aged ≥65 years in England, 2020/21[2,4,5,6]

	Population
Population aged ≥65 years	10,464,019
Severe AS incidence	24,621
Symptomatic severe AS incidence	16,816
Patients treated with TAVI, average per year (2016/17–2020/21)	2,900
Patients treated with SAVR, average per year (2016/17–2020/21)	5,000
Total number treated with TAVI or SAVR, average per year (2016/17–2020/21)	7,895
Treatment gap number (symptomatic severe AS patients minus number treated)	8,921
Treatment gap number (% symptomatic severe AS patients minus number treated)	53.1%

Figure 7.

Percentage gap between incidence and treatment at ICS level, mid-2020[2]

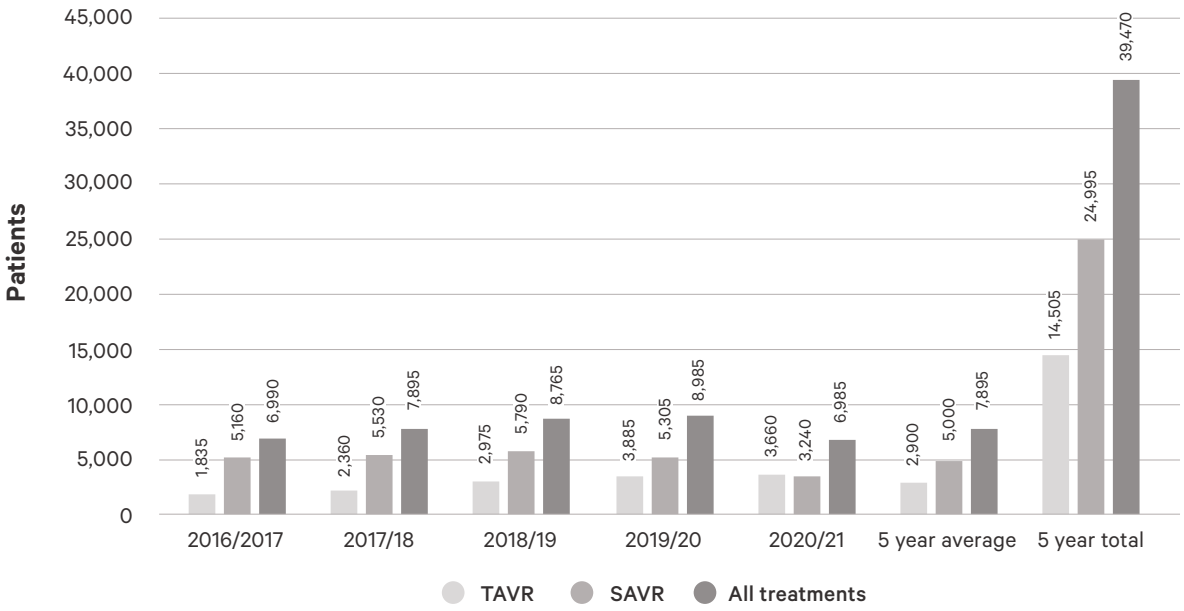
(Shows the known Cardiac Clinical Network boundaries, although not all are confirmed at the time of publication.)



2.6 Patients pay the price

The number of SAVR and TAVI procedures carried out in England has climbed marginally in the last five years (see Figure 8)[2]; however, it would need to increase significantly to meet the level of need that exists. The fictional but realistic story of a patient called Malcolm[17] (2018) perfectly illustrates how prompt detection diagnosis of HVD (through primary care detection of heart murmur) can set a patient on the path to effective treatment (in his case a TAVI). This had a life-changing outcome for Malcolm, who had three extra years of life and almost five years of much improved quality of life. Malcolm's optimal care pathway was accompanied by a £20,000 direct healthcare cost saving compared to suboptimal care, which rises to £46,000 when broader health and social care costs were taken into account. The difference that optimal care makes underlines exactly why HVD matters.

Figure 8.
Patients undergoing TAVI and SAVR procedures in England, 2016/17 to 2020/21[2]



17. Heart Valve Voice (2018) Unwarranted Variation Scenario: The variation between suboptimal and optimal pathways. Malcolm's story: Inoperable aortic valve disease versus transcatheter aortic valve implantation (TAVI) procedure. Available at: **https://heartvalvevoice.com/application/files/4115/7891/9799/Unwarranted_Variation_Scenario.pdf** (accessed March 2022).

3 Rationale for developing an integrated care pathway for HVD

The central ambition of The NHS Long Term Plan[3] is to save 150,000 lives from heart disease and dementia, but early and significant changes need to take place across all areas of England over the next eight and a half years to make this happen. The aim of this integrated pathway is to improve the identification of HVD within the community and to support primary care in ensuring appropriate referral into specialist care.

The clinical advisory group was set up in order to produce a template for community management of HVD, in order to support local areas in identifying patients sooner, with clear advice of what should be done, over what timescale and to whom patients should be referred for specialist care.

The pathway also gives advice on active surveillance of patients whose condition does not warrant immediate intervention but requires active monitoring. Patients need to be empowered to help ensure this monitoring happens at the correct time interval. In conjunction with this, electronic patient record systems should be shared between secondary and primary care so that all involved (including the patient) are proactively alerted to when a patient should be recalled for monitoring, including echocardiography.

The objectives of the HVD pathway are to:

- Improve early detection rates of HVD.
- Initiate timely referral and treatment for people with HVD.
- Identify those needing urgent referral within 2 weeks.
- Ensure equity of access to specialist assessment, diagnosis and treatment.
- Reduce morbidity and mortality due to HVD, including reducing hospitalisation.
- Give patients access to education about their condition.

3.1 COVID-19

The COVID-19 pandemic has had a significant impact on cardiology services. Closure of clinics, social distancing requirements and staff redeployment has reduced capacity. The number of hospital referrals and echocardiograms being carried out has fallen and in turn, intervention rates for HVD have declined. Historically there has also been under-provision of echocardiograms and staff training to meet demand and systems have not commissioned adequate service capacity. This creates a large backlog of patients that need to be seen in secondary care and also increases the projected number of patients in the community who require investigation and potential onward referral.

In the context of the pandemic the British Cardiovascular Society (BCS) set up a Working Group on the Future of Cardiology with the brief of capturing service developments expedited by the crisis which should be adopted across the NHS in a new model of cardiovascular care. The BCS's 2020 report[18] outlines key principles of service delivery which include:

1. **Integration**
   Cardiology services should be delivered on the basis of networks or systems of care that are fully and seamlessly integrated from community to tertiary care.
2. **Utilise technology**
   Systems of care should be designed with a patient-centric approach with an emphasis on the use of technology to facilitate diagnostics, monitoring and communication at all levels.
3. **Standardisation**
   Primary/community care identification, coding and surveillance of cardiovascular patients should be standardised and improved.
4. **Community hubs**
   As a default, diagnostics should be delivered in an integrated community diagnostic hub run by secondary care in partnership with the primary care network and by staff rotating through secondary and/or tertiary care.

18. British Cardiovascular Society (2020) The future of cardiology: a paper produced by the British Cardiovascular Society Working Group on the future of cardiology. Available at: **www.britishcardiovascularsociety.org/__data/assets/pdf_file/0010/21142/BCS-Future-of-Cardiology-17-Aug-2020.pdf** (accessed March 2022).

The Getting It Right First Time (GIRFT) Cardiology GIRFT Programme National Specialty Report[19] (2021) written by Professor Simon Ray and Dr Sarah Clarke centres on the major themes of cardiology service delivery emerging from the COVID-19 experience, especially in those areas worst affected. It compliments and provides direction on what needs to change in order to achieve the NHS Long Term Plan[3] ambitions in saving 150,000 lives over the next eight years, including the introduction of the cardiac clinical networks under the national clinical directors' leadership.

Key themes in the report include:

- **Managed Clinical Networks**

  The best way to deliver equity of access to appropriate services and expertise, match demand to capacity and make the most efficient use of resources is to create a network model. This should be dictated by function and local need, not geography, and should reflect the fact that patients will need access to various tiers of service on both an elective and emergency basis.

- **Workforce**

  Appropriate diagnostic and interventional services should run seven days per week to ensure prompt access and to reduce length of stay.

- **Data flows across pathways**

  All relevant clinical data including imaging must be accessible at all parts of the pathway from primary to tertiary care and incorporated in a single continuous electronic NHS record. All referrals to secondary care should be triaged with maximum use made of NHS e-Referral Service (ERS) Advice and Guidance and with virtual rather than face-to-face appointments where clinically appropriate.

