

Increasing detection of heart valve disease in Farnborough PCN using auscultation AI in the community pharmacy setting

The Border GP Practice Community Echo Clinic, Chapel Pharmacy, eMurmur®, Edwards Lifesciences and Wilmington Healthcare collaborative working service evaluation report.

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Acknowledgements



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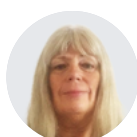
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Foreword



Heart valve disease (HVD) is common, treatable, but generally poorly recognised, as is its severity. For instance, untreated severe aortic stenosis carries a worse prognosis than most cancers. Its prevalence increases with age and its associated symptoms, such as reduced exercise tolerance and breathlessness, are often attributed to advancing years. The NHS Long Term Plan (2019) highlighted the need for earlier diagnosis of HVD, which in turn has raised the challenge of increasing awareness of the condition and ensuring earlier detection. Historically, initial detection has rested on clinical suspicion, followed by cardiac auscultation by a general practitioner, but over recent years, shorter appointment times and the shift towards telephone and virtual consultation have made detection even more challenging.



In this context it is most welcome to see new ways suggested for addressing this challenge; using new technology (artificial intelligence) and extending the role of an existing workforce. This service evaluation investigated the role of community pharmacists in prompting discussions about HVD with selected customers, and then identifying those with a heart murmur using the digital eMurmur® stethoscope, and artificial intelligence (AI) software to interpret the sounds recorded. Digital data could also be shared quickly with other healthcare professionals ensuring the most appropriate onwards referrals for echocardiography.

This pilot service evaluation gives us important insight. Community pharmacists can play an important role in detection of HVD, detecting more people with the condition than services which rely on general practice alone, and new technology can improve the quality of onward referrals to specialist clinics. Importantly, the community pharmacy service was well received by patients.

Population studies have shown that an increasingly aged population will result in ever more people living with significant heart valve disease, and the challenge of detecting them will only increase. The potential use of AI in widening the workforce capable of detecting these conditions, and the environments in which this can be undertaken, is exciting and potentially could result in a significant change in our approach to implementing the objectives of the NHS Long Term Plan for HVD. The authors of this pilot service evaluation should be congratulated on demonstrating the potential of an innovative approach to longstanding workforce and technology challenges, and argues for an assessment of a wider implementation, perhaps by one of England's Cardiac Clinical Networks.

17.03.23

A handwritten signature in black ink that reads "Huon Gray".

Professor Huon Gray CBE

**Consultant Cardiologist Emeritus and previously
National Clinical Director for Heart Disease, NHS England (2013-19)**

1. Service evaluation summary

Background

Cardiovascular disease (CVD) is responsible for a quarter of all deaths in the UK, making it a top priority within the NHS. If diagnosed early, HVD can be treated effectively with heart valve replacement or repair before a patient's condition deteriorates. However, up to 46% of people with severe symptomatic aortic stenosis (AS), up to 41% of patients with moderate to severe mitral valve regurgitation (MVR) and up to 81% of patients with moderate or greater tricuspid valve regurgitation (TVR) are estimated to be undiagnosed or untreated each year in England.

Heart valve disease is often detected in primary care by identification of a heart murmur through cardiac auscultation by a general practitioner (GP). Patients are then referred to community-based providers or secondary care to confirm the diagnosis and its severity with echocardiography. In recent years, particularly during the COVID-19 pandemic, community pharmacy has taken on additional roles, with the support of the NHS and acceptance of patients. With 11,200 community pharmacies in England and 89% of the population in England within a 20-minute walk of at least one, community pharmacists using technology such as digital stethoscopes have the potential to increase identification of HVD.

Service evaluation design

We undertook a service evaluation to determine whether community pharmacists can be effective in identifying undiagnosed patients with HVD using the eMurmur® digital stethoscope.

The objectives were to:

1. determine whether digital auscultation with eMurmur® heart artificial intelligence (AI) can be used by a community pharmacist to identify patients with undiagnosed HVD
2. determine whether the public will accept a digital auscultation service in the community pharmacy setting
3. compare the quality of referrals from the community pharmacy detection service to those from alternative referral routes to the GPwER in cardiology's community-based echocardiography service.

Methods The community pharmacist engaged patients at the pharmacy who were aged >75 years, or had type 2 diabetes, angina/myocardial infarction, atrial fibrillation or high blood pressure. Patients with known HVD or who had an echocardiogram in the past 10 years were excluded.

- A leaflet added to the prescription bag of eligible patients prompted discussion of HVD.
- The patient underwent auscultation at the pharmacy using the digital stethoscope.
- Patients in whom a systolic murmur was identified were referred to a community clinic for full compensation echocardiography.
- Echocardiography findings and next steps were explained to the patient, and an echocardiography report, including recommendations, was sent to the patient's GP.
- Patients referred to the community echocardiography clinic by GP practices were used as a control group.

Results

- The community pharmacist detected a murmur in 39 (45%) of 86 patients and referred them to the community echocardiography clinic. Mean age was 77.8 years. Eight (21%) patients were classed as having moderate or severe HVD, 9 (23%) with mild HVD and 22 (56%) as 'normal' or with 'trivial' HVD upon review of their echocardiography results.
- The community echocardiography service also received 24 referrals from GP practices during the evaluation period. Mean age was 65 years. Two (8%) patients were classed as having moderate or severe HVD, 8 (33%) with mild HVD and 14 (58%) as 'normal' or having 'trivial' HVD.
- Over the analysis period, the pharmacy referred 70% more patients diagnosed with non-trivial HVD than GP practices (17 patients vs 10 patients).

Discussion

- Our service evaluation shows that community pharmacists can play an important role in the detection of HVD.
- Technology can improve the quality of referrals to echocardiography clinics, as the community pharmacist using a digital stethoscope to detect HVD referred 70% more patients with non-trivial HVD than GP practices during the evaluation period.
- Patients accepted and were comfortable with attending a service that checks for murmurs to investigate the presence of HVD by a community pharmacist in the pharmacy setting.
- Technology can support rapid, potentially lifesaving decision-making among HCPs, as rapid sharing of data was not only convenient to patients and the involved HCPs but was also crucial in identifying patients with critical severe AS requiring immediate treatment.

Proactive community detection in a pharmacy setting has great potential to increase detection of diseases such as HVD. Such a service may help reduce the estimated 46% gap of patients with undiagnosed and untreated severe symptomatic AS, as well as other forms of severe HVD in England. The service will inevitably improve outcomes for patients with HVD and save the NHS money and resources through proactive detection and timely treatment.

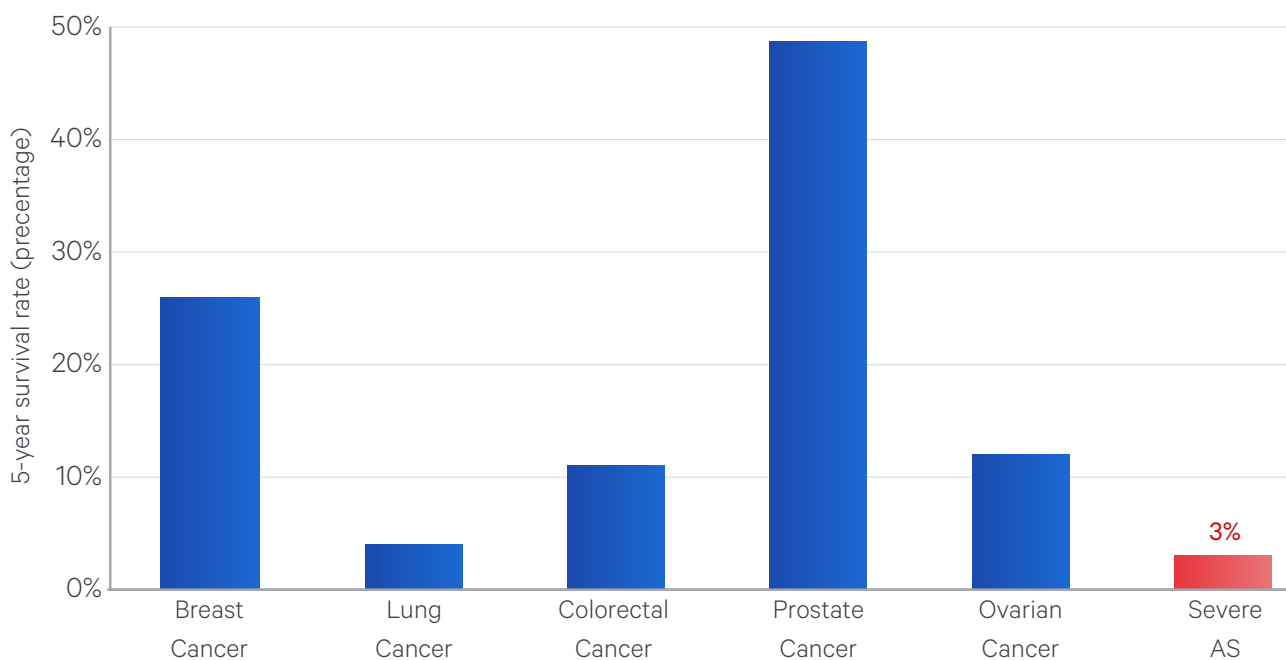
2. Introduction

2.1 Heart valve disease

Cardiovascular disease (CVD) is widely preventable, and many treatments exist. Yet, there are still barriers to patients accessing care, and CVD is responsible for a quarter of all deaths in the UK,¹ making it a top priority within the NHS. Since April 2021, there have been 10% more deaths than expected among those aged 50–65 years, most of which cannot be credited to COVID-19, and the Chair-Elect of the Royal Society for Public Health stated that those attributed to CVD likely would have been avoided with appropriate care.²

If diagnosed early, heart valve disease (HVD) can be treated effectively with heart valve replacement or repair before a patient’s condition deteriorates. Unfortunately, HVD is notoriously underdiagnosed due to the elusive nature of its symptoms, which can go unnoticed for years by patients and clinicians. If patients are not diagnosed early, once they finally present, it is often too late for them to receive optimal treatment. Inadequate detection and no or late treatment can be devastating for patients. Five-year survival rates for some forms of severe HVD are lower than the most common metastatic cancers in the UK (Figure 1),³ and about 50% of people with severe aortic stenosis (AS) who do not receive effective or appropriate treatment do not survive two years.⁴ Late treatment may also expose such patients to higher risk of poor outcomes post-procedure.⁴

Figure 1. Comparison of 5-year survival rates for untreated severe aortic stenosis (AS) and the most common metastatic cancers in the United Kingdom.³



The disparity between patients with a diagnosis of HVD and people whose HVD is undetected can only be exacerbated by NHS system pressures, particularly in primary care, which may lead to increased risk of premature death and more non-elective admissions. As the population ages, current issues will only intensify as more people develop HVD. The NHS must act now to improve detection of HVD and access to treatment in the UK.

2.2 Scale of the problem

Although HVD is a serious condition, it is treatable if detected early. The true prevalence of HVD in England is unknown, as many patients are undiagnosed; however, nearly 1.5 million people in the UK aged ≥ 65 are estimated to have moderate to severe HVD, and this number is expected to rise to 2.7 million by 2040.⁵

We can use population data⁶ and reliable models^{7,8} together with Hospital Episode Statistics (HES)⁹ to estimate the annual incidence of various forms of HVD. [Appendix A](#) describes the full HES methods used and [Section 6](#) provides details of the HES disclaimer and digital licence.

Severe symptomatic aortic stenosis (AS), which requires surgical intervention, is estimated to affect 2.1% of people aged ≥ 65 years.⁷ Using HES data,⁹ population data,⁶ and the prevalence model,⁷ it is estimated that up to 46% of patients with severe symptomatic AS either do not have a diagnosis for their condition or do not receive treatment with transcatheter aortic valve implantation (TAVI) or surgical aortic valve replacement (sAVR) in England each year ([Table 1](#)). Using the same method, 41% of patients with moderate to severe MVR in England are estimated to be undetected or untreated each year.^{6,8,9} In addition, up to 81% of patients with moderate or greater TVR are estimated to be undiagnosed or untreated each year.^{6,8,9}

Table 1. Estimated annual incidence, annual average of patients treated (HES), and estimated percentage treatment gap for three forms of HVD in England.⁶⁻⁹

Estimated incidence of severe symptomatic AS (annual average)	Patients with AS treated with TAVI or sAVR (annual average)	Estimated severe symptomatic AS incidence gap (annual average)	Percentage severe symptomatic AS incidence gap (annual average)
16,291 people per year	8,805 people per year	7,486 people per year	46%
Estimated incidence of moderate or greater MVR (annual average)	Patients with MVR treated with mitral valve repair or replacement (annual average)	Estimated moderate or greater MVR incidence gap (annual average)	Percentage annual average moderate or greater MVR incidence gap
5,656 people per year	3,310 people per year	2,346 people per year	41%
Estimated incidence of moderate or greater TVR (annual average)	Patients with TVR treated with tricuspid valve repair or replacement (annual average)	Estimated moderate or greater TVR incidence gap (annual average)	Percentage moderate or greater TVR incidence gap (annual average)
4,202 people per year	795 people per year	3,407 people per year	81%

2.3 HVD within the NHS

The NHS is experiencing system pressures nationally, with some regional variation,² and this has impacted on detection and management of HVD within the NHS. Many issues along the HVD care pathway need to be addressed.

