British Heart Foundation

Research Evaluation Report: Outputs and impact metrics of BHF funded research

2023-24

Research

Foreword

This report captures the research outputs realised or reported in the 2023 to 2024 financial year and outlines strategic initiatives introduced over a similar timeframe. The output data presented have been gathered from the 2024 annual Researchfish submissions. The 2024 Researchfish submission included elibible awards open for any length of time between 2019 to 2024 (Appendix, page 50). Other resources used in the report include:

- BHF Annual Report 2023-2024[1]
  (2023 to 2024 financial year information)
- Internal statistics produced by the Medical Directorate, BHF[2]
  (2023 to 2024 financial year information)
- Publication data, retrieved and collated from Europe PubMed Central (Europe PMC)[3]
  (dates as indicated)
- Citation data from InCites, Clarivate[4]
  (dates as indicated)

The annual BHF Research Evaluation Report is primarily an internal resource to be used as a reference document within BHF. Please contact the Medical Directorate at researchevaluation@bhf.org.uk for sign-off before using the information in this report.

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[1] BHF Annual Report 2024, BHF, https://www.bhf.org.uk/-/media/files/what-we-do/annual-reports/annual-report-and-accounts-2024.pdf
[2] BHF award information can be found online www.bhf.org.uk/for-professionals/information-for-researchers/previous-awards
[3] Europe PMC, http://europepmc.org/
[4] InCites, Clarivate, https://incites.clarivate.com/

Executive summary: key data for the year

Received in 2023/24

Awarded in 2023/24

BHF's current research investment

Highlights in strategic 'we will' statements:

Fund research across the full spectrum from discovery science to innovation in practice

CardioStars is helping BHF funded researchers maximise the translational potential of their research

Attract, nurture and support the brightest minds and the best ideas

Research staff numbers funded through BHF research grants is starting to show signs of recovery since the pandemic

Make strategic investments to address unmet needs and seize new opportunities

The BHF/DRI Centre for Vascular Dementia Research will increase vascular dementia research investment by £9m

Actively develop new national & international partnerships to maximise our impact

BHF DSC in alliance with leading funders has formed Catalysts to drive research into stroke, diabetes and kidney disease.

Use our position as a major research funder to influence the research environment

Through its commitment to DORA, BHF has helped to ensure its funding and evaluation processes fair and transparent

Measure and share the impact of the research we fund

BHF's Impact thematic reviews showcase the impact of BHF support in a specific disease area, field of science, or technology

Abbreviations:
BHF/DRI - British Heart Foundation/UK Dementia Research Institute
BHF DSC - British Heart Foundation Data Science Centre
DORA – San Franciso Declaration on Research Assessment

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Introduction

Latest figures show that in 2022, the number of people dying prematurely of cardiovascular disease is at its highest since 2008[5]. Despite significant advances in research, the progress made in tackling cardiovascular disease is beginning to stall, as for the first time, there is an increase in death rates from cardiovascular disease. BHF's response will include the development of a new Research Strategy.

BHF's core mission is to fund pioneering research to prevent, diagnose, treat and where possible, cure cardiovascular disease. In acknowledgement of the high-quality discovery science BHF has funded and will continue to fund, the BHF strategy to 2030 highlighted an ambition to see more research being translated into patient benefit. As the BHF strategy to 2030 was developed, the funding threshold for the Translational Awards scheme was raised from £250k to £750k and since its publication, the increased focus on innovation has helped increase the proportion of translational research funded by BHF[6]. More recently, the CardioStars educational programme[7] has helped give researchers the tools they need to translate their research breakthroughs into innovations. However, there is more BHF can do to help researchers realise the full translational potential of their pioneering research.

It is understood that the research community has suffered from attrition that, whilst exacerbated by the pandemic, has had its roots in long established poor research culture and work-life balance practices[8]. The lack of security, narrow measures of success and discrimination, amongst other setbacks, have led to non-clinical and clinical researchers seeking employment elsewhere. Through initiatives such as the BHF EDI strategy - Igniting Change[9], becoming a San Francisco Declaration on Research Assessment (DORA) signatory[10] and extending some fellowship schemes[11], BHF has begun to help address this crisis and make cardiovascular research an attractive career choice for the brightest researchers.

Recent opportunities in artificial intelligence have highlighted the importance of interdisciplinary research. Although BHF has always been open to funding interdisciplinary research at the full spectrum of discovery to clinical research, there has been little extension into engineering, physics, mathematics, behavioural sciences and until recently, data science. Creating or expanding a cardiovascular space within these disciplines requires capacity building and potentially support for more high-risk projects.