- **Patient flows and care pathways**

  Each network should have pathways in place that ensure patients have prompt access to appropriate diagnostics and interventions consistent with current guidelines. This will require an expansion of the workforce, investment in imaging infrastructure.

- **MDTs**

  Multidisciplinary team (MDT) meetings are an essential part of cardiology treatment pathways and a core function of the heart team. Currently, there is significant variation in access to regular, quorate cardiovascular MDT meetings. They should be virtual by default and have the capability of bringing other clinical expertise into them as appropriate.

- **Data and registries**

  Currently, the degree of clinical involvement with coding varies significantly between trusts. Correct coding is important not just for financial reasons but also for identifying variation in the quality of care and all trusts should ensure that there is a mechanism for capture of the key information from the clinical record and regular clinical validation of coding data.

- **Digital transformation and cardiology**

  Cardiology has long been an innovative specialty and should be at the forefront of the digital transformation needed to improve the quality of our services. Key areas for development include:

  - Improving communication between cardiology services and patients, between colleagues and between secondary and tertiary care.
  - Making more effective use of the growing volume of patient-generated data; and using artificial intelligence (AI) to identify patterns that may not be apparent to clinicians.
  - Any service redesign must have patient-centered care at its heart.

3.2 Methodology

This integrated community detection care pathway was developed through an iterative consensus process involving experts in this specialist field. The panel comprised of eight individuals who contributed via group video calls to scope out, map and review the pathway. Feedback was also provided individually via email. Feedback was assimilated into the pathway and circulated to the panel for further individual review and group discussion to revise the document until the group reached consensus.

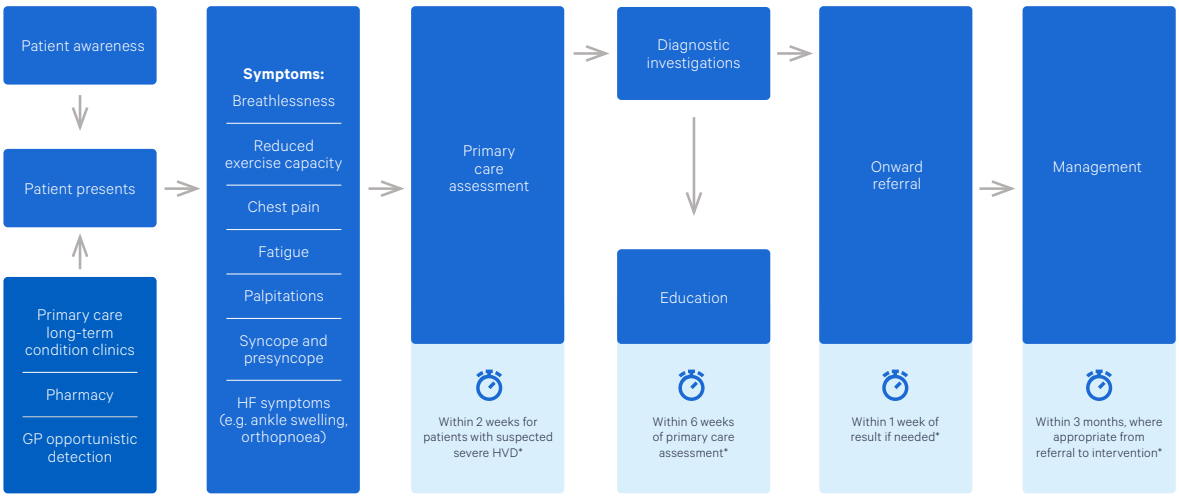
19. GIRFT (2021) Cardiology GIRFT Programme National Specialty Report. Available at: **https://www.gettingitrightfirsttime.co.uk/wp-content/uploads/2021/08/Cardiology-Jul21k-NEW.pdf** (accessed March 2022).

4 Mapping the pathway

Better awareness of HVD, among both patients and HCPs, will ensure that more patients are directed onto the HVD care pathway and therefore more patients would be able to access timely treatment. A proactive population management approach within primary care is vital to increase diagnosis levels by screening of at-risk groups.

The overall pathway for HVD maps the patient journey from presentation in primary care through to diagnosis, referral, intervention and ongoing management (see Figure 9). While many patients are prompted to visit their GP by symptoms of HVD, others with a chest infection or breathlessness may be detected by GPs incidentally or may be picked up at annual review in type 2 diabetes, coronary heart disease and hypertension clinics. There is also the possibility of pharmacies directing patients to visit their GP.

Figure 9.
The HVD community pathway



A key part of the pathway is the establishment of ideal timelines for each stage, which are highlighted, although these are unlikely to be met during the pandemic:

- Primary care assessment for patients with suspected HVD within two weeks.
- Echocardiogram within six weeks of primary care assessment.
- Onward referral within one week of results if needed (shorter time intervals may be appropriate if clinical deterioration occurs).
- Intervention within three months of referral.

Further information and alerts provide more detail on important topics which are summarised in the sections below.

4.1 Audit points, key performance indicators and standards for care

> Services need to be benchmarked regularly to monitor local variation, to track improvement efforts and to highlight areas that need attention. Services should be audited against the timelines set out within the pathway and against the proportion of diagnosed patients versus the expected prevalence of HVD within the local population.

Existing guidelines published by the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS) in 2017[20] provide an important standard on which services for care of HVD can be modelled. National Institute for Health and Care Excellence (NICE) published guidelines in 2021 for the investigation and management of HVD presenting in adults[21].

The care pathway provides a set of key performance indicators to enable services to quantify performance and gauge progress on a regular basis. These include:

- Clear referral pathways and patient prioritisation
- Standardisation of assessment and referral process
- Relevant investigations and patient information available
- Reducing delays in patient's journey later in pathway
- Cost- and time-effective management
- Integrated patient records
- Appropriate referral for patients and equity of access to the specialist team.

4.2 Symptoms suggestive of HVD and reasons for urgent referral

> The pathway underscores the need for HCPs in the community to "think HVD", especially when assessing patients with recognised cardiac symptoms such as chest pain and shortness of breath. It is important that HCPs are aware of the significance of symptoms such as syncope in the presence of a murmur which indicates the need for urgent referral.

HVD is more common in those over 65 years, in those with hypertension, diabetes and other risk factors for atherosclerosis, including smoking. Furthermore, HVD often presents as deterioration in other chronic diseases, a frequent example being chronic obstructive pulmonary disease (COPD). HCPs in the community should consider HVD as a differential diagnosis in any patient with 'recognised' cardiac symptoms such as chest pain, shortness of breath, and ankle swelling. Suspicion should also be raised by other symptoms, including palpitations, dizziness or loss of consciousness on exercise, especially where there are signs of a heart murmur or atrial fibrillation. HVD frequently co-exists in patients with other cardiac diseases such as atrial fibrillation, heart failure and coronary artery disease.

Patients with the following symptoms need **urgent referral** within two weeks: syncope/presyncope with exercise, rapidly deteriorating symptoms over a few weeks, chest pain, or signs of heart failure. Patients may be referred to a community GP with extended role (GPwER) clinic, a Rapid Access Valve Clinic, or to cardiology.

20. 2017 ESC/EACTS guidelines for the management of valvular heart disease. Baumgartner H et al. Eur Heart J. 2017;21;38(36):2739-2791.
21. NICE (2021) Heart valve disease presenting in adults: investigation and management. NICE guideline [NG208]. Available at: **https://www.nice.org.uk/guidance/ng208** (accessed March 2022).

4.3 Patient information and the importance of awareness

> Strange et al's 2022 study[1] on the burden of AS made news headlines and brought public awareness to an under recognised condition. This coverage has highlighted the importance of educating people about relevant symptoms and to ask for a heart health check if they are experiencing these. Patients with a diagnosis of HVD should be made aware of symptoms that may indicate a worsening condition.

While awareness campaigns have been effective in educating the public about common health warning signs, such as blood in the stool in bowel cancer, public awareness around HVD is sorely lacking. Patients must be alert to HVD and understand what symptoms should prompt a visit their GP. Regular health check-ups and annual stethoscope checks could help with early detection.