Although the first point of contact for patients with HVD should be assessment in primary care, great pressure on primary care means that many patients with HVD are undetected and could therefore present late with very severe disease that requires an urgent non-elective admission, which could lead to worse patient outcomes or, if untreated, early death. Compared to pre-pandemic levels, GPs see fewer patients face-to-face, limiting opportunities for cardiac auscultation.¹⁰ Furthermore, waiting times to see GPs fall short of their targets in many areas,¹¹ and efforts made by the NHS to improve primary care access prove unfavourable to some GPs, who claim they still do not have the resources required to run their service.¹² In November 2022, the Health and Social Care Secretary promised to improve access to primary care – pledging 2-week waits for non-urgent appointments and same-day appointments for urgent cases.¹³ As part of this plan, the government aims to increase primary care staff and incentivise those already practising to stay.¹³

In addition to system pressures, there are other barriers to HVD detection. Low levels of awareness of HVD among the population, patients and community clinicians may lead to incorrect or delayed diagnosis and delay in referral to secondary care for echocardiography.¹⁴ Heart murmurs are a critical sign of HVD, yet they are often missed in breathless patients in whom problems can often be attributed to other conditions – for example, chronic respiratory disease or heart failure.¹⁵ Furthermore, symptoms of heart valve disease are often attributed to normal signs of ageing or are unnoticeable to those experiencing them, which can be due to the presence of other mobility limiting comorbidities such as arthritis.¹⁵

When HVD is detected by a GP, waiting times for echocardiography can be lengthy and are only increasing.¹⁶ The British Heart Foundation (BHF) reported that 37% of patients in 2021 waited more than six weeks to receive an echocardiogram – up from only 4% of patients in 2020¹⁶ – and that this was likely due to a shortage of echocardiographers. Indeed, the British Society of Echocardiography (BSE) published a report in February 2022 stating that 53% of echocardiography services surveyed had advertised posts but failed to appoint anyone to the role.¹⁷ When a patient does receive an echocardiogram, complicated imaging reports may be difficult for GPs to interpret and can lead to incorrect or delayed referral.¹⁴

Clear community detection pathways for HVD that include diagnosis and referral into specialised services need to be commissioned by every ICB to establish fully integrated pathways for HVD. An example of a community detection pathway is Wilmington Healthcare's *Heart valve disease: community pathway*,¹⁸ which is endorsed by the British Heart Valve Society, Primary Care Cardiovascular Society, Society for Cardiothoracic Surgery in Great Britain and Ireland (SCTS), Heart Valve Voice, National Pharmacy Association and the BSE.



2.4 Supporting ICBs with NHS Long Term Plan priorities for CVD

One of the LTP's commitments for 2020–30 is to reduce 150,000 premature deaths from heart disease and dementia.¹⁹ The LTP sets out actions to achieve this commitment, including providing greater access to echocardiography in primary care to improve early detection of HVD. Furthermore, for the first time in a health policy document, the LTP calls for earlier diagnosis of HVD and prioritisation of referral into specialist care, with a strong recommendation to check for heart murmurs.¹⁹ Increasing diagnosis of HVD will require primary care to detect more cases of HVD and to have a clear referral pathway for echocardiography,¹⁹ and the value of GPs with Extended Roles (GPwER) should not be overlooked. GPwER in cardiology can perform echocardiography at their practice, removing steps in the HVD patient pathway and bringing patients closer to referral to specialist care.

The 11,200 community pharmacies in England sit at the centre of many communities, with 89% of the population in England within a 20-minute walk of at least one pharmacy.^{20,21} Community pharmacists thus have the opportunity to engage with patients more frequently than HCPs in other clinical environments and can reach and advise patients from healthcare and preventative perspectives.²² Pharmacy users report positive experiences with community pharmacies, with 87% feeling that they were both treated with respect on their last visit and able to get what they needed, and 91% feeling that they received good advice when they used a pharmacy in the past year for advice about medicines, a health problem or injury, or what health service they should use.²² To increase detection of HVD, the LTP therefore also calls for community pharmacists, as well as nurses in GP practices, to be given more opportunities to identify people with high-risk conditions such as HVD, which could also relieve pressure on GPs.^{19,23} Accordingly, community pharmacy has in recent years developed new services, having a particularly important role during the COVID-19 pandemic when they undertook prevention and infection control (including vaccination), ensured adequate medical supplies, and provided patient care.^{22,24} The public is comfortable with community pharmacies offering these new services.^{22,23}

The All-Party Pharmacy Group (APPG)²⁵ has also called on the UK Government and NHS to embrace pharmacy as a solution to implementing NHS priorities and clearing backlogs of patients waiting for appointments. However, there is a need for future commissioning and funding to empower pharmacies to extend their services beyond dispensing, allowing them to offer more innovative services.²⁵ As the public migrate towards the pharmacy setting for care, commissioning and funding of services must follow. Furthermore, community pharmacy should be at the centre of decision-making and should have more influence at the ICB level. Community pharmacies, and other primary care professions, should therefore be consulted during ICB planning.

Clarifying the role of community pharmacy in patient care pathways would allow pharmacy to play a greater role in primary care and the wider NHS.²⁵ This would not only increase the opportunity for community pharmacists to detect HVD in their communities but also support initiatives aimed at reducing health inequalities by providing services within deprived communities.

2.5 The role of digital technology

In 2018, the Secretary of State for Health published a policy paper on the future of healthcare and the Department of Health & Social Care's vision for digital, data and technology in health and social care.²⁶ This included the use of cutting-edge technologies to support preventative, predictive and personalised care – for example, using data-driven technologies to help diagnose diseases and conditions. Digitisation will save health and social care providers money and free up staff time, which in turn can be used to provide better care.

The COVID-19 pandemic was a catalyst for rapid adoption of technology in health systems.²⁶ HCPs and patients alike had to adapt quickly to adhere to public health policy, which resulted in an increase in virtual appointments and other remote health services in the NHS.²⁷ Three years on, the UK public seems to have accepted digital technology in medicine.

The LTP underpins the importance of technology in the future NHS, setting out the critical priorities that will support digital transformation and provide a step change in the way the NHS cares for its patients.^{19,28} Digital technology is a key theme in Getting it Right First Time (GIRFT)'s Cardiology GIRFT programme national specialty report, which provides direction on what needs to change to achieve the LTP ambition to save 150,000 lives over the next eight years.²⁹ This report recommends that:²⁹

- 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.
- Cardiology should be at the forefront of the digital transformation needed to improve the quality of services, with key areas for development including:
 - 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
 - using artificial intelligence (AI) to identify patterns that may not be apparent to clinicians.

The rapid adoption of digital technologies in combination with public acceptance offer a unique opportunity for the NHS to arm community pharmacists with digital technology so they can meet the NHS LTP's objectives around HVD.^{19,30} For example, smart stethoscopes and AI software – handheld tools that analyse heart sounds digitally to assist with auscultation and identify significant murmurs – could help to support HVD detection.³⁰

If it wasn't the case before, COVID-19 has shown us that having the right digital and data tools at the NHS' disposal can be as important as having the right medicines in our formularies.

Timothy Ferris, National Director of Transformation, 29 June 2022³¹

3. Community HVD detection pathway service evaluation

3.1 Development of a community HVD detection pathway

In 2020, an expert group of clinical advisors ([Appendix B](#)) began developing an integrated care pathway for HVD to improve community detection ([Figure 2](#)). The group was set up to produce a template for community management of HVD to help local areas identify patients sooner, with clear advice on what should be done, over what timescale, and to whom patients should be referred for specialist care.

The pathway was developed through an iterative consensus process involving experts in this specialist field. The panel comprised 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.

The pathway was published in 2022 to support primary care to ensure appropriate referral of patients with HVD to specialist care.¹⁸ It aimed to:

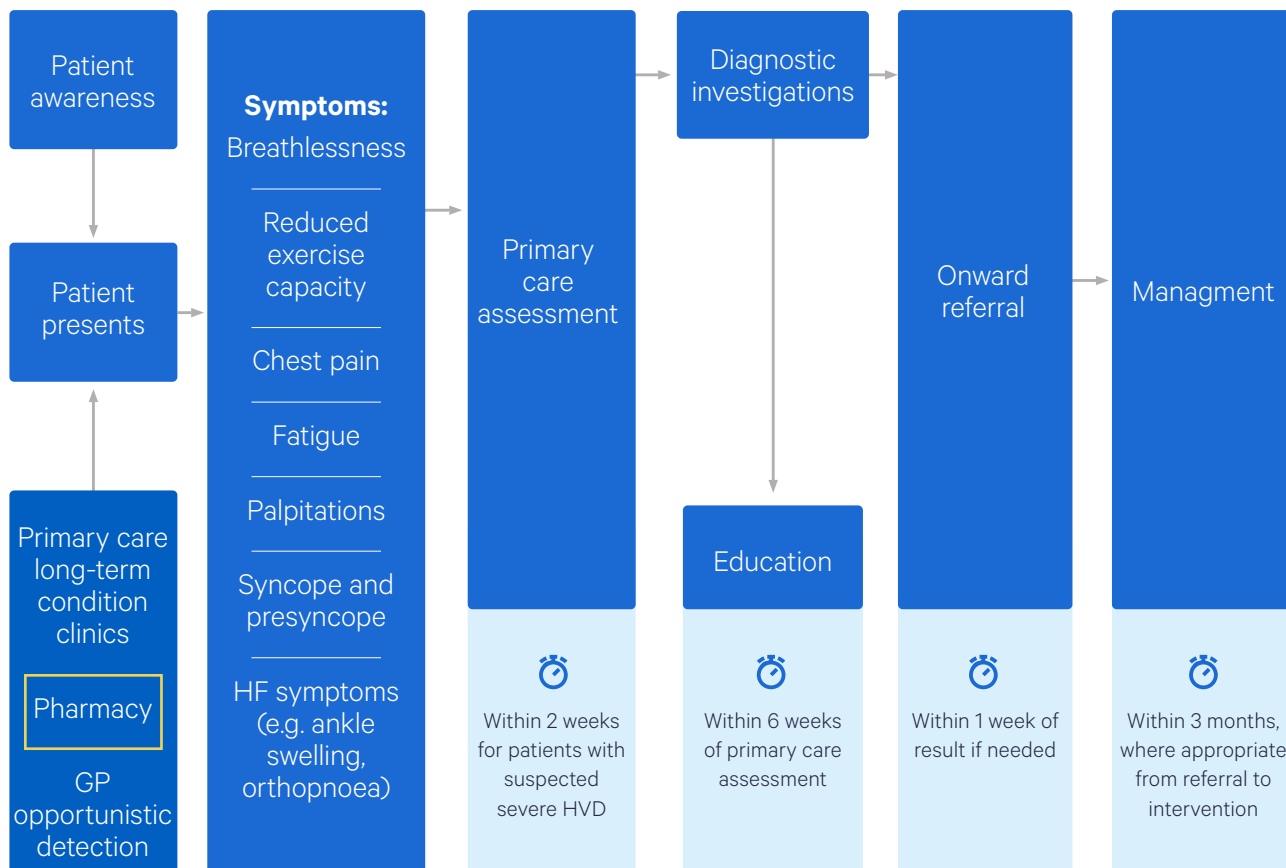
- improve early detection rates of HVD
- initiate timely referral and treatment for people with HVD
- identify those needing urgent referral within two weeks
- ensure equity of access to specialist assessment, diagnosis and treatment
- reduce morbidity and mortality due to HVD, including reducing hospitalisations
- give patients access to education about their condition.

A key part of the pathway is the establishment of ideal timelines for each stage:

- 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.

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

Figure 2. An overview of the HVD pathway developed by an expert group and published by Wilmington Healthcare. The pathway¹⁸ was endorsed by The British Heart Valve Society, Primary Care Cardiovascular Society, Society for Cardiothoracic Surgery in Great Britain and Ireland (SCTS), Heart Valve Voice, National Pharmacy Association, and the British Society of Echocardiography.



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 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 stakeholders (including the patient) are proactively alerted to when a patient should be recalled for monitoring, including echocardiography.

3.2 Service evaluation aims and objectives

Once the pathway was developed, we undertook a service evaluation in partnership with eMurmur[®] technology (Box 1), a community pharmacist and a GPwER in cardiology, who worked together to detect HVD within Farnborough Primary Care Network (PCN), which is part of Frimley Health and Care ICB catchment area.

Similar to the national-level gap analysis used in the introduction, we used HES data,⁹ ONS population data,⁶ and reliable models^{7,8} to estimate the percentage incidence gap of three different forms of HVD in the Frimley ICB catchment area (Table 2). It is estimated that up to 53% of patients with severe symptomatic AS in Frimley ICB are left undiagnosed and untreated.

Table 2. Estimated annual incidence, annual average of patients treated (HES), and estimated percent treatment gap for three forms of HVD in NHS Frimley Integrated Care Board (ICB).⁶⁻⁹

Incidence of severe symptomatic AS (annual average)	Patients with AS treated with TAVI or sAVR (annual average)	Estimated AS incidence gap (annual average)	Percentage AS incidence gap (annual average)
192 people per year	90 people per year	102 people per year	53%
Incidence of moderate or greater MVR	Patients with MVR treated with mitral valve repair or replacement (annual average)	Estimated moderate or greater MVR incidence gap (annual average)	Percentage annual average moderate or greater MVR incidence gap
73 people per year	45 people per year	28 people per year	38%
Incidence of moderate or greater TVR (annual average)	Patients with TVR treated with tricuspid valve repair or replacement (annual average)	Estimated TVR moderate or greater incidence gap (annual average)	Percentage TVR moderate or greater incidence gap (annual average)
54 people per year	10 people per year	44 people per year	81%

The hypothesis of this service evaluation was that community pharmacists can effectively identify patients with potential HVD using digital auscultation with eMurmur® Heart AI technology.

This service evaluation aimed to determine whether the community pharmacy setting can be an effective way of identifying undiagnosed patients with HVD using digital auscultation with AI technology. The main aim of this service evaluation was therefore to test the pharmacy entry point from the pathway ([Figure 2](#)).

The objectives were to:

1. determine whether digital auscultation with eMurmur® Heart AI can be used by a community pharmacist to identify patients with undiagnosed HVD
2. determine whether the public will accept a digital auscultation service in the community pharmacy setting
3. compare the quality of referrals from the community pharmacy detection service to those from alternative referral routes to the GPwER in cardiology's community-based echocardiography service.

eMurmur®

Box 1. eMurmur®

eMurmur® is a software company that offers a complete solution supporting digital auscultation. The eMurmur® auscultation software works with multiple digital stethoscope models and has a user-friendly interface with multiple useful features for playback and analysis of auscultation sounds. It runs on mobile phones (iOS and Android) and desktop computers and can be used during in-person and remote visits to record auscultation sounds, as well as save them for future reference. Primary care providers can send recordings to specialists through the software for electronic consultation based on concerns about abnormal auscultatory findings. Summary PDF reports from auscultation sessions include permalinks for immediate playback of the sounds, with sophisticated filters and volume adjustments built into the player. These PDF reports, which include algorithm-suggested diagnoses and structured reporting of provider findings, can be uploaded into electronic health records for additional optional documentation.

The auscultation software is powered by integrated CE- and US Food and Drug Administration (FDA)-cleared algorithms for the immediate analysis of heart and lung sound recordings. These algorithms can recognise signal quality at point-of-care and aid diagnosis by recognising abnormal findings in heart and lung sounds. They also allow providers to follow patients sequentially using previous recordings to personalise follow-up of known conditions.

3.3 Methods

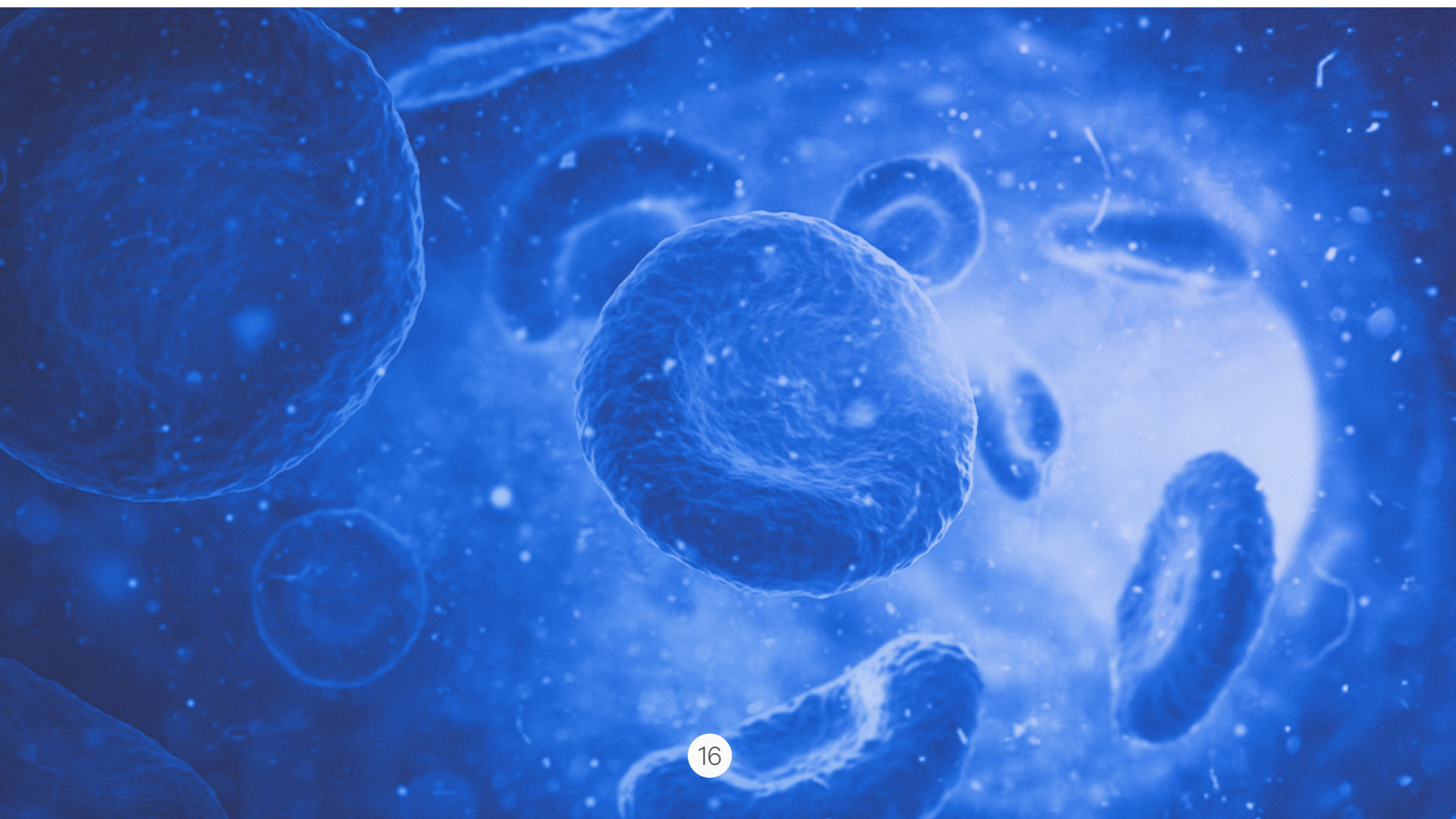
3.3.1 Service evaluation governance and set up

The setup of this service evaluation required compliance, legal and ethical due diligence. The GPwER communicated with Farnborough PCN and the former North East Hants & Farnham CCG to establish shared interest and gain permission for the service evaluation. Following engagement of these stakeholders, processes were followed per Caldicot Guardian and data protection impact assessment (DPIA) protocols to ensure compliant data sharing between the community pharmacist and the community echocardiography service.

For our HVD detection service evaluation, the eMurmur[®] auscultation program was used to record heart sounds, analyse these with eMurmur[®] Heart AI (artificial intelligence) software, and store resulting auscultation data for future reference. The Heart AI software detects potentially pathological heart murmurs, which are an important indicator of HVD, especially in elderly patients.

We had to identify a local pharmacy with the capacity and infrastructure to use a digital stethoscope with eMurmur[®] Heart AI on patients. The pharmacy needed to have a private room and place for the patient to lie down. Once the pharmacy was identified, the pharmacist was trained by the GPwER at their GP practice so the pharmacist could understand auscultation and how to use the equipment.

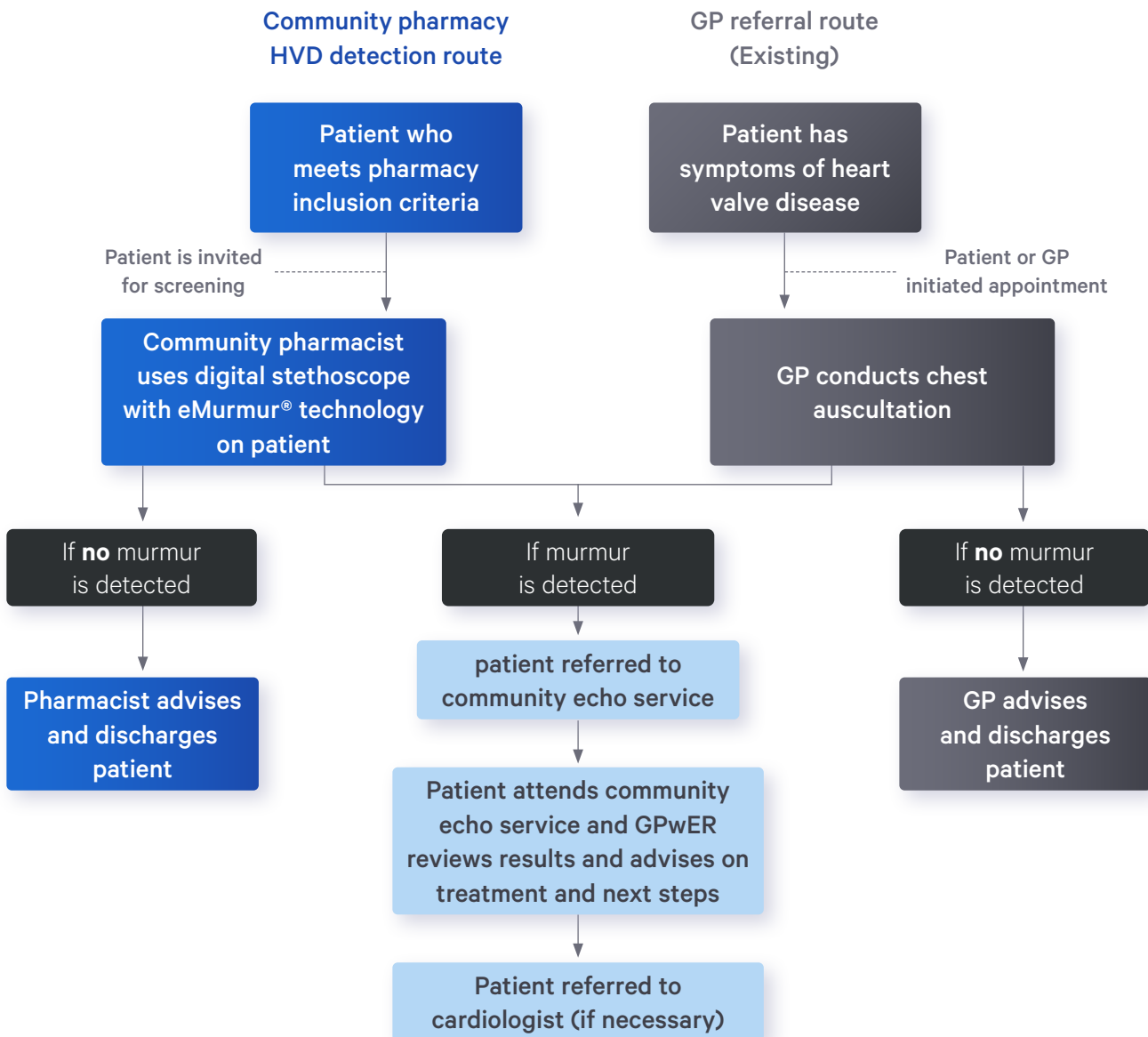
A reimbursement fee per patient seen was set up for the pharmacist to conduct the test to establish that extra services provided by pharmacists should be adequately resourced. This was in line with the fee for other services, including an atrial fibrillation service evaluation previously run in Frimley ICS. Edwards provided a financial grant to fund these fees within this service evaluation. Additionally, eMurmur[®] provided their software and equipment free of charge. The cost of community echocardiography was also covered by the educational grant from Edwards. The service evaluation was therefore run at no cost to the local NHS. The Local Medical Committee and Local Pharmaceutical Committee was keen that this was not set up as a free service and fully supported the service evaluation with its financial support.