The HVD **symptom tracker tool** has been developed by Heart Valve Voice, the UK's dedicated heart valve disease charity, to help people who think they may be suffering from HVD to capture their symptoms ahead of visiting their HCP. It provides a two-week diary to track symptoms and potential associated factors in a quick and easy way, enabling a GP or specialist to more easily assess their potential cause and severity. Heart Valve Voice also provides resources for patients including a **post-treatment pathway**, **checklist** and **recovery plan**.

4.4 Recognised signs and symptoms of HVD

> It is essential that primary HCPs fully understand and can identify the signs and symptoms of HVD. An awareness raising campaign is needed to ensure that primary HCPs always "think HVD" when they encounter patients with signs and symptoms similar to heart failure and respiratory issues. This will improve detection and enable more patients to be referred onto the HVD care pathway to access the appropriate treatment.

HVD has a variety of symptoms which are compatible with but not diagnostic of HVD. Common symptoms and signs of HVD are similar to those for **heart failure** and **respiratory issues**, so it is important that HCPs are alert to this and have HVD in mind when assessing patients. The expert group stressed the importance of heart **murmur** (heard by stethoscope) as a sign of HVD and auscultation of the heart is key.

Other important symptoms that are compatible with but not exclusive to HVD are breathlessness, reduced exercise tolerance, chest pain (patients describe tightness, pressure or a band-like sensation), fatigue, palpitations, syncope and presyncope, and heart failure symptoms such as ankle swelling and breathlessness lying flat in bed. The care pathway provides further details on these individual symptoms. If HVD is suspected GPs should arrange an echocardiogram or refer to a specialist.

4.5 Clinical assessment in primary care

All primary care clinicians should have easy, direct access to advice and guidance from a HVD specialist, without a requirement for referral for an outpatient appointment. This needs to be addressed nationally.

The symptoms of HVD described in the section above are non-specific. Therefore, primary HCPs should always keep valve disease in mind, and take account of the fact that it may often co-exist or contribute to other cardiovascular conditions, such as heart failure.

Examination must include auscultation of the heart for murmur as a key priority. Many primary HCPs might benefit from a **refresher course**[22] on clinical skills relating to HVD.

GPs should also assess: pulse (regular/irregular, weak/strong), blood pressure (high or low blood pressure can be indicative), jugular venous pressure (raised), basal crepitations, and peripheral oedema. A minority of patients will also have a history of valve disease in the family.

GPs should be aware that NT-proBNP (N-terminal pro b-type natriuretic peptide) does not rule HVD in or out. This protein is continually produced in small quantities in the heart and released in larger quantities when the heart senses that it needs to work harder. Elevation is a possible sign of advanced HVD with patients more likely to progress to valve replacement or death. Raised NT-proBNP >400 ng/L is a trigger for further investigation of HVD and/or heart failure and should be referred urgently for echocardiography.

Smart stethoscopes are currently in development to assist with auscultation. These handheld tools analyse heart sounds digitally to help identify significant murmurs and could help to support primary HCPs with HVD detection.

4.6 Investigations

Community-based diagnostic hubs should be set up within integrated systems to include echocardiography with appropriate diagnostic interpretation as a norm across the whole country. However, currently there are insufficient numbers of trained echocardiographers to deliver unfettered access. Training is not centrally funded by NHS England or government and there is no plan in place to replace those retiring. There is a significant need to increase funding for training of these vital HCPs to support primary care detection of HVD.

A complete set of investigations is recommended; however, the main investigation is an echocardiogram. HVD and heart failure symptoms overlap, so if a heart problem is suspected an echocardiogram will help determine the specific issue. Echocardiography is a semi-quantitative technique that requires skill and experience, particularly in the field of HVD. Provision of this service should meet well-established standards, including accreditation of the individual performing the echocardiogram, as well as facilities for support of the echocardiographer to deliver a high-quality service, including digital image storage, reporting systems on-site and ability to transfer images for review.

The level of interpretation provided in echocardiogram reports can vary, so it is essential these come with clear guidance relating to appropriate management of HVD that has been diagnosed. Sufficient numbers of trained echocardiographers are critical to delivery of HVD services to support primary care.

It is a requirement of an integrated health care system that all diagnostic services, including echocardiography, are incorporated into an integrated electronic patient record that opens up access to both images and reports.

Investigations to be available should include blood testing and 12-lead electrocardiogram (ECG), which are currently required in primary care for patients with suspected heart failure. The 12-lead ECG may pick up atrial fibrillation (stroke risk), heart block or evidence of left ventricular hypertrophy, all of which can indicate HVD (although note that normal ECG does not exclude severe HVD). GPs may also consider chest X-ray, which can indicate HVD although sensitivity is low.

22. Refresher resource on heart murmur clinical skills and the sounds of common murmurs: **www.practicalclinicalskills.com/heart-sounds-murmurs**.

4.7 Onward referral

More patients need access to echocardiogram to increase the rate of community detection of HVD. Currently, access to echocardiography is limited, yet this investigation is critical for diagnosis, assessment of severity and should be the trigger for referral. In turn, this inevitably delays access to intervention for a significant number of patients.

It is essential that GPs are aware of the indicators for urgent two-week referral: deteriorating symptoms including breathlessness, syncope/presyncope, and chest pain, especially in the context of signs including a murmur and evidence of heart failure.

Patients should be referred to a specialist who has an interest in HVD.

Management of the patient will depend on how the patient accesses an echocardiogram:

- Direct access – moderate/severe HVD managed in hospital.
- Via GPwER – patient managed by GPwER.
- Via private provider – echocardiogram report will make a specific recommendation or patients with moderate/severe HVD and heart failure are referred to specialist service for management.

Services that carry out echocardiography are delivered primary care but could be delivered by a number of providers including acute trusts. Storage of these studies for future review is essential, ideally to a cloud-based server and to be incorporated into an integrated shared patient record.

4.8 Management plan for long-term monitoring

GPs need to be able to access expert advice easily. A local HVD management strategy should be agreed that can include 'no follow-up' or repeat echocardiography at **recommended intervals** via open access via open access or automated call back. Rapid review should be available if the clinical state changes and patients with worsening symptoms should be re-referred. Strong primary care links with the valve clinic at the hospital are important, including tracking from the valve clinic and clear guidance on indications for referral between services.

As part of the management plan for patients with HVD, the GP and patient should be alert to increasing shortness of breath, ankle swelling, development of chest pain etc, which may indicate clinical deterioration of HVD. The patient must be aware of the need for re-assessment when their symptoms change. Patients should be given information leaflets and also be made aware of complications, including endocarditis or replacement valve failure. All patients should be advised at every stage about exercise, diet, and careful control of risk factors such as hypertension and dental care.

Mild disease is very common, occurring in about 50% of patients over the age of 65, with most cases not progressing to severe disease or ever requiring treatment. These patients can be managed in primary care but a clear decision should be made to identify those who do not require further assessment, and identification of the smaller number who may still require an an echocardiogram at **recommended intervals**. Advice should be available to GPs, e.g. physiologist/scientist-led murmur clinic, comment on report from a cardiologist, automated advice in the conclusion from a drop-down menu.

Patients with moderate to severe disease will have a management plan that has had input from a specialist but which includes primary care monitoring until the optimal time for intervention. After initial assessment or discussion with the cardiologist supervising the valve clinic, some cases could reasonably be followed up in community clinics provided the necessary competencies and processes are in place.

There must be clear and prompt communication with the patient's GP to include details of longer-term follow-up, frequency of echocardiography (arranged by community or secondary care) and expectations of primary care. There should be a similar management plan for those patients who have already undergone surgical or transcatheter intervention, including a post-surgery check guidance for primary care. There should be strong links with the valve clinic or service (where available) at the hospital including frequency of monitoring and clear guidance on indications for referral back to the valve clinic. Patients in this group are suitable for management by a community GPwER clinic, where it exists.

Palliative care should be available when intervention for symptomatic severe HVD is not feasible or is considered clinically inappropriate. The option of optimal medical therapy as an alternative to intervention should be discussed, especially in patients with complex care requirements where benefits may be more limited. Primary care should have a central role to play in managing any patient who is at the end of life, with advanced care planning where symptom control is paramount and engaging palliative care specialist services where appropriate. HCPs should adopt the **ReSPECT process** (Recommended Summary Plan for Emergency Care and Treatment).

5 Conclusion

HVD is a common, serious and yet treatable condition. Improved community detection therefore offers significant scope to make a difference to patients. Patients need early identification and prompt intervention when indicated. However, the UK has significant variation in care of HVD. Many people wait too long for a diagnosis, often due to a lack of patient and clinician awareness of the condition, which can have major ramifications for their symptom management, quality of life and life expectancy.