3.3.2 Pharmacist engagement with patients

Figure 3 shows how the community pharmacy detection route differs from the existing referral route used by Farnborough PCN. In summary, the pathways differ in the location of first detection of HVD. The community pharmacy HVD detection route does not require the patient to have a either proactively book a GP appointment or be called in for an appointment by their GP practice.

Figure 3. Differences and similarities between the community pharmacy detection pathway and the existing referral route used by Farnborough PCN.



3.3.3 Eligibility criteria

The community pharmacist engaged patients at the pharmacy who were identified as eligible for the service evaluation based on at least one of the criteria below:

- Aged >75 years
- Type 2 diabetes
- Ischaemic heart disease (IHD) (angina and myocardial infarction)
- Atrial fibrillation
- High blood pressure

Patients evaluated at Chapel Pharmacy were recruited to the service either through a leaflet added to their prescription pack or as a walk-in to the pharmacy; the pharmacy had posters advertising the service (see [Figure 4; Appendix H](#) for details of the poster). [Figure 5](#) shows the patient breakdown by initiation route.

A patient information leaflet ([Figure 4; Appendix H](#)) was included with prescriptions prepared for patients identified as eligible for the service evaluation and used to prompt conversation about HVD. To be considered eligible, patients were required to indicate that they had neither received a diagnosis of HVD in the past nor had an echocardiogram within the past ten years.

Figure 4. Patient information leaflet.

Community Heart Valve Check

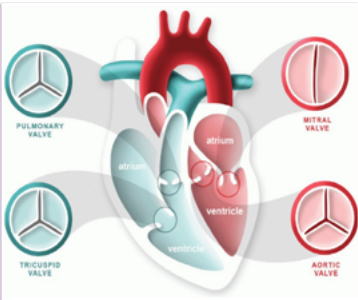
Early identification of **Heart Valve Disease** is important as this helps prevent damage to the heart and reduces the risk of developing cardiovascular disease.

To help early identification of heart valve problems the **Community Cardiology Clinic** is offering a **free Heart Valve Check** at Chapel Pharmacy to those at risk.

Heart valve disease is a serious condition involving damage to one or more of the four heart valves. Early detection of any problem means appropriate treatment can be started which will help prevent damage to the heart.

Heart valve disease is identified through listening to your heart beat with a stethoscope.

It can occur at any age but is more common in the over 65s.



Heart Valve Check

- The check will be undertaken at Chapel Pharmacy in one of their private consulting rooms by a pharmacist.
- A digital stethoscope will be placed on your chest to identify whether you have a heart murmur. The stethoscope is linked to a smart phone which will help determine if the murmur is significant.
- If the murmur is significant, you will be referred to the Community Cardiology Clinic based at Border Practice.
- Your GP practice will be informed of the check.

Should you book a Heart Valve Check?

- If you have NOT already been diagnosed with a Heart Valve problem? **Yes!**
- If you are over 75? **Yes!**
- If you have angina, high blood pressure, atrial fibrillation or type II diabetes? **Yes!**

To book your free Heart Valve Check please phone 01276 33819

The pharmacists at Chapel Lane Pharmacy are Mak Johal and James Martin.
The Community Cardiology clinic is led by Dr John de Verteuil.

At the labelling step of the dispensing process, the dispenser annotated the patient's patient medical record (PMR) stating that a leaflet had been supplied and recording the date on which it was supplied. The dispenser then filled out the spreadsheet with the patient's name, date of birth, address, contact details and eligibility for the service. Once the prescription was dispensed and bagged up, the leaflet was added to the bag.

On handing out the prescription, the member of staff would draw attention to the leaflet inside the bag. They would either have a conversation with the patient at the time or make the patient aware and prompt them to read it later, inviting them to call to speak with the pharmacist if they had any questions. Once handed out, the spreadsheet was annotated to say that the prescription with the leaflet had been collected.

After an undefined period of time from when the patient collected the prescription, the pharmacist checked the spreadsheet to see which patients had not made contact with the pharmacy. These patients were followed up to see if they had received the leaflet and if they had read it. The pharmacist would refer to the telephone questionnaire protocol below:

- Check the following with the patient:
 - Name
 - Age/date of birth (>75 years)
 - Did they receive our leaflet?
 - Do they suffer from any of the following: IHD, high blood pressure, type 2 diabetes mellitus, atrial fibrillation?
 - Had they had ultrasound of the heart within ten years? (exclude if yes)
 - Had they previously been diagnosed with a heart valve problem? (exclude if yes)
- Describe the service as per [Appendix C](#) explaining that the patient would need to undress down to the waist but would be covered with a modesty drape and a chaperone would be present if needed. They could also bring a companion with them if they wished.
- Book an appointment.

If a patient presented acutely for advice with breathlessness and/or chest pain 'on exertion', ankle swelling, palpitations or episodes of light-headedness (feeling as though they might faint) or blackouts, they would be advised to make an appointment to see their GP. However, the pharmacist would explain that they could offer them an appointment for heart auscultation in the meantime.

The pharmacist would explain that their symptoms might be linked to HVD and that listening to the heart for the presence of a murmur is the initial way of identifying HVD. The pharmacist would then explain the auscultation process with the aid of the leaflet and book an appointment with them.

If the patient looked ill or had chest pain at rest at the time, the pharmacist was instructed to call an ambulance or advise them to go to the emergency department immediately.

3.3.4 The pharmacist performing the service

If possible, prior to appointment, the patient's details were put on to Jelly software, allowing seamless transfer of information between the pharmacy, general practice and Dr de Verteuil (GPwER echocardiography, see [Section 3.3.5](#)). The pharmacist ensured that the consultation room was ready to use and that a disposable towel covered the examination couch.

At the appointment, the pharmacist would introduce themselves to the patient and show them the consultation room and couch. They would establish whether a chaperone was required, explain the procedure ([Appendix C](#)) and ask the patient to sign the consent form ([Appendix D](#)).

While the patient was getting ready, the pharmacist would enter their details in the eMurmur® software on a tablet and ensure that the digital stethoscope was connected to it via Bluetooth.

Once the patient was undressed, the pharmacist would ask them to lie on their left side facing the wall, with the modesty drape pulled up. The chaperone could help the patient if required.

The pharmacist would then perform the auscultation as per [Appendix E](#).

3.3.5 Patients referred to Dr de Verteuil echocardiography service

Dr John de Verteuil is a GPwER in Cardiology and Echocardiography and has been running a one-stop echocardiography clinic in the community since 2004. He runs this community cardiology and echocardiography clinic from the Border Practice GP practice in Aldershot. He generally receives referrals from GP colleagues throughout the former North East Hants & Farnham CCG.

The typical patient referred to Dr de Verteuil is anyone eliciting possible cardiac signs or symptoms for which an echocardiogram would be a first-line investigation (e.g. heart failure, valve disease, genetic screening, abnormal electrocardiograms and chest X-rays).

For this service evaluation, Dr de Verteuil followed the protocol outlined below. The echocardiography evaluation aimed to identify whether the murmur represented a significant valvular problem or an alternative insignificant issue (e.g. flow murmur or aortic sclerosis).

1. Patient identified as having a systolic murmur by community pharmacist James Martin at Chapel Pharmacy.
2. Patient informed that they will be referred to Dr de Verteuil at the Border Practice echocardiography clinic.
3. Patient's details and findings entered into a spreadsheet.
4. Patient's details and findings emailed to Dr de Verteuil by secure NHS email.
5. Patient's details sent to Dr de Verteuil's secretary, patient is contacted, and date for echocardiography booked.
6. When the patient arrives at the echocardiography clinic, they are welcomed, the previous findings are discussed with them, and the procedure and what signs are being looked for are explained.
7. Patient undergoes full compensation echocardiography.
8. Before the patient leaves the room, the findings are explained to the patient to their satisfaction. The patient is notified as to any further actions that are needed (e.g. referral for follow-up echocardiography to look at the valve problem in one year or referral to the hospital for further treatment).
9. A full report is written and sent to the patient's GP. This report contains technical details, as well as an explanation of what has taken place and recommendations on further management.
10. The spreadsheet is updated with Dr de Verteuil's findings.

Dr de Verteuil considered patients referred to him by GP practices in Farnborough PCN as a control group and the patient demographics and echocardiography results were tracked to compare with those referred to him by Chapel Pharmacy.

3.4 Results

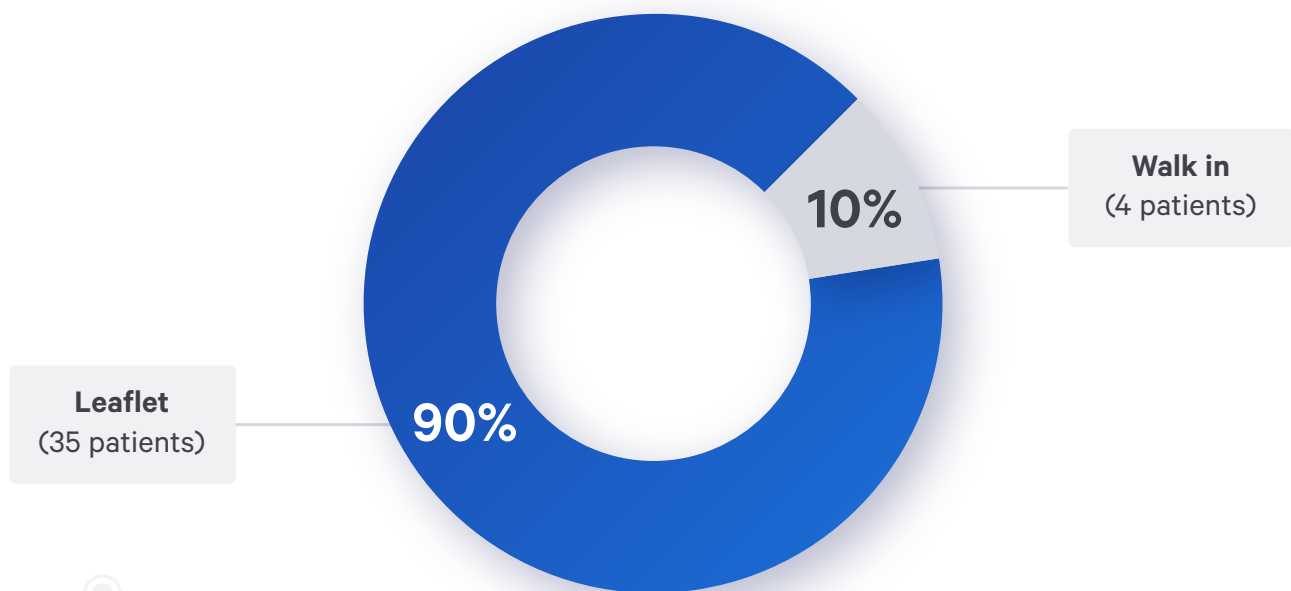
3.4.1 Patient demographics

The community pharmacist at Chapel Pharmacy successfully recruited and evaluated 86 patients using the digital stethoscope with eMurmur® technology. The pharmacist detected a murmur in 39 (45%) patients. These 39 patients were then referred to the community echocardiography service (Table 3). However, upon review of the audio file recording, two patients were referred directly to A&E by the GPwER and received an echocardiography in hospital.

Table 3. Patients evaluated with digital stethoscope and eMurmur® technology by the community pharmacist at Chapel Pharmacy.

Patient group	Patients n (%)
Number of patients in community pharmacy sample	86
Patients referred to clinic	39 (45)
Patients not referred	47 (55)

Figure 5. Patient initiation (successful recruitment) routes to evaluation with digital stethoscope and eMurmur® technology at Chapel Pharmacy, for those who received onward referral to the community echocardiography service.



The mean age of patients referred by the community pharmacist to the community echocardiography service was 77.8 years. Nine patients (23%) were aged 65–74 years and 30 (77%) were aged ≥75 years. [Table 4](#) shows echocardiography result by age group.

Table 4. Echocardiography results of patients referred to echocardiography by Chapel Pharmacy between July 2022 and February 2023 by age group.

Patient group	Age (years)			
	<55	55-64	65-74	≥75
Number of patients referred	0	0	9	30
Patients diagnosed with at least mild HVD	0	0	2	15
Patients classed as ‘normal’ or with ‘trivial’ HVD	0	0	7	15

Over the same period, the community echocardiography service also received 24 referrals from GP practices in Farnborough PCN. These referrals were more diverse in age, ranging from <55 years to ≥75 years (mean 65 years). This diversity is as expected because those aged ≥75 years were specifically targeted by Chapel Pharmacy, though this would not necessarily be the case in GP practices in Farnborough PCN. [Table 5](#) shows echocardiography results by age group for those referred by GP practices in Farnborough PCN.

Table 5. Echocardiography results for patients referred to echocardiography by GP practices in Farnborough PCN between July 2022 and February 2023 by age group.

Patient group	Age (years)			
	<55	55-64	65-74	≥75
Number of patients referred	5	3	11	5
Patients diagnosed with at least mild HVD	1	0	6	3
Patients classed as ‘normal’ or with ‘trivial’ HVD	4	3	5	2

3.4.2 Community pharmacy versus GP practice referrals

Of the patients referred by the community pharmacist at Chapel Pharmacy, 56% were classed as having 'normal' or 'trivial' HVD based on their echocardiography results ([Table 6](#)). Of those referred by GP practices in Farnborough PCN, 58% had HVD classed as 'normal' or 'trivial' ([Table 7](#)).

Table 6. Patients referred by Chapel Pharmacy between July 2022 and February 2023 by echocardiography result.

Patient group	Patients n (%)
Number of patients referred	39
Patients diagnosed with moderate or severe HVD	8 (21)
Patients diagnosed with mild HVD	9 (23)
Patients classed as 'normal' or with 'trivial' HVD	22 (56)

Table 7. Patients referred by GP practices in Farnborough PCN between July 2022 and February 2023 by echocardiography result.

Patient group	Patients n (%)
Number of patients referred	24
Patients diagnosed with moderate or severe HVD	2 (8)
Patients diagnosed with mild HVD	8 (33)
Patients classed as 'normal' or with 'trivial' HVD	14 (58)

Over the analysis period, Chapel Pharmacy referred 70% more patients diagnosed with non-trivial HVD than GP practices in Farnborough PCN (17 patients vs 10 patients).

Figure 6 and Figure 7 show patient counts for all cases of non-trivial HVD referred by Chapel Pharmacy or by GP practices in Farnborough PCN, respectively, by diagnosis. It is possible for patients to have more than one HVD diagnosis.

Figure 6. Patients with non-trivial HVD referred by Chapel Pharmacy by diagnosis.

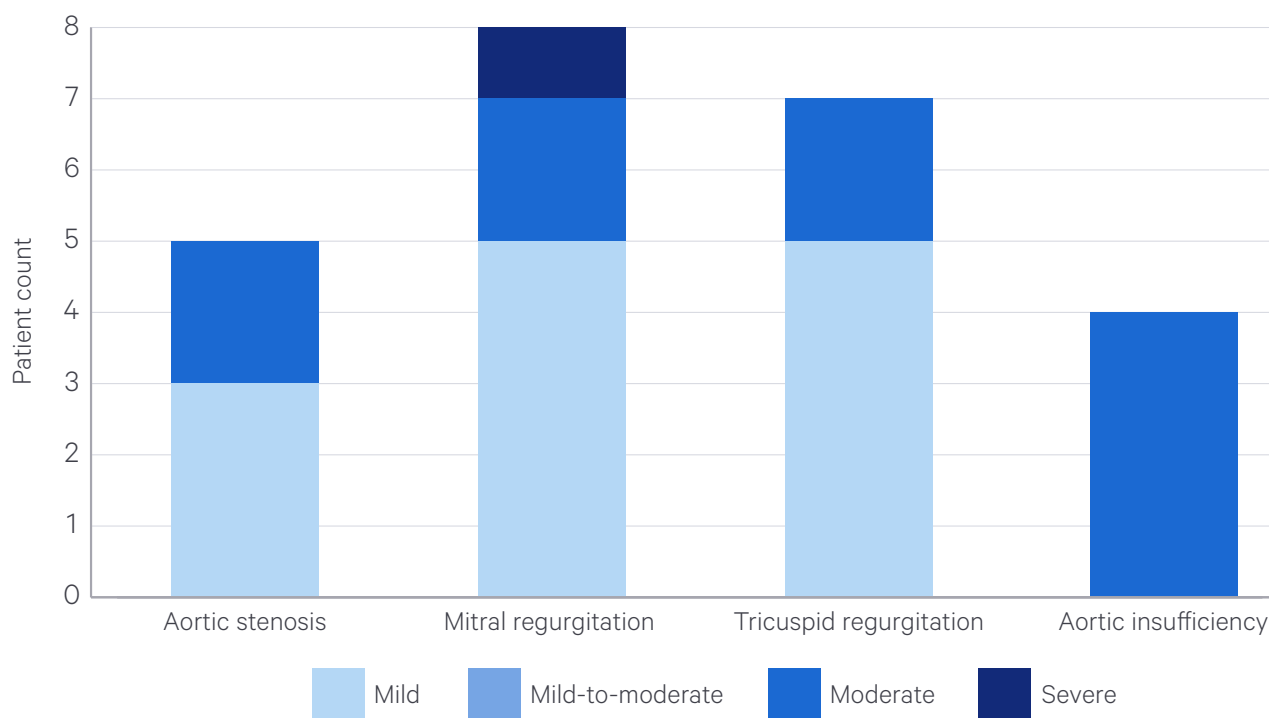
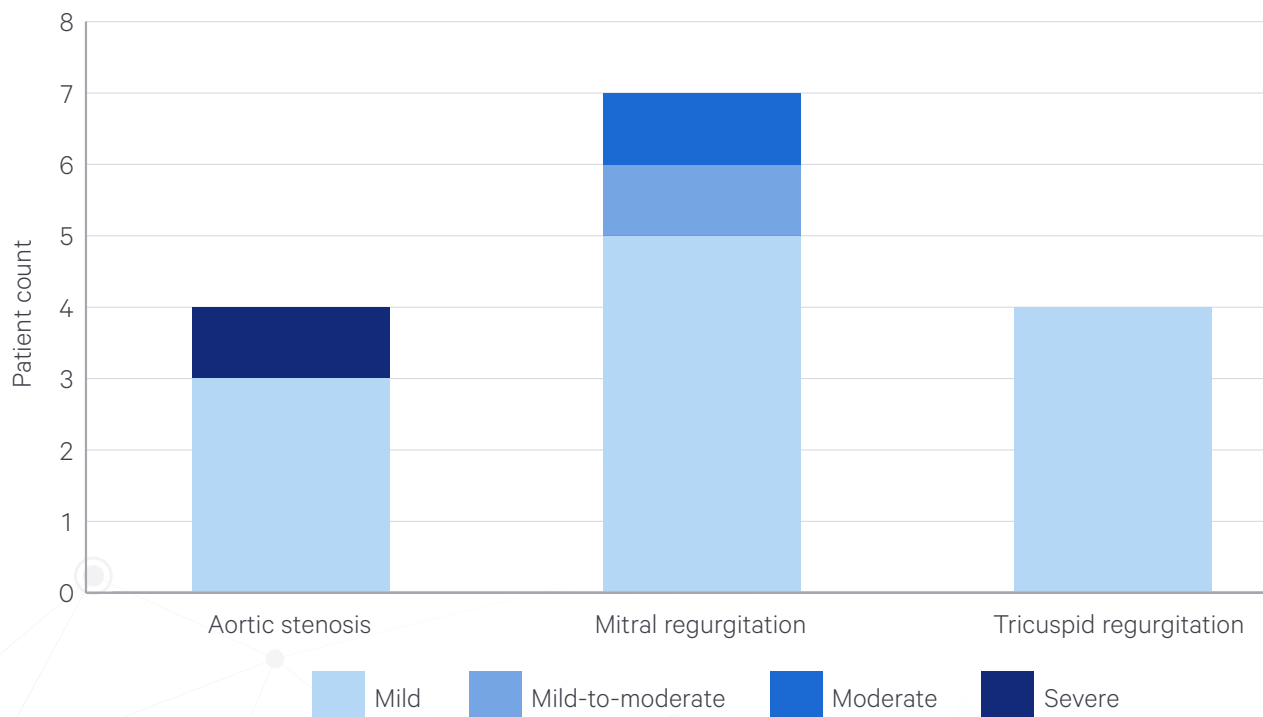


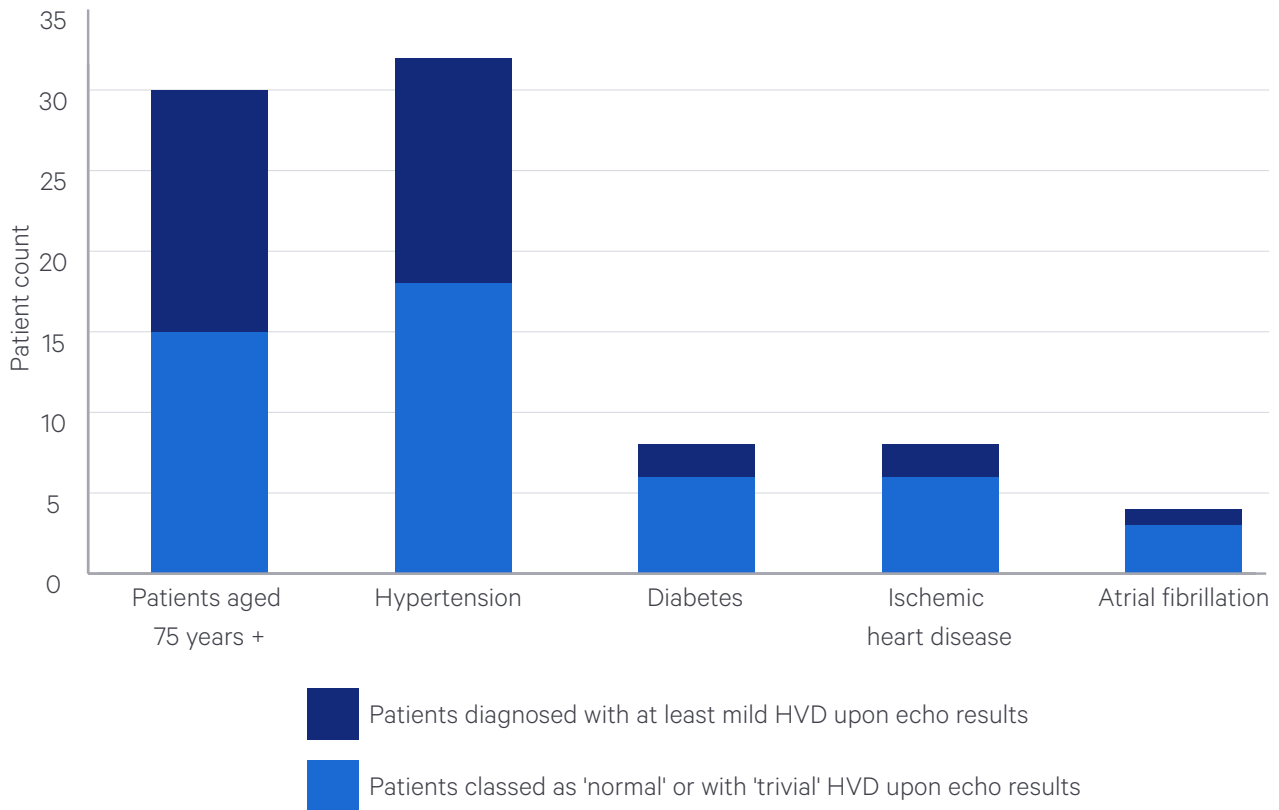
Figure 7. Patients with non-trivial HVD referred by GP practices in Farnborough PCN by diagnosis.



3.4.3 Comorbidities

Due to limitations in our service evaluation, comorbidities of patients referred by GP practices in Farnborough PCN are not known. However, comorbidities of patients referred by Chapel Pharmacy are shown by echocardiography result in [Figure 8](#). The most common comorbidity of patients referred by Chapel Pharmacy was hypertension (82%). Patients may have more than one comorbidity.

Figure 8. Comorbidities among patients referred by Chapel Pharmacy by echocardiography result.



3.4.4 Deprivation

Most patients referred by Chapel Pharmacy and by GP practices in Farnborough PCN were from less deprived areas (Figure 9; Figure 10).

Figure 9. Patients referred by Chapel Pharmacy by deprivation.