HVD is a national priority: The NHS Long Term Plan[3] (2019) highlights the need for increased access to testing in primary care and the creation of multi-disciplinary networks that will serve to speed up appropriate care.

The prevalence of HVD continues to grow as the population ages. The data analysis in this report suggests that under half of people ≥65 years with symptomatic severe AS receive any treatment. This is a problem that requires urgent focus, both in terms of raising public awareness about the symptoms and treatment options, and better awareness among community HCPs about how the condition presents and the importance of referral for early diagnostics and onward referral into specialist care. Underdiagnosis has dire effects on patient outcomes and incurs higher costs for services over the long term. Early detection is essential in order for patients to access prompt treatment. Urgent attention is needed from NHS England to address capacity within specialist centres, otherwise patients will be left waiting for treatment and will experience avoidable complications (see Malcolm's story[17]).

By keeping HVD in mind in the context of cardiac symptoms, especially for patients attending annual review for conditions such as type 2 diabetes, coronary heart disease and hypertension, primary HCPs play an important role in enabling HVD patients to access the care they need. The majority of these clinics are delivered by non-allied health professionals (non-AHPs) who do not undertake cardiac auscultation in primary care and therefore either training or the uptake of digital technologies to enable auscultation to be delivered accurately. This also presents an opportunity for non-AHPs such as community pharmacists and healthcare assistants to perform screening to detect murmurs and refer patients for echocardiogram. The burden of underdiagnosis and undertreatment currently leads to unnecessarily poor outcomes for many people with HVD. Adopted across the UK, the best practice community care pathway developed by this expert group would have an important impact on the lives of a great many families.

6 Resources

- 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. Eur Heart J. 2016;37(47):3515-3522
- NHS (2019) NHS Long Term Plan
- British Heart Valve Society (2020) Network based care for heart valve disease
- Baumgartner H et al. 2017 ESC guidelines for the management of valvular heart disease. Eur Heart J. 2017;21;38(36):2739-2791
- NICE (2021) Heart valve disease presenting in adults: investigation and management. NICE guideline [NG208]
- Heart Valve Voice (2016) Towards a heart healthy future: a 2020 vision for heart valve disease
- Wilmington Healthcare (2018) Unwarranted variation scenario: the variation between suboptimal and optimal pathways. Malcolm's story: inoperable aortic valve disease versus transcatheter aortic valve implantation (TAVI) procedure
- Thoenes M et al. Patient screening for early detection of aortic stenosis (AS)—review of current practice and future perspectives. J Thorac Dis. 2018;10(9):5584-5594
- Yang H et al. Echocardiographic screening for non-ischaemic stage B heart failure in the community. Eur J Heart Fail 2016;18(11):1331-1339
- British Cardiovascular Society (2020) The future of cardiology: a paper produced by the British Cardiovascular Society Working Group on the future of cardiology
- Heart Valve Voice's resources for patients including the HVD symptom tracker tool, post-treatment pathway, checklist and recovery plan.
- 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;6(1):G9-G15

7 Organisations

- British Cardiovascular Society
- British Heart Foundation
- British Heart Valve Society
- British Society of Echocardiography
- Heart Valve Voice
- Primary Care Cardiovascular Society
- Royal College of General Practitioners
- Society for Cardiothoracic Surgery in Great Britain and Ireland

8 Glossary of abbreviations

AHP	Allied health professional
AS	Aortic stenosis
BCS	British Cardiovascular Society
COPD	Chronic obstructive pulmonary disease
CVD	Coronary heart disease
DES	Directed enhanced services
EACTS	European Association for Cardio-Thoracic Surgery
ECG	Electrocardiogram
ESC	European Society of Cardiology
GIRFT	Getting It Right First Time
GPwER	GP with extended role
HCP	Health care professional
HVD	Heart valve disease
ICS	Integrated care system
MDT	Multidisciplinary team
NICE	National Institute for Health and Care Excellence
NT-proBNP	N-terminal pro b-type natriuretic peptide
NYHA	New York Heart Association classification
PCN	Primary care network
SAVR	Surgical aortic valve replacement
SSAS	Severe symptomatic aortic stenosis
TAVI	Transcatheter aortic valve implantation

9 Data tables

9.1a Severe AS prevalence at ICS level, mid-2020[4,5,6]

Organisation	Population aged ≥65 years	Severe AS prevalence	Symptomatic severe AS prevalence	Severe AS incidence	Symptomatic severe AS incidence
England	**10,464,019**	**223,555**	**152,688**	**24,621**	**16,816**
BATH & NORTH EAST SOMERSET,SWINDON & WILTSHIRE ICS	185,319	3,982	2,720	440	300
BEDFORDSHIRE, LUTON AND MILTON KEYNES ICS	151,511	3,171	2,166	347	237
BIRMINGHAM AND SOLIHULL ICS	178,499	3,888	2,656	433	296
BRISTOL,NORTH SOMERSET & SOUTH GLOUCESTERSHIRE ICS	166,686	3,639	2,485	405	276
BUCKINGHAMSHIRE, OXFORDSHIRE & BERKSHIRE WEST ICS	313,750	6,826	4,662	758	518
CAMBRIDGE AND PETERBOROUGH ICS	166,201	3,545	2,421	390	266
CHESHIRE AND MERSEYSIDE HEALTH & CARE PARTNERSHIP	502,510	10,658	7,280	1,171	800
CORNWALL AND THE ISLES OF SCILLY ICS	145,457	3,073	2,099	335	229
COVENTRY AND WARWICKSHIRE ICS	171,698	3,738	2,553	415	284
DEVON ICS	293,939	6,345	4,334	701	478
FRIMLEY HEALTH AND CARE	121,705	2,629	1,796	292	199
GREATER MANCHESTER HLTH & SOCIAL CARE PARTNERSHIP	459,044	9,643	6,586	1,054	720
HAMPSHIRE AND THE ISLE OF WIGHT ICS	381,042	8,276	5,653	916	626
HEALTHIER LANCASHIRE & SOUTH CUMBRIA	354,693	7,520	5,136	824	562
HEREFORD AND WORCESTERSHIRE ICS	185,897	3,983	2,720	439	300
HERTFORDSHIRE AND WEST ESSEX ICS	259,333	5,655	3,862	629	430
HUMBER COAST & VALE HEALTH & CARE PARTNERSHIP	378,534	8,040	5,491	882	602
JOINED UP CARE DERBYSHIRE ICS	212,694	4,525	3,091	497	339
KENT AND MEDWAY ICS	368,048	7,857	5,366	863	589
LEICESTER & RUTLAND ICS	200,622	4,234	2,892	464	317

Organisation	Population aged ≥65 years	Severe AS prevalence	Symptomatic severe AS prevalence	Severe AS incidence	Symptomatic severe AS incidence
LINCOLNSHIRE ICS	182,278	3,876	2,648	425	290
MID AND SOUTH ESSEX ICS	233,986	5,009	3,421	551	376
NORFOLK AND WAVENEY ICS	257,855	5,609	3,831	621	424
NORTH CENTRAL LONDON PARTNERS IN HEALTH & CARE ICS	187,068	3,959	2,704	436	298
NORTH EAST AND NORTH CUMBRIA ICS	614,170	12,870	8,790	1,405	960
NORTH EAST LONDON ICS	209,887	4,359	2,977	478	326
NORTH WEST LONDON ICS	284,653	5,963	4,073	655	448
NORTHAMPTONSHIRE ICS	133,984	2,763	1,887	299	204
NOTTINGHAM AND NOTTINGHAMSHIRE HEALTH & CARE ICS	187,795	3,979	2,718	437	298
ONE GLOUCESTERSHIRE	139,420	2,986	2,039	329	225
OUR DORSET	198,608	4,366	2,982	486	332
OUR HEALTHIER SOUTH EAST LONDON ICS	215,183	4,558	3,113	502	343
SHROPSHIRE, TELFORD & WREKIN ICS	112,955	2,395	1,636	263	180
SOMERSET ICS	141,969	3,048	2,082	336	230
SOUTH WEST LONDON HEALTH & CARE PARTNERSHIP	201,662	4,249	2,902	467	319
SOUTH YORKSHIRE AND BASSETLAW ICS	282,502	6,021	4,113	663	453
STAFFORDSHIRE AND STOKE ON TRENT ICS	238,605	5,097	3,481	560	383
SUFFOLK AND NORTH EAST ESSEX ICS	227,093	4,897	3,344	540	369
SURREY HEARTLANDS HEALTH & CARE PARTNERSHIP ICS	201,301	4,447	3,038	497	340
SUSSEX HEALTH & CARE PARTNERSHIP ICS	384,576	8,420	5,751	936	639
THE BLACK COUNTRY AND WEST BIRMINGHAM ICS	225,347	4,920	3,360	549	375
WEST YORKSHIRE & HARROGATE HLTH & CARE PARTNERSHIP	405,940	8,535	5,829	933	638