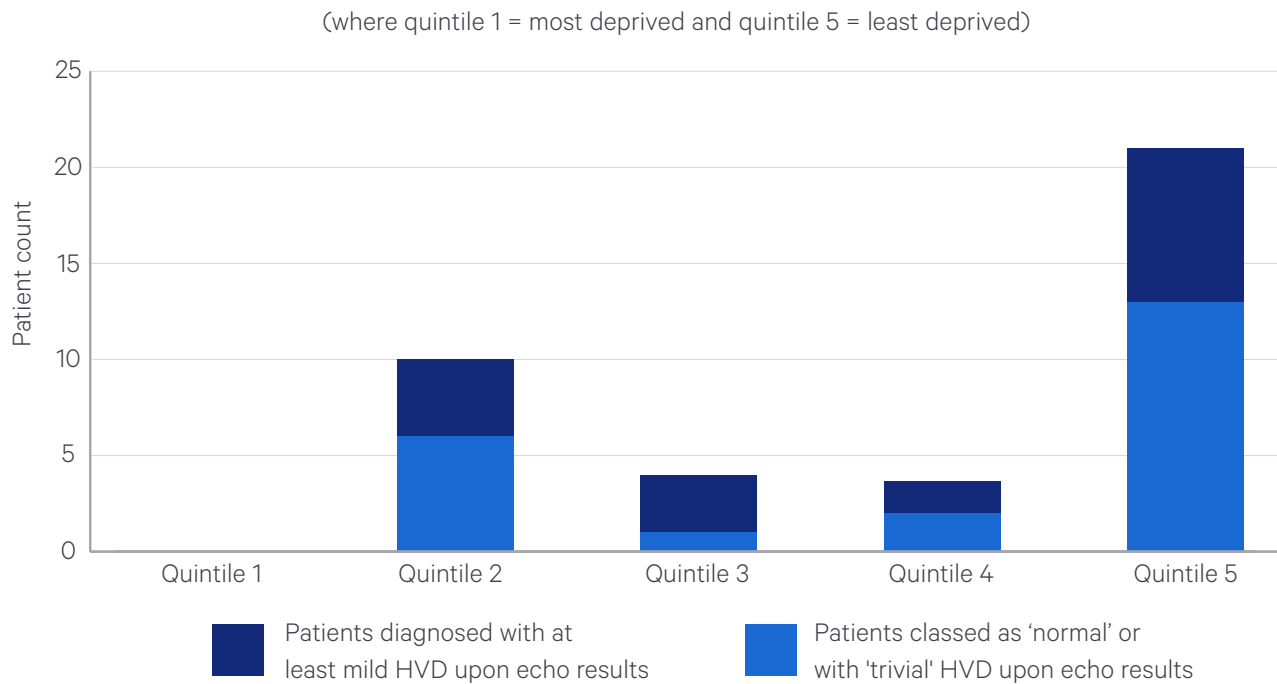
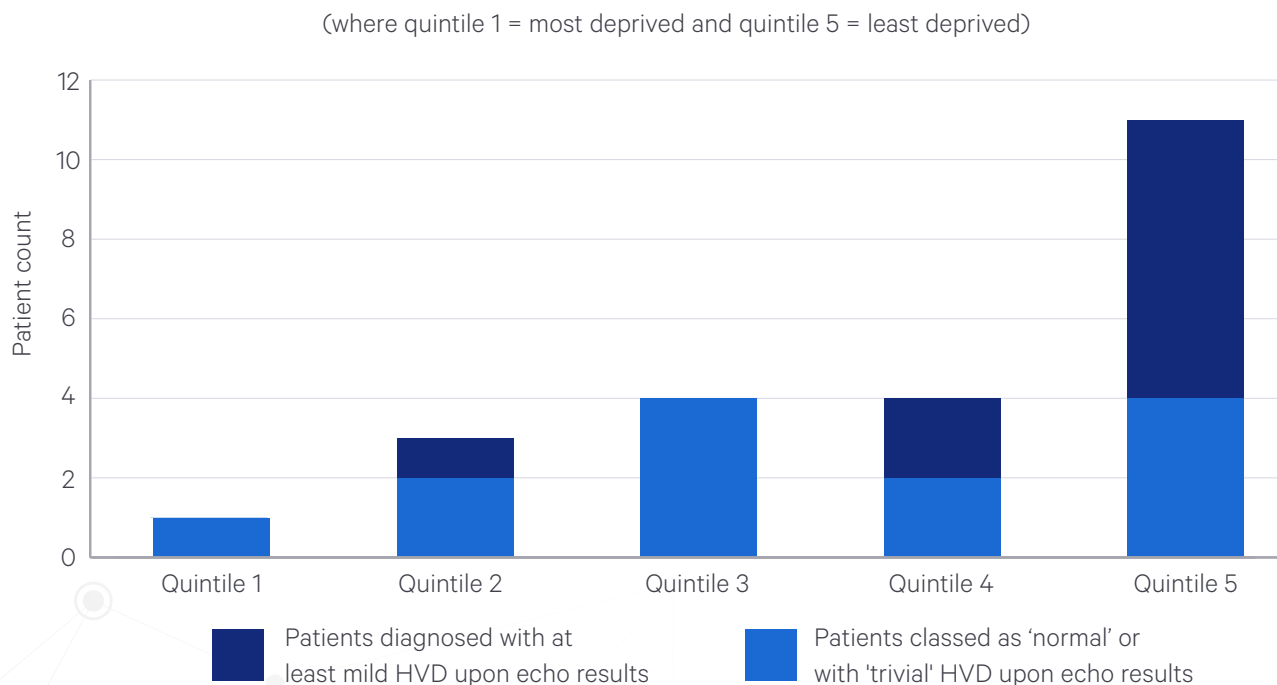


Figure 10. Patients referred by GP practices in Farnborough PCN by deprivation.



One patient did not have a valid postcode and is therefore not included in Figure 10.



3.4.5 Case study

The case study presented below features a patient diagnosed with severe symptomatic AS, demonstrating the imperative for proactive detection strategies. The study also shows the pivotal role that community pharmacists can play in identifying and referring patients for timely medical intervention.

Through a collaborative effort between the pharmacist and the GPwER in cardiology, remote access to the patient's heart recording was obtained, allowing for informed decision-making regarding the need for hospital admission. This case exemplifies the potential benefits of such services in enhancing patient outcomes.

How AI software can help avoid delays in patient care - a case review

7th July 2022

A 79 year old patient who is **breathless on exertion** attends a **GP appointment**.



GP detects a **heart murmur**.

GP Refers him for further investigations (ECG).

NT-pro-BNP test

2nd August 2022

GP phones the patient and informs him that **he's been referred to a Rapid Access Heart Failure Clinic**.



Patient's **breathlessness increases** and he phones 111.

A **paramedic** is sent who **detects a heart murmur**.



Patient attends **A&E** but the **doctors tell him there is no murmur** and discharge him home.

Patient's **breathlessness increases** and he's **feeling weaker**.



6th October 2022

Patient calls the GP and learns that **no appointment had been made** and that tests would need to be repeated so that they are up-to-date for a new appointment.



Patient is **very worried**.

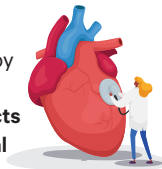
8th October 2022

Patient speaks to **pharmacist** who offers **eMurmur digital stethoscope** with **hard AI software check**.



10th October 2022

Patient has his heart listened to by **eMurmur** which **detects pathological murmur**.



He looks **very ill** and is **breathless**.



Dr de Verteuil **listens to the audio file** and **recommends patient attend A&E immediately**.

Pharmacists phones GP with special interest in cardiology.



Patient admitted to **hospital** under care of cardiology. An **echo** is performed which **demonstrates severe aortic stenosis**.



13th October 2022

The **patient is stabilised** and discharged with an **appointment in TAVI clinic**.



26th October 2022

Patient seen in **TAVI clinic** and **workup for TAVI begins**.



Key points

- Opportunities missed for prompt detection of severe symptomatic aortic stenosis in the community.
- Patient has deteriorated over the last 3 months and required non-elective admission which could have been avoided.
- Demonstrates the benefit of eMurmur being available to pharmacists.
- The ability to share eMurmur audio file with specialists enabled fast access to specialist care which has led to a prompt treatment plan being put in place.

Supported by an unrestricted grant from Edwards Lifesciences

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4. Discussion

Heart valve disease is a common and serious but treatable condition. Early detection is essential for patients to access prompt and optimal treatment 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. Underdiagnosis not only has dire effects on patient outcomes but incurs higher costs for services in the long term.

The HES analysis set out in the introduction of this report demonstrates that a significant proportion of patients with HVD have undetected and untreated HVD. This is a problem that requires urgent focus – both in terms of raising public awareness about the symptoms and treatment options and raising awareness among community HCPs about presentation of the HVD and the importance of referral for early diagnosis and onward referral to specialist care.

The prevalence of HVD continues to grow as the population ages, and the NHS must appropriately allocate resource to address the burden of this disease. Improving community detection of HVD and increasing use of community pharmacists are key contemporary NHS LTP objectives and offer significant opportunities to make a difference to patients. NHS England also needs to address capacity within specialist centres, otherwise patients with HVD waiting for treatment may experience avoidable complications.

Our service evaluation has shown that primary care HCPs play an important role in enabling detection of and access to care for HVD. It highlights how technology can improve the quality of referrals to community echocardiography services through community pharmacists trained to use digital technology to detect HVD. Indeed, the community pharmacist at Chapel Pharmacy referred 70% more patients with non-trivial HVD than the alternative referral route via GP practices in Farnborough PCN during the evaluation period.

Patients accepted and were comfortable with attending a service that checks for murmurs to investigate the presence of HVD by a community pharmacist in the pharmacy setting, which is supported by previous research.²² These findings serve as indicators that proactive community detection in a pharmacy setting is an ideal place to undertake methods of detecting certain diseases, such as HVD, and community pharmacists thus have significant potential in terms of detecting HVD in their community.

During this service evaluation, the community pharmacist could communicate quickly with the GPwER, who could listen to recorded audio files of the digital stethoscope auscultation and remotely assess the patient. This rapid sharing of data was not only convenient to patients and the involved HCPs but was also crucial in identifying patients with critical severe AS requiring immediate treatment. Sharing of audio files accelerated the patient pathway, likely preventing worse patient outcomes. The evaluation therefore showcases how digital technology can support rapid, potentially lifesaving decision-making among HCPs.

The burden of underdiagnosis and undertreatment of HVD leads to unnecessarily poor outcomes for many people with this condition. If more community pharmacists and other allied HCPs in the UK were supported to perform HVD detection using digital technologies, more patients with HVD could be identified and receive appropriate treatment before they experience poor outcomes. This service therefore has the potential to reduce the 46% gap in terms of patients with undiagnosed and untreated severe symptomatic AS, as well as other forms of severe HVD in England. This will inevitably improve outcomes for patients with HVD and save the NHS money through proactive detection and treatment, leading to less urgent or non-elective admissions.

5. Recommendations for future service

This service should be offered in a wider and more diverse geographical area to see the potential impact of community pharmacy detection of HVD with eMurmur® technology and enable full patient outcome and economic evaluation.

In future services, community detection should target patients >65 years rather than >75 years. In this study, Chapel Pharmacy, on average, referred older patients than GP practices in Farnborough PCN. This is because patients aged >75 years were specifically targeted by the pharmacist and were part of the inclusion criteria for the service evaluation. GP practices referred patients with non-trivial HVD across age groups, including those aged <55 years. In the pharmacy setting, targeting patients aged >65 years may lead to increased detection of HVD.

The most common comorbidity of patients referred by Chapel Pharmacy was hypertension. One potential reason for this is that HVD may be more likely to be detected in other clinical settings in patients with known CVD. This finding suggests that proactive assessment of patients with hypertension may be a useful approach to early detection of HVD.

A more systematic approach to identifying patients with HVD is needed, and this will require adequate resource and financial incentives. Primary care networks (PCNs) are the ideal place for this to happen in the form of 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.



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Appendices

Appendix A: Hospital Episode Statistics (HES) analysis methods

HES methods.

Edwards HVD Community Detection Report - (2) Gap Analysis Data

Analyst: Stephen Thomas

Date of Publication: March 2023

Sources: Hospital Episode Statistics; Strange G, Scalia GM, Playford D et al. (2021); Cahill TJ, Prothero A, Wilson J, et al (2021) and ONS Mid-Year Population Estimates for CCGs

Organisation Level: National and Integrated Care Board (ICB)

Methodology

Section 1 - Aortic Stenosis (AS) Gap Analysis

(Sources: Hospital Episode Statistics; Strange G, Scalia GM, Playford D et al. (2021) and ONS Mid-Year Population Estimates for CCGs)

1a. Gap Between Estimated Incidence of Severe Symptomatic AS and Patients Treated with TAVI or sAVR

The gap is the difference between the estimated incidence of severe symptomatic AS within the population aged 65+ and the number of patients treated with TAVI or sAVR at ICB level. Please see the sections below for a detailed methodology as to how these figures are calculated.

The gap is calculated as an annual average and is also extrapolated to show an estimated value over 5 years.