9.1b Severe AS prevalence by age group at ICS level, mid-2020[4,5,6]

Organisation	Population aged ≥65 years			Population aged ≥75 years		
	Population	Severe AS prevelance	% prevalence	Population	Severe AS prevalence	% prevalence
England	**10,464,019**	**223,555**	**2.1%**	**4,865,591**	**170,296**	**3.5%**
BATH & NORTH EAST SOMERSET,SWINDON & WILTSHIRE ICS	185,319	3,982	2.1%	87,045	3,047	3.5%
BEDFORDSHIRE, LUTON AND MILTON KEYNES ICS	151,511	3,171	2.1%	68,087	2,383	3.5%
BIRMINGHAM AND SOLIHULL ICS	178,499	3,888	2.2%	86,209	3,017	3.5%
BRISTOL,NORTH SOMERSET & SOUTH GLOUCESTERSHIRE ICS	166,686	3,639	2.2%	80,470	2,816	3.5%
BUCKINGHAMSHIRE, OXFORDSHIRE & BERKSHIRE WEST ICS	313,750	6,826	2.2%	150,673	5,274	3.5%
CAMBRIDGE AND PETERBOROUGH ICS	166,201	3,545	2.1%	77,035	2,696	3.5%
CHESHIRE AND MERSEYSIDE HEALTH & CARE PARTNERSHIP	502,510	10,658	2.1%	230,851	8,080	3.5%
CORNWALL AND THE ISLES OF SCILLY ICS	145,457	3,073	2.1%	66,019	2,311	3.5%
COVENTRY AND WARWICKSHIRE ICS	171,698	3,738	2.2%	82,505	2,888	3.5%
DEVON ICS	293,939	6,345	2.2%	138,797	4,858	3.5%
FRIMLEY HEALTH AND CARE	121,705	2,629	2.2%	57,823	2,024	3.5%
GREATER MANCHESTER HLTH & SOCIAL CARE PARTNERSHIP	459,044	9,643	2.1%	207,137	7,250	3.5%
HAMPSHIRE AND THE ISLE OF WIGHT ICS	381,042	8,276	2.2%	181,897	6,366	3.5%
HEALTHIER LANCASHIRE & SOUTH CUMBRIA	354,693	7,520	2.1%	162,306	5,681	3.5%
HEREFORD AND WORCESTERSHIRE ICS	185,897	3,983	2.1%	86,771	3,037	3.5%
HERTFORDSHIRE AND WEST ESSEX ICS	259,333	5,655	2.2%	125,143	4,380	3.5%
HUMBER COAST & VALE HEALTH & CARE PARTNERSHIP	378,534	8,040	2.1%	173,912	6,087	3.5%
JOINED UP CARE DERBYSHIRE ICS	212,694	4,525	2.1%	98,051	3,432	3.5%
KENT AND MEDWAY ICS	368,048	7,857	2.1%	170,323	5,961	3.5%

Organisation	Population aged ≥65 years			Population aged ≥75 years		
	Population	Severe AS prevelance	% prevalence	Population	Severe AS prevalence	% prevalence
LEICESTER & RUTLAND ICS	200,622	4,234	2.1%	91,383	3,198	3.5%
LINCOLNSHIRE ICS	182,278	3,876	2.1%	83,799	2,933	3.5%
MID AND SOUTH ESSEX ICS	233,986	5,009	2.1%	108,821	3,809	3.5%
NORFOLK AND WAVENEY ICS	257,855	5,609	2.2%	123,226	4,313	3.5%
NORTH CENTRAL LONDON PARTNERS IN HEALTH & CARE ICS	187,068	3,959	2.1%	86,097	3,013	3.5%
NORTH EAST AND NORTH CUMBRIA ICS	614,170	12,870	2.1%	276,042	9,661	3.5%
NORTH EAST LONDON ICS	209,887	4,359	2.1%	93,774	3,282	3.5%
NORTH WEST LONDON ICS	284,653	5,963	2.1%	128,930	4,513	3.5%
NORTHAMPTONSHIRE ICS	133,984	2,763	2.1%	58,355	2,042	3.5%
NOTTINGHAM AND NOTTINGHAMSHIRE HEALTH & CARE ICS	187,795	3,979	2.1%	86,103	3,014	3.5%
ONE GLOUCESTERSHIRE	139,420	2,986	2.1%	65,097	2,278	3.5%
OUR DORSET	198,608	4,366	2.2%	96,692	3,384	3.5%
OUR HEALTHIER SOUTH EAST LONDON ICS	215,183	4,558	2.1%	99,146	3,470	3.5%
SHROPSHIRE, TELFORD & WREKIN ICS	112,955	2,395	2.1%	51,836	1,814	3.5%
SOMERSET ICS	141,969	3,048	2.1%	66,501	2,328	3.5%
SOUTH WEST LONDON HEALTH & CARE PARTNERSHIP	201,662	4,249	2.1%	91,932	3,218	3.5%
SOUTH YORKSHIRE AND BASSETLAW ICS	282,502	6,021	2.1%	130,940	4,583	3.5%
STAFFORDSHIRE AND STOKE ON TRENT ICS	238,605	5,097	2.1%	110,718	3,875	3.5%
SUFFOLK AND NORTH EAST ESSEX ICS	227,093	4,897	2.2%	106,894	3,741	3.5%
SURREY HEARTLANDS HEALTH & CARE PARTNERSHIP ICS	201,301	4,447	2.2%	99,190	3,472	3.5%
SUSSEX HEALTH & CARE PARTNERSHIP ICS	384,576	8,420	2.2%	186,121	6,514	3.5%
THE BLACK COUNTRY AND WEST BIRMINGHAM ICS	225,347	4,920	2.2%	109,348	3,827	3.5%
WEST YORKSHIRE & HARROGATE HLTH & CARE PARTNERSHIP	405,940	8,535	2.1%	183,592	6,426	3.5%

9.1c Severe AS prevalence at ICS level, mid-2020, and projections to mid-2025 and mid-2030[4,5,6]

Organisation	Severe AS prevalence			% of population ≥65 yrs with severe AS		
	Mid-2020	Mid-2025	Mid-2030	Mid-2020	Mid-2025	Mid-2030
England	**223,555**	**254,035**	**278,096**	**2.1%**	**2.2%**	**2.2%**
BATH & NORTH EAST SOMERSET, SWINDON & WILTSHIRE ICS	3,982	4,583	5,084	2.1%	2.2%	2.2%
BEDFORDSHIRE, LUTON AND MILTON KEYNES ICS	3,171	3,696	4,125	2.1%	2.2%	2.2%
BIRMINGHAM AND SOLIHULL ICS	3,888	4,179	4,452	2.2%	2.2%	2.2%
BRISTOL, NORTH SOMERSET & SOUTH GLOUCESTERSHIRE ICS	3,639	4,021	4,294	2.2%	2.3%	2.2%
BUCKINGHAMSHIRE, OXFORDSHIRE & BERKSHIRE WEST ICS	6,826	7,822	8,582	2.2%	2.3%	2.2%
CAMBRIDGE AND PETERBOROUGH ICS	3,545	4,077	4,490	2.1%	2.2%	2.2%
CHESHIRE AND MERSEYSIDE HEALTH & CARE PARTNERSHIP	10,658	12,102	13,247	2.1%	2.2%	2.2%
CORNWALL AND THE ISLES OF SCILLY ICS	3,073	3,581	3,961	2.1%	2.2%	2.2%
COVENTRY AND WARWICKSHIRE ICS	3,738	4,200	4,525	2.2%	2.3%	2.2%
DEVON ICS	6,345	7,275	8,021	2.2%	2.3%	2.2%
FRIMLEY HEALTH AND CARE	2,629	2,984	3,270	2.2%	2.2%	2.2%
GREATER MANCHESTER HLTH & SOCIAL CARE PARTNERSHIP	9,643	10,726	11,488	2.1%	2.2%	2.1%
HAMPSHIRE AND THE ISLE OF WIGHT ICS	8,276	9,516	10,419	2.2%	2.3%	2.2%
HEALTHIER LANCASHIRE & SOUTH CUMBRIA	7,520	8,497	9,196	2.1%	2.2%	2.2%
HEREFORD AND WORCESTERSHIRE ICS	3,983	4,603	5,077	2.1%	2.3%	2.2%
HERTFORDSHIRE AND WEST ESSEX ICS	5,655	6,315	6,858	2.2%	2.2%	2.2%
HUMBER COAST & VALE HEALTH & CARE PARTNERSHIP	8,040	9,179	10,057	2.1%	2.2%	2.2%
JOINED UP CARE DERBYSHIRE ICS	4,525	5,172	5,646	2.1%	2.2%	2.2%
KENT AND MEDWAY ICS	7,857	9,005	9,814	2.1%	2.2%	2.2%