1b. AS Patients Admitted to Hospital for Treatment with TAVI or sAVR, 2017/2018 to 2021/2022

A count of the number of patients who have had an inpatient spell with a diagnosis of AS between 1st April 2017 and 31st March 2022 and have subsequently had a TAVI or sAVR procedure (either within the same inpatient spell or in a subsequent spell). Please see "Procedure Codes" for the definitions of TAVR and sAVR.

1c. Estimated Prevalence and Incidence of Severe Symptomatic AS, Mid-2017 to Mid-2020

AS prevalence and incidence has been estimated by applying the age-specific estimates of severe AS prevalence and incidence from the report by Strange G, Scalia GM, Playford D et al. (2021) to ONS Mid-Year Population Estimates for CCGs, aggregated to ICB level. Based on the report, it is assumed that 68.3% of these severe AS patients will be symptomatic (the remaining patients will be asymptomatic).

Section 2 - Mitral Regurgitation (MR) Gap Analysis

(Sources: Hospital Episode Statistics; Cahill TJ, Prothero A, Wilson J, et al (2021) and ONS Mid-Year Population Estimates for CCGs)

2a. Gap Between Estimated Incidence of Mitral Regurgitation and Patients Treated with Mitral Valve (MV) Repair/Replacement

The gap is the difference between the estimated incidence of MR within the population aged 65+ and the number of patients treated with MV repair or replacement at ICB level. Please see the sections below for a detailed methodology as to how these figures are calculated.

The gap is calculated as an annual average and is also extrapolated to show an estimated value over 5 years.

2b. MR Patients Admitted to Hospital for Mitral Valve Repair/Replacement, 2017/2018 to 2021/2022

A count of the number of patients who have had an inpatient spell with a diagnosis code relating to mitral valve diseases (MVD) between 1st April 2017 and 31st March 2022 and have subsequently had a procedure of tricuspid valve repair/replacement (either within the same inpatient spell or in a subsequent spell).

2c. Estimated Prevalence and Incidence of Mitral Regurgitation, Mid-2017 to Mid-2019

The population with MR has been estimated using the adjusted prevalence benchmarks from the Heart article by Cahill TJ, Prothero A, Wilson J, et al (2021) "Community prevalence, mechanisms and outcome of mitral or tricuspid regurgitation" which states the community prevalence of moderate or greater MR within adults aged 65+ is 3.5%. This benchmark has been applied to ONS Mid-Year Population Estimates for CCGs and aggregated to ICB level.

The estimated incidence of MR has been calculated based on the change in community prevalence of moderate or greater MR from year-to-year at ICB level: from mid-2017 to mid-2018 and mid-2018 to mid-2019. The average change over these two time periods represents an estimate of the incidence of MR within adults aged 65+.

Please note that mid-2020 population estimates have not been used in this analysis due to the impact of the COVID-19 pandemic on the size of the over 65 population and the subsequent impact on estimated MR prevalence which would distort the estimates of MR incidence.

Section 3 - Tricuspid Regurgitation (TR) Gap Analysis

(Sources: Hospital Episode Statistics; Cahill TJ, Prothero A, Wilson J, et al (2021) and ONS Mid-Year Population Estimates for CCGs)

3a. Gap Between Estimated Incidence of Tricuspid Regurgitation and Patients Treated with Tricuspid Valve (TV) Repair/Replacement

The gap is the difference between the estimated incidence of TR within the population aged 65+ and the number of patients treated with TV repair or replacement at ICB level. Please see the sections below for a detailed methodology as to how these figures are calculated.

The gap is calculated as an annual average and is also extrapolated to show an estimated value over 5 years.

3b. TR Patients Admitted to Hospital for Tricuspid Valve Repair/Replacement, 2017/2018 to 2021/2022

A count of the number of patients who have had an inpatient spell with a diagnosis code relating to tricuspid valve diseases (TVD) between 1st April 2017 and 31st March 2022 and have subsequently had a procedure of tricuspid valve repair/replacement (either within the same inpatient spell or in a subsequent spell).

3c. Estimated Prevalence and Incidence of Tricuspid Regurgitation, Mid-2017 to Mid-2019

The population with TR has been estimated using the adjusted prevalence benchmarks from the Heart article by Cahill TJ, Prothero A, Wilson J, et al (2021) “Community prevalence, mechanisms and outcome of mitral or tricuspid regurgitation” which states the community prevalence of moderate or greater TR within adults aged 65+ is 2.6%. This benchmark has been applied to ONS Mid-Year Population Estimates for CCGs and aggregated to ICB level.

The estimated incidence of TR has been calculated based on the change in community prevalence of moderate or greater TR from year-to-year at ICB level: from mid-2017 to mid-2018 and mid-2018 to mid-2019. The average change over these two time periods represents an estimate of the incidence of TR within adults aged 65+.

Please note that mid-2020 population estimates have not been used in this analysis due to the impact of the COVID-19 pandemic on the size of the over 65 population and the subsequent impact on estimated TR prevalence which would distort the estimates of TR incidence.

Section 4 - Aortic Stenosis (AS) Inpatient Spells

(Source: Hospital Episode Statistics)

4a. Inpatient Spells with a Diagnosis of Aortic Stenosis by Admission Method, 2017/2018 to 2021/2022

A count of inpatient spells with a diagnosis of AS, split by method of admission at national level only.

Bibliography

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<https://heart.bmj.com/content/early/2021/03/03/heartjnl-2020-318482.full>

ONS Mid-Year Population Estimates for Clinical Commissioning Groups (CCGs) in England by Single Year of Age and Sex

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/s/12429clinicalcommissioninggroupscgspopulationestimatesbysingleyearofageandsexenglandmid2001tomid2019>

Strange G, Scalia GM, Playford D et al. (2021) Uncovering the treatable burden of severe aortic stenosis in Australia: current and future service evaluation ions within an ageing population. BMC Health Serv Res 21, 790

<https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-021-06843-0>

Diagnosis Codes

Diagnosis Codes for Aortic Stenosis

ICD-10 Code	Diagnosis Description
I35.0	Aortic (valve) stenosis
I35.2	Aortic (valve) stenosis with insufficiency

Diagnosis Codes for Mitral Valve Diseases

ICD-10 Code	Diagnosis Description
I05.0	Mitral stenosis
I05.1	Rheumatic mitral insufficiency
I05.2	Mitral stenosis with insufficiency
I05.8	Other mitral valve diseases
I05.9	Mitral valve disease, unspecified
I08.0	Disorders of both mitral and aortic valves
I08.1	Disorders of both mitral and tricuspid valves
I08.3	Combined disorders of mitral, aortic and tricuspid valves
I34.0	Mitral (valve) insufficiency
I34.1	Mitral (valve) prolapse
I34.2	Nonrheumatic mitral (valve) stenosis
I34.8	Other nonrheumatic mitral valve disorders
I34.9	Nonrheumatic mitral valve disorder, unspecified

Diagnosis Codes for Tricuspid Valve Diseases

ICD-10 Code	Diagnosis Description
I07.0	Tricuspid stenosis
I07.1	Tricuspid insufficiency
I07.2	Tricuspid stenosis with insufficiency
I07.8	Other tricuspid valve diseases
I07.9	Tricuspid valve disease, unspecified
I08.1	Disorders of both mitral and tricuspid valves
I08.2	Disorders of both aortic and tricuspid valves
I08.3	Combined disorders of mitral, aortic and tricuspid valves
I36.0	Nonrheumatic tricuspid (valve) stenosis
I36.1	Nonrheumatic tricuspid (valve) insufficiency
I36.2	Nonrheumatic tricuspid (valve) stenosis with insufficiency
I36.8	Other nonrheumatic tricuspid valve disorders
I36.9	Nonrheumatic tricuspid valve disorder, unspecified

Procedure Codes

Procedure Codes for TAVI

A TAVI procedure has been identified wherever there is the TAVI procedure code and at least one TAVI approach code using the following OPCS codes:

OPCS Code	Procedure Description	Type
K26.2	Xenograft replacement of aortic valve	TAVI procedure
Y79.1	Transluminal Approach to Organ Through Subclavian Artery	TAVI approach
Y79.2	Transluminal Approach to Organ Through Brachial Artery	TAVI approach
Y79.3	Transluminal Approach to Organ Through Femoral Artery	TAVI approach
Y79.4	Transluminal Approach to Organ Through Aortic Artery	TAVI approach
Y79.8	Approach to Organ Through Artery, Other Specified	TAVI approach
Y79.9	Approach to Organ Through Artery, Unspecified	TAVI approach
Y49.4	Transapical Approach to Heart	TAVI approach

Procedure Codes for sAVR

A sAVR procedure has been identified wherever there is the sAVR procedure code and at least one sAVR approach code using the following OPCS codes:

OPCS Code	Procedure Description	Type
K26.1	Allograft Replacement of Aortic Valve	sAVR procedure
K26.2	Xenograft Replacement of Aortic Valve	sAVR procedure
K26.3	Prosthetic Replacement of Aortic Valve	sAVR procedure
K26.4	Replacement of Aortic Valve Nec	sAVR procedure
K26.5	Aortic Valve Repair Nec	sAVR procedure
K26.8	Plastic Repair of Aortic Valve, Other Specified	sAVR procedure
K26.9	Plastic Repair of Aortic Valve, Unspecified	sAVR procedure
Y73.1	Cardiopulmonary Bypass	sAVR approach

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

Procedure Codes for Tricuspid Valve Replacement & Repair

OPCS Code	Procedure Description	Type
K27.1	Allograft replacement of tricuspid valve	TV replacement
K27.2	Xenograft replacement of tricuspid valve	TV replacement
K27.3	Prosthetic replacement of tricuspid valve	TV replacement
K27.4	Replacement of tricuspid valve NEC	TV replacement
K27.5	Repositioning of tricuspid valve	TV repair
K27.6	Tricuspid valve repair NEC	TV repair
K27.8	Other specified plastic repair of tricuspid valve	TV repair
K27.9	Unspecified plastic repair of tricuspid valve	TV repair

Procedure Codes for Mitral Valve Replacement & Repair

OPCS Code	Procedure Description	Type
K25.1	Allograft replacement of mitral valve	MV replacement
K25.2	Xenograft replacement of mitral valve	MV replacement
K25.3	Prosthetic replacement of mitral valve	MV replacement
K25.4	Replacement of mitral valve NEC	MV replacement
K25.5	Mitral valve repair NEC	MV repair
K25.8	Other specified plastic repair of mitral valve	MV repair
K25.9	Unspecified plastic repair of mitral valve	MV repair

Appendix B: Expert group for development of the HVD detection pathway

The expert group included:

- **Professor Huon H Gray CBE**, the Emeritus NHS England Director for Cardiovascular Disease, former Cardiac Network Clinical Lead, NHS England (London Region)
- **Dr Benoy Shah**, President of British Heart Valve Society, Consultant Cardiologist, Wessex Cardiac Centre
- **Dr Rick Steeds**, Past President British Society of Echocardiography, Consultant Cardiologist, University Hospitals Birmingham
- **Dr Jim Moore**, President of Primary Care Cardiology Society
- **Dr John de Verteuil**, GPwER in Cardiology
- **James Wood**, Director of Contractor and LPC Support, Pharmaceutical Services Negotiating
- **Hinal Patel**, Service Development & Support Pharmacist, Community Pharmacy Surrey and Sussex
- **Wil Woan**, CEO Heart Valve Voice
- **Sarah Denham**, Principal Consultant, Wilmington Healthcare

The group developed an interactive pathway from patient presentation through management in secondary and tertiary care. At each step in the pathway, information, tips and guides for patients and HCPs were provided.

Upon completion, the group wanted to implement the pathway, and they were particularly interested in further exploring HVD community detection. The group decided to investigate if it were possible to conduct effective community HVD detection using allied health professionals (AHPs) and digital technology outside of a clinical setting.

Appendix C: Auscultation explanation

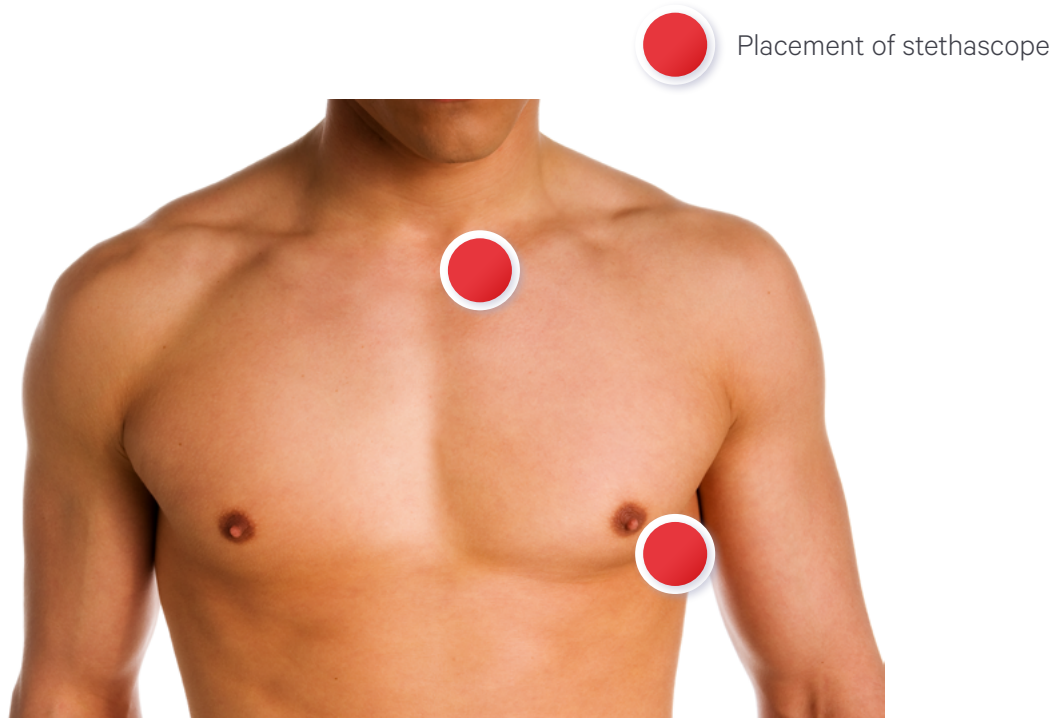
When you attend your appointment at Chapel pharmacy, you will be brought into our consultations/examination room, where you will meet James Martin (our pharmacist) and a chaperone if required. You can bring in a companion with you if you like.

James will take you through the procedure of listening to your heart with our digital stethoscope, and you will be asked to sign our consent form.

The Procedure:

You will be asked to go behind our clinical area which is curtained, and you will be asked to undress to the waist and lie on our couch on your left side. A modesty drape will be provided for you, and you can cover yourself with this. Our chaperone can help you with this if need be.

James will then come in and listen to your heart with our specialised digital stethoscope. This will involve placing the stethoscope on your chest (left side), first at the upper left side of your sternum, and then at the apex of your left chest, which is situated at the lower outer part of your left chest wall - see diagram below.



Your heart sounds will be picked up by the stethoscope and will then be transferred digitally and wirelessly (Bluetooth) to our specialised application on an iPad. This will interpret the heart sounds and determine whether a heart murmur is present or not.

If there is no murmur found, we will merely notify your GP that you have had this procedure performed.

If a murmur is found, this is not necessarily a bad thing, but it would mean that we would need to investigate things further, with what is called an echocardiogram (Echo). Again, we will share this information with your GP, but we will also refer you directly to Dr John de Verteuil, our Community Cardiology Lead, who will send you an appointment for an echocardiogram.

This is an ultrasound scan of your heart (the same technology that we use with pregnant ladies), and is quite painless and easy to do. It will be done by Dr de Verteuil at The Border Practice (GP practice) in Aldershot. Again, after the scan you will be offered an explanation of the findings immediately. Dr de Verteuil will also write a report of his findings to your GP.

Appendix D: Consent and information form (Jelly)

Heart valve disease (HVD) is a 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 anyone at any age but is more often found in the elderly population. As the average age of the population is increasing, so we expect to see increasing numbers of patients with heart valve disease.

Because heart valve disease can detrimentally affect the functioning of the heart, it is always best to try and identify the problem early. This would then allow prompt intervention before too much damage is done.

With this in mind, we are carrying out a surveillance of our over-75 patients, and also patients with diagnosed hypertension, type II diabetes, ischaemic heart disease and atrial fibrillation. We will also be looking at patients with symptoms of breathlessness, swelling of ankles, palpitations and episodes of light-headedness or faints.

The way in which we try to diagnose heart valve disease is to try and identify whether the patient has a heart murmur. This is a sound which we hear with our stethoscope when listening to the heartbeat.

One way in which we can identify whether the heart murmur is significant or not, is to analyse the heart sound digitally, with our digital stethoscope linked to a mobile phone or tablet with specialised audio software.

We would therefore be very grateful if you would allow us to analyse your heart sounds with our digital stethoscope. If the stethoscope picks up an abnormal murmur, we will then offer you an echocardiogram (ultrasound Scan of your heart), which will allow us to see if there is a problem with your heart valve.

If you are in agreement with us listening to your heart with our digital stethoscope, then we would be grateful if you could sign below.

Heart Valve Check

- The check will be undertaken at Chapel Pharmacy in one of their private consultation rooms by a pharmacist.
- A digital stethoscope will be placed on your chest to identify whether you have a heart murmur. The stethoscope is linked to a smart phone or tablet which will determine if the murmur is present.
- If the murmur is present, you will be referred to the Community Cardiology Clinic based at the Border Practice.
- Your GP will be informed of the check.

Consent

- You agree to the service, which includes the pharmacist to listen your heart using a digital stethoscope.
- In order to get the best recording the device works best with direct contact with the skin. Due to the position of the heart this will require you to remove your top. A modesty cover will be available and a female chaperone will be present for all female patients.
- Agree for information from eMurmur® application to be shared with GP and Cardiology Clinic if a pathological murmur likely.
- Agree for your medical records (summary care records) to be accessed and information shared with Cardiology Clinic.

Appendix E: Auscultation process

{Taking the recording}

1. Turn on the stethoscope.
2. Log into the eMurmur® app and make sure the stethoscope and app are connected.
3. In the app, select PATIENTS on the home screen. Create a new patient. Make sure to enter the correct date of birth, and the patient ID, which is their initials and then numerical (e.g John smith would be JS1, Jenny South would be JS2).
4. Click REC to start listening to heart sounds for this patient. For each patient, make two recordings: at 2nd left ICS and at the apex location.
5. Press REC to start the recording and hold still until the recording is complete.
6. Select which position you used to make the recording and press NEXT.
7. Select the patient position during recording and press NEXT.
8. Select what you heard and press NEXT. The home screen will show you the eMurmur® AI murmur detection result.
9. Select the + button to add a new recording.
10. Save the recordings.
11. Once complete ask the patient to get dressed while you prepare the paperwork.
12. Closing of consultation:
 - If murmur found:
 - Explain to the patient this is not necessarily a bad thing, but that it might be possible there is a slight problem with one of the heart valves.
 - Explain that you will be therefore, referring them to Dr de Verteuil at Border Practice for an echocardiogram and that they will receive an appointment within 4 weeks.
 - Explain that as per the consent information we will also be sending a copy of their SCR to Dr de Verteuil and informing their GP.
 - If no murmur found:
 - Reassure the patient and allow them to leave.
 - Let them know that you will inform their GP of this consultation and result.

The pharmacist completes the paperwork per the protocol below:

1. Jelly – Ensure Consultation is completed on Jelly including the patient’s unique reference number used in the eMurmur® application.
2. Download the printout from the eMurmur® portal.
3. Download the patient’s SCR from the NHS spine.
4. From within Jelly send form “as pdf” to the patient’s GP.
 - a. If murmur found:
 - i. Use “murmur found” email template
 - ii. Attach SCR and eMurmur® pdf
 - iii. Send to GP and CC in Dr de Verteuil.
 - b. If no murmur found:
 - i. Use “no murmur found” email template
 - ii. Attach eMurmur® pdf
 - iii. Send to GP.
5. Update spreadsheets:
 - a. Shared with Dr de Verteuil include the following:
 - i. Date, eMurmur® ID, Surname, First Name, DOB, NHS number, Surgery
 - ii. Applicable group (>75, Hypertension, Diabetes, IHD, AF)
 - iii. Acute presentation Sx (SOB, Chest pain, SOA, palpitations, Lightness/Faint).
 - b. Update internal Spreadsheet.

Appendix F: Template letter when no murmur present

Patient Name: [Custtitle] [Custfirstname] [Custlastname], DOB: [Custdob], NHS: [CustNo]

Dear [Doctors Title] [Doctors FirstName] [Doctors LastName],

We saw [Custtitle][Custlastname] at Chapel pharmacy today. Using a digital stethoscope we listened to [Custtitle][Custlastname]'s heart and no murmur was detected. As per agreed service guidelines, we have not referred [Custtitle][Custlastname] to Dr John de Verteuil's heart valve clinic at the Border Practice, but have attached the results from the eMurmur® for your reference.

If you have any questions please don't reply to this email as the inbox is not monitored, but feel free to contact me on the number below or email pharmacy.fxm19@nhs.net.

Kind regards,

James Martin
Pharmacist Independent Prescriber,
Pharmacy Manager

Chapel Pharmacy
102-104 Chapel Lane,
Farnborough
01276 33 819

Appendix G: Template letter for murmur present

Patient Name: [Custtitle] [Custfirstname] [Custlastname], DOB: [Custdob], NHS: [CustNo]

Dear [Doctors Title] [Doctors FirstName] [Doctors LastName],

We saw [Custtitle][Custlastname] at Chapel pharmacy today. Using a digital stethoscope we detected the possibility of a pathological murmur. As per agreed service guidelines, we have referred [Custtitle] [Custlastname] to Dr John de Verteuil's heart valve clinic at the Border Practice.

Please find attached a copy of the service form as well as a copy of the eMurmur® pdf. With [Custtitle] [Custlastname]'s consent, I have also attached a copy of the their medical record for Dr de Verteuil's reference.

If you have any questions please don't reply to this email as the inbox is not monitored, but feel free to contact me on the number below or email pharmacy.fxm19@nhs.net.

Kind regards,

[UserFirstName] [UserLastName]

Pharmacist Independent Prescriber,
Pharmacy Manager

Chapel Pharmacy
102-104 Chapel Lane,
Farnborough
01276 33 819

Community Heart Valve Check



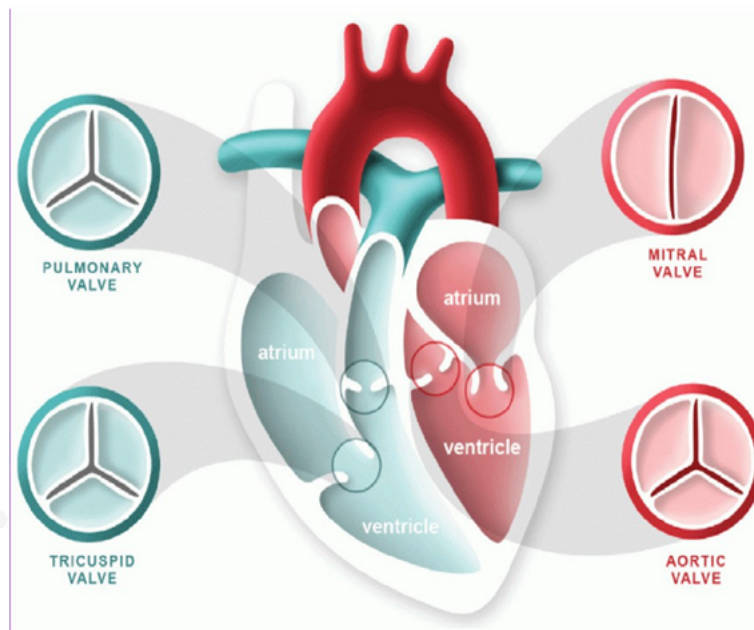
Early identification of **Heart Valve Disease** is important as this helps prevent damage to the heart and reduces the risk of developing cardiovascular disease.

To help early identification of heart valve problems the **Community Cardiology Clinic** is offering a **free** Heart Valve Check at Chapel Pharmacy to those at risk.

Heart valve disease is a serious condition involving damage to one or more of the four heart valves. Early detection of any problem means appropriate treatment can be started which will help prevent damage to the heart.

Heart valve disease is identified through listening to your heart beat with a stethoscope.

It can occur at any age but is more common in the over 65s.



Your Heart Matters

Heart Valve Check

- The check will be undertaken at Chapel Pharmacy in one of their private consulting rooms by a pharmacist.
- A digital stethoscope will be placed on your chest to identify whether you have a heart murmur. The stethoscope is linked to a smart phone which will help determine if the murmur is significant.
- If the murmur is significant, you will be referred to the Community Cardiology Clinic based at Border Practice.
- Your GP practice will be informed of the check.

Should you book a Heart Valve Check?

- If you have NOT already been diagnosed with a Heart Valve problem? **Yes!**
- If you are over 75? **Yes!**
- If you have angina, high blood pressure, atrial fibrillation or type II diabetes? **Yes!**

To book your free Heart Valve Check please phone 01276 33819

The pharmacists at Chapel Lane Pharmacy are Mak Johal and James Martin.

The Community Cardiology clinic is led by Dr John de Verteuil.



Wilmington
Healthcare

WHCB16921