Organisation	Severe AS prevalence			% of population ≥65 yrs with severe AS		
	Mid-2020	Mid-2025	Mid-2030	Mid-2020	Mid-2025	Mid-2030
LEICESTER & RUTLAND ICS	4,234	4,901	5,448	2.1%	2.2%	2.2%
LINCOLNSHIRE ICS	3,876	4,449	4,881	2.1%	2.2%	2.2%
MID AND SOUTH ESSEX ICS	5,009	5,672	6,093	2.1%	2.3%	2.2%
NORFOLK AND WAVENEY ICS	5,609	6,406	6,972	2.2%	2.3%	2.3%
NORTH CENTRAL LONDON PARTNERS IN HEALTH & CARE ICS	3,959	4,539	5,122	2.1%	2.1%	2.1%
NORTH EAST AND NORTH CUMBRIA ICS	12,870	14,567	15,943	2.1%	2.2%	2.2%
NORTH EAST LONDON ICS	4,359	4,902	5,516	2.1%	2.1%	2.0%
NORTH WEST LONDON ICS	5,963	6,902	7,823	2.1%	2.1%	2.1%
NORTHAMPTONSHIRE ICS	2,763	3,278	3,657	2.1%	2.2%	2.2%
NOTTINGHAM AND NOTTINGHAMSHIRE HEALTH & CARE ICS	3,979	4,517	4,956	2.1%	2.2%	2.2%
ONE GLOUCESTERSHIRE	2,986	3,492	3,894	2.1%	2.2%	2.2%
OUR DORSET	4,366	4,949	5,403	2.2%	2.3%	2.3%
OUR HEALTHIER SOUTH EAST LONDON ICS	4,558	5,100	5,653	2.1%	2.1%	2.1%
SHROPSHIRE, TELFORD & WREKIN ICS	2,395	2,815	3,176	2.1%	2.2%	2.2%
SOMERSET ICS	3,048	3,574	4,003	2.1%	2.3%	2.2%
SOUTH WEST LONDON HEALTH & CARE PARTNERSHIP	4,249	4,815	5,361	2.1%	2.2%	2.1%
SOUTH YORKSHIRE AND BASSETLAW ICS	6,021	6,755	7,305	2.1%	2.2%	2.2%
STAFFORDSHIRE AND STOKE ON TRENT ICS	5,097	5,761	6,210	2.1%	2.2%	2.2%
SUFFOLK AND NORTH EAST ESSEX ICS	4,897	5,653	6,183	2.2%	2.3%	2.3%
SURREY HEARTLANDS HEALTH & CARE PARTNERSHIP ICS	4,447	4,915	5,299	2.2%	2.3%	2.3%
SUSSEX HEALTH & CARE PARTNERSHIP ICS	8,420	9,668	10,603	2.2%	2.3%	2.2%
THE BLACK COUNTRY AND WEST BIRMINGHAM ICS	4,920	5,275	5,574	2.2%	2.2%	2.2%
WEST YORKSHIRE & HARROGATE HLTH & CARE PARTNERSHIP	8,535	9,598	10,413	2.1%	2.2%	2.2%

9.2 Treatments (TAVI and SAVR procedures) at ICS level, 2016/2017 to 2020/2021[2]

Organisation	Patients						
	2016/17	2017/18	2018/19	2019/20	2020/21	5 year average	5 year total
England – All treatments	**6,990**	**7,895**	**8,765**	**8,985**	**6,895**	**7,895**	**39,470**
England – TAVI	**1,835**	**2,360**	**2,975**	**3,685**	**3,660**	**2,900**	**14,505**
England – SAVR	**5,160**	**5,530**	**5,790**	**5,305**	**3,240**	**5,000**	**24,995**
BATH & NORTH EAST SOMERSET,SWINDON & WILTSHIRE ICS	130	130	135	125	115	125	635
BEDFORDSHIRE, LUTON AND MILTON KEYNES ICS	120	115	130	120	95	115	580
BIRMINGHAM AND SOLIHULL ICS	115	120	155	165	90	130	645
BRISTOL,NORTH SOMERSET & SOUTH GLOUCESTERSHIRE ICS	100	115	110	120	110	110	550
BUCKINGHAMSHIRE, OXFORDSHIRE & BERKSHIRE WEST ICS	210	230	245	300	285	255	1,270
CAMBRIDGE AND PETERBOROUGH ICS	95	140	160	180	135	140	710
CHESHIRE AND MERSEYSIDE HEALTH & CARE PARTNERSHIP	330	410	460	440	285	385	1,920
CORNWALL AND THE ISLES OF SCILLY ICS	130	125	135	140	95	125	615
COVENTRY AND WARWICKSHIRE ICS	100	125	155	135	105	125	620
DEVON ICS	200	220	220	265	185	220	1,090
FRIMLEY HEALTH AND CARE	90	85	85	90	70	85	420
GREATER MANCHESTER HLTH & SOCIAL CARE PARTNERSHIP	370	340	410	425	345	375	1,885
HAMPSHIRE AND THE ISLE OF WIGHT ICS	220	300	280	280	225	260	1,305
HEALTHIER LANCASHIRE & SOUTH CUMBRIA	210	300	305	320	225	270	1,360
HEREFORD AND WORCESTERSHIRE ICS	85	120	155	165	100	125	625
HERTFORDSHIRE AND WEST ESSEX ICS	225	200	200	235	160	205	1,020
HUMBER COAST & VALE HEALTH & CARE PARTNERSHIP	255	230	305	285	190	255	1,265
JOINED UP CARE DERBYSHIRE ICS	125	165	155	160	130	145	735

Organisation	Patients						
	2016/17	2017/18	2018/19	2019/20	2020/21	5 year average	5 year total
KENT AND MEDWAY ICS	210	265	295	345	275	275	1,385
LEICESTER & RUTLAND ICS	105	145	155	170	115	140	690
LINCOLNSHIRE ICS	90	130	155	170	120	135	665
MID AND SOUTH ESSEX ICS	185	130	170	175	115	155	775
NORFOLK AND WAVENEY ICS	135	180	190	185	205	180	900
NORTH CENTRAL LONDON PARTNERS IN HEALTH & CARE ICS	170	185	160	155	100	155	775
NORTH EAST AND NORTH CUMBRIA ICS	515	490	590	550	460	520	2,595
NORTH EAST LONDON ICS	175	185	175	135	100	155	765
NORTH WEST LONDON ICS	190	240	275	275	220	240	1,195
NORTHAMPTONSHIRE ICS	75	100	125	125	110	105	535
NOTTINGHAM AND NOTTINGHAMSHIRE HEALTH & CARE ICS	55	135	165	155	115	125	625
ONE GLOUCESTERSHIRE	105	85	105	105	105	100	495
OUR DORSET	140	160	160	160	115	145	740
OUR HEALTHIER SOUTH EAST LONDON ICS	120	150	160	160	170	150	755
SHROPSHIRE, TELFORD & WREKIN ICS	70	85	145	115	75	100	490
SOMERSET ICS	95	90	130	115	70	100	500
SOUTH WEST LONDON HEALTH & CARE PARTNERSHIP	115	170	155	155	155	150	755
SOUTH YORKSHIRE AND BASSETLAW ICS	185	235	225	230	135	200	1,005
STAFFORDSHIRE AND STOKE ON TRENT ICS	130	150	190	250	150	175	875
SUFFOLK AND NORTH EAST ESSEX ICS	165	175	215	210	170	185	930
SURREY HEARTLANDS HEALTH & CARE PARTNERSHIP ICS	140	155	180	190	150	160	810
SUSSEX HEALTH & CARE PARTNERSHIP ICS	270	340	360	375	275	325	1,620
THE BLACK COUNTRY AND WEST BIRMINGHAM ICS	150	180	185	180	115	160	810
WEST YORKSHIRE & HARROGATE HLTH & CARE PARTNERSHIP	295	265	295	345	315	300	1,515

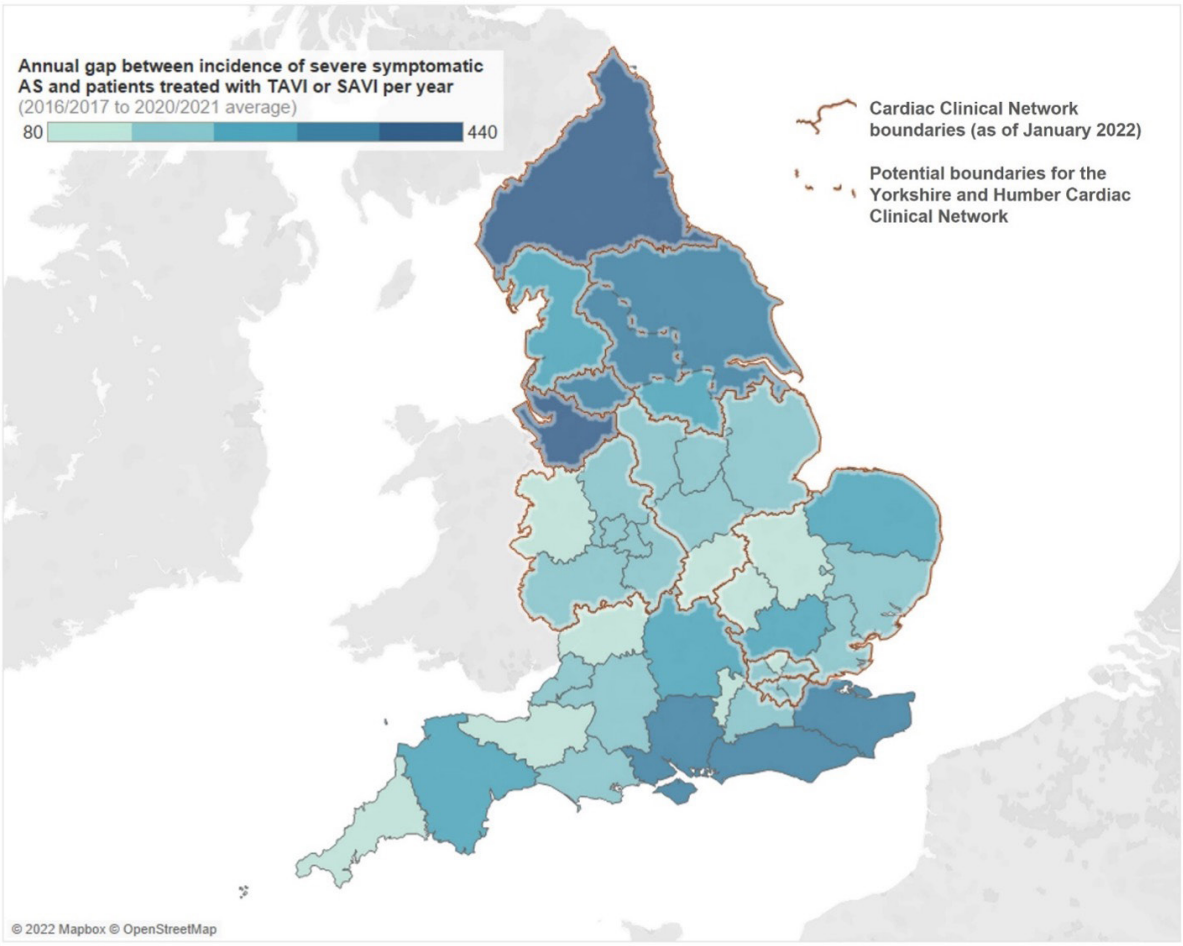
9.3a Gap between incidence and treatment at ICS level, mid-2020[2,4,5,6]

Organisation	Patients			Treatment			Gap between incidence and treatment		
	Population aged ≥65 years	Severe AS incidence	Symptomatic severe AS incidence	Average patients treated with TAVI per year	Average patients treated with SAVR per year	Average patients treated with TAVI or SAVR per year	Number of patients annually	Number of patients over 5 years	%
England	**10,464,019**	**24,621**	**16,816**	**2,900**	**5,000**	**7,895**	**8,921**	**44,606**	**53.1%**
BATH & NORTH EAST SOMERSET, SWINDON & WILTSHIRE ICS	185,319	440	300	40	85	125	175	877	58.4%
BEDFORDSHIRE, LUTON AND MILTON KEYNES ICS	151,511	347	237	40	75	115	122	609	51.4%
BIRMINGHAM AND SOLIHULL ICS	178,499	433	296	65	65	130	166	830	56.1%
BRISTOL, NORTH SOMERSET & SOUTH GLOUCESTERSHIRE ICS	166,686	405	276	35	75	110	166	832	60.2%
BUCKINGHAMSHIRE, OXFORDSHIRE & BERKSHIRE WEST ICS	313,750	758	518	110	145	255	263	1,315	50.8%
CAMBRIDGE AND PETERBOROUGH ICS	166,201	390	266	45	95	140	126	632	47.4%
CHESHIRE AND MERSEYSIDE HEALTH & CARE PARTNERSHIP	502,510	1,171	800	125	260	385	415	2,073	51.8%
CORNWALL AND THE ISLES OF SCILLY ICS	145,457	335	229	25	95	125	104	521	45.4%
COVENTRY AND WARWICKSHIRE ICS	171,698	415	284	45	80	125	159	793	55.9%
DEVON ICS	293,939	701	478	55	160	220	258	1,292	54.0%
FRIMLEY HEALTH AND CARE	121,705	292	199	30	55	85	114	571	57.3%
GREATER MANCHESTER HLTH & SOCIAL CARE PARTNERSHIP	459,044	1,054	720	135	240	375	345	1,723	47.9%
HAMPSHIRE AND THE ISLE OF WIGHT ICS	381,042	916	626	60	200	260	366	1,829	58.5%
HEALTHIER LANCASHIRE & SOUTH CUMBRIA	354,693	824	562	80	195	270	292	1,462	52.0%
HEREFORD AND WORCESTERSHIRE ICS	185,897	439	300	60	65	125	175	873	58.3%
HERTFORDSHIRE AND WEST ESSEX ICS	259,333	629	430	90	110	205	225	1,124	52.3%
HUMBER COAST & VALE HEALTH & CARE PARTNERSHIP	378,534	882	602	70	180	255	347	1,736	57.7%
JOINED UP CARE DERBYSHIRE ICS	212,694	497	339	40	110	145	194	972	57.3%
KENT AND MEDWAY ICS	368,048	863	589	115	165	275	314	1,571	53.3%
LEICESTER & RUTLAND ICS	200,622	464	317	50	90	140	177	885	55.8%
LINCOLNSHIRE ICS	182,278	425	290	30	100	135	155	776	53.5%

Organisation	Patients			Treatment			Gap between incidence and treatment		
	Population aged ≥65 years	Severe AS incidence	Symptomatic severe AS incidence	Average patients treated with TAVI per year	Average patients treated with SAVR per year	Average patients treated with TAVI or SAVR per year	Number of patients annually	Number of patients over 5 years	%
MID AND SOUTH ESSEX ICS	233,986	551	376	55	100	155	221	1,105	58.8%
NORFOLK AND WAVENEY ICS	257,855	621	424	50	125	180	244	1,220	57.5%
NORTH CENTRAL LONDON PARTNERS IN HEALTH & CARE ICS	187,068	436	298	85	70	155	143	715	48.0%
NORTH EAST AND NORTH CUMBRIA ICS	614,170	1,405	960	175	340	520	440	2,198	45.8%
NORTH EAST LONDON ICS	209,887	478	326	75	80	155	171	857	52.5%
NORTH WEST LONDON ICS	284,653	655	448	130	110	240	208	1,038	46.4%
NORTHAMPTONSHIRE ICS	133,984	299	204	40	70	105	99	495	48.5%
NOTTINGHAM AND NOTTINGHAMSHIRE HEALTH & CARE ICS	187,795	437	298	50	75	125	173	867	58.1%
ONE GLOUCESTERSHIRE	139,420	329	225	45	55	100	125	624	55.5%
OUR DORSET	198,608	486	332	20	125	145	187	933	56.3%
OUR HEALTHIER SOUTH EAST LONDON ICS	215,183	502	343	70	80	150	193	966	56.3%
SHROPSHIRE, TELFORD & WREKIN ICS	112,955	263	180	40	55	100	80	398	44.3%
SOMERSET ICS	141,969	336	230	20	80	100	130	648	56.4%
SOUTH WEST LONDON HEALTH & CARE PARTNERSHIP	201,662	467	319	70	80	150	169	844	53.0%
SOUTH YORKSHIRE AND BASSETLAW ICS	282,502	663	453	40	165	200	253	1,264	55.8%
STAFFORDSHIRE AND STOKE ON TRENT ICS	238,605	560	383	80	95	175	208	1,039	54.3%
SUFFOLK AND NORTH EAST ESSEX ICS	227,093	540	369	65	120	185	184	918	49.8%
SURREY HEARTLANDS HEALTH & CARE PARTNERSHIP ICS	201,301	497	340	75	85	160	180	898	52.9%
SUSSEX HEALTH & CARE PARTNERSHIP ICS	384,576	936	639	140	185	325	314	1,570	49.1%
THE BLACK COUNTRY AND WEST BIRMINGHAM ICS	225,347	549	375	75	85	160	215	1,076	57.4%
WEST YORKSHIRE & HARROGATE HLTH & CARE PARTNERSHIP	405,940	933	638	135	165	300	338	1,688	52.9%

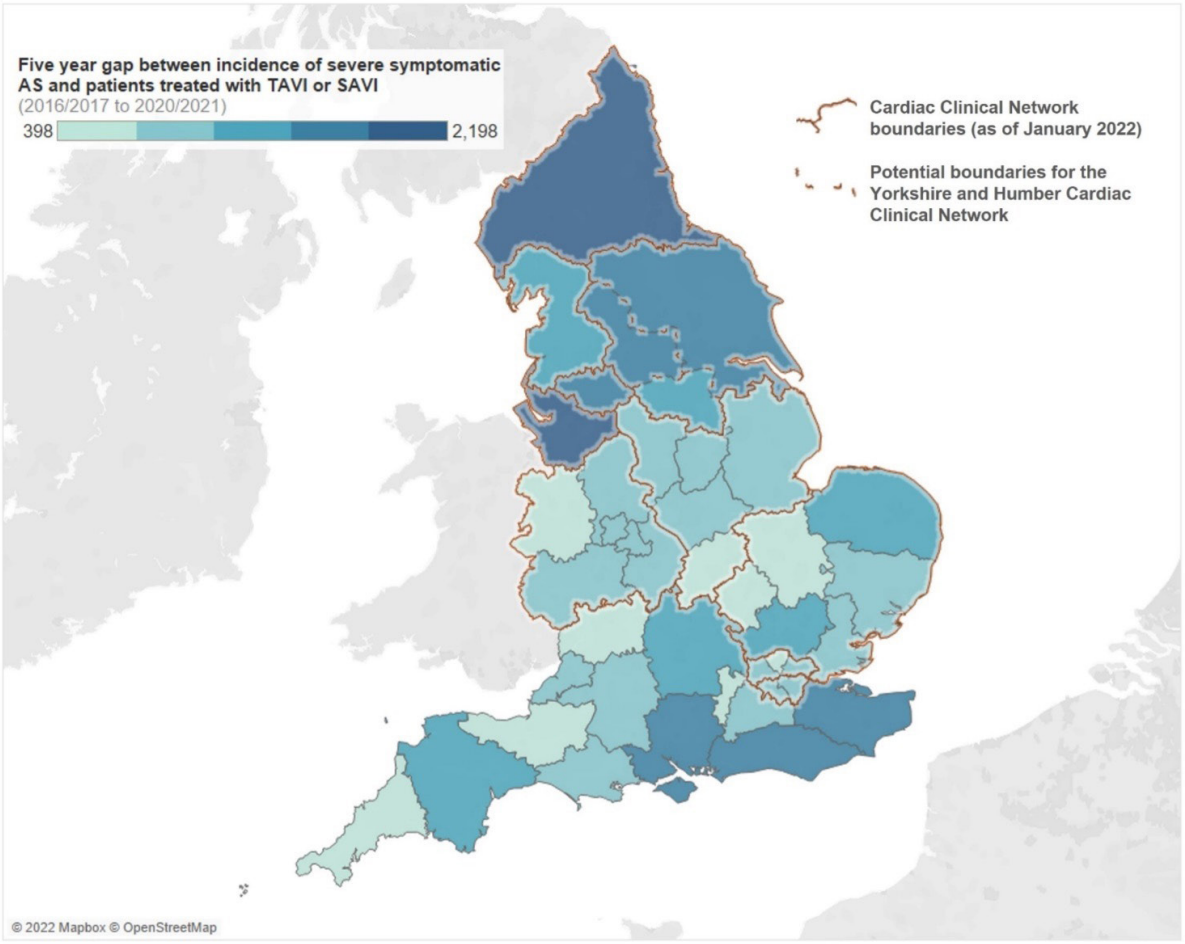
9.3b Yearly gap between incidence and treatment at ICS level, mid-2020[2]

(Shows the known Cardiac Clinical Network boundaries, although not all are confirmed at the time of publication.)



9.3c Five year gap between incidence and treatment at ICS level, mid-2020[2]

(Shows the known Cardiac Clinical Network boundaries, although not all are confirmed at the time of publication.)



10 Methodology for data analysis

Note on suppression and rounding

- Patient and spell numbers above 7 have been rounded to the nearest 5.
- Patient and spell numbers between 1 and 7 (inclusive) have been suppressed and are represented by *.

Severe AS prevalence and incidence, mid-2020

Sources: Strange et al (2021)[6]; ONS Mid-Year Population Estimates for CCGs[4]; and ONS 2018-based Subnational Population Projections[5].

Estimates of the prevalence and incidence of severe AS within the population aged ≥65 years have been calculated by applying age-specific estimates of severe aortic stenosis (AS) from the report by Strange et al (2021)[6] to the ONS Mid-Year population estimates[4].

As well as overall prevalence and incidence, prevalence is shown by broad age group (within the population aged ≥65 years and the population aged ≥75 years).

Estimates of severe AS prevalence are also provided for the following time periods:

- Mid-2015 to mid-2019 using age-specific estimates of severe AS from Strange et al (2021)[6] and ONS Mid-Year Population Estimates for CCGs[4].
- Mid-2025 and mid-2030 (i.e. projected prevalence) using age-specific estimates of severe AS from Strange et al (2021)[6] and ONS 2018-based Subnational Population Projections[5].

TAVI and SAVR procedures, 2016/2017 to 2020/2021

Source: Hospital Episode Statistics[2].

A count of the number of patients and spells where a TAVI or SAVR procedure has taken place between 2016/2017 and 2020/2021. A TAVI procedure has been identified wherever there is the following TAVI procedure (OPCS code) and at least one TAVI approach (OPCS) code as detailed below:

- TAVI procedure code - K262: Xenograft Replacement of Aortic Valve.
- TAVI approach codes - Y79: Approach to Organ Through Artery; Y494: Transapical Approach to Heart.

A SAVR procedure has been identified wherever there is a SAVR procedure (OPCS) code alongside a SAVR approach (OPCS) code:

- SAVR procedure code - K26: Plastic Repair of Aortic Valve.
- SAVR approach code - Y731: Cardiopulmonary Bypass.

Where a spell could be classed as either TAVI or SAVR it has been assigned as TAVI only.

The data has been restricted to only patients who have been diagnosed with AS in either a previous inpatient spell or in the current spell using the ICD-10 codes listed:

- I350: Aortic (valve) stenosis.
- I352: Aortic (valve) stenosis with insufficiency.

Gap between incidence and treatment, mid-2020

Sources: Strange et al (2021)[6]; ONS Mid-Year Population Estimates for CCGs[4]; and Hospital Episode Statistics[2].

The gap is the difference between the estimated incidence of patients with severe symptomatic AS in mid-2020 and the average number of patients treated annually with TAVI or SAVR based on admissions data from the last 5 years (2016/2017 to 2020/2021). The gap is presented as an absolute number and as a percentage.

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