Whilst BHF has made progress in the areas highlighted above, there is more work to do. The new BHF Research Strategy will help us outline our ambitions and focus progress. The strategy will be

[5] Early heart disease deaths rise to 14-year high, https://www.bhf.org.uk/what-we-do/news-from-the-bhf/news-archive/2024/january/early-heart-disease-deaths-rise-to-14-year-high
[6] Research spend categorised into discovery science, translational and clinical research using HRCS coding, Research Evaluation Report: Outputs and impact metrics of BHF funded research 2022-23
[7] CardioStars, https://www.bhf.org.uk/what-we-do/news-from-the-bhf/news-archive/2024/march/bhf-partners-with-panacea-innovation-to-launch-cardiostars
[8] What researchers think about the culture they work in, Wellcome Trust, https://wellcome.org/reports/what-researchers-think-about-research-culture
[9] BHF EDI strategy - Igniting Change, https://www.bhf.org.uk/what-we-do/equality-diversity-and-inclusion
[10] Fit for DORA, https://www.bhf.org.uk/what-we-do/news-from-the-bhf/news-archive/2021/april/fit-for-dora
[11] Flexible, longer term personal awards, Research evaluation report: Outputs, outcomes and impact of BHF funded research: 2015-16

developed with the cardiovascular research community and other stakeholders, ensuring that BHF's core mission is at its heart.

This report is an overview of research initiatives, outputs and research funded in the context of the BHF Strategy to 2030. With the development of a new Research strategy, it is likely that a new style of reporting on progress will be necessary and therefore this is the tenth and last edition of the BHF Research Evaluation Report.

Fund research into all heart and circulatory diseases and their risk factors

BHF 2023-2024 financial year research funding

In the 2023-2024 financial year, BHF awarded around £112 million to 177 new research grants across the UK (figures unaudited). This brings BHF's current research portfolio to just over 700 research grants, worth over £435 million. BHF received 544 full applications worth around £307m, increase around a third from the previous financial year. Around 53% of external experts approached agreed to review, compared with 47% in the previous year, suggest there is some continued recovery in experts willing to provide independent review.

New awards in the financial year are below (figures are rounded, include joint awards, 4-year PhD studentships and exclude supplements).

- 74 Fellowships*, £26.6m
- 59 Project Grants, £16.0m
- 9 Programme Grants, £11.9m
- 9 Special Project Grants, £4.8m
- 1 New Horizons Grant, £239k
- 8 Research Excellence Awards, £34m
- 6 Clinical Study Grants, £5.2m
- 2 Infrastructure Grants, £1.2m
- 1 Translational Award, £125k
- 3 Strategic Initiative Awards, £7.6m
- 4 International Awards, £1.9m
- 1 Accelerator Award, £1m

**Including one Research Training Fellowship and one PhD studentship that were not taken up, one PhD studentship that ended prematurely.*

BHF is primarily a response mode funder, investing in cardiovascular research across the UK. The distribution of BHF funding across UK research institutions is dependent on the application rates and the success of individual researchers. The tables below show the top 10 research institutions receiving BHF funding in the financial year.

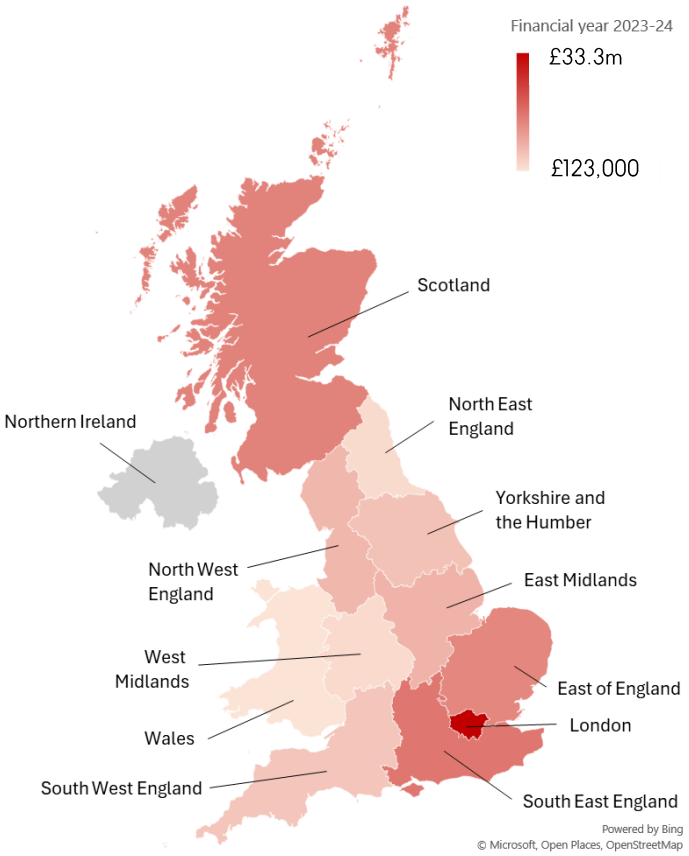
Top 10 institutions - number of awards 2023-24	
Institution	Number
Imperial College London	26
University of Oxford	21
University of Cambridge	16
King's College London	13
University of Edinburgh	10
University of Manchester	10
University of Bristol	10
University of Leicester	8
University College London	8
University of Leeds	8

Top 10 institutions - amount awarded 2023-24	
Institution	Amount
Imperial College London	£15.1m
University of Oxford	£14.9m
University of Cambridge	£13.5m
University of Edinburgh	£9.8m
King's College London	£7.6m
University of Leicester	£7.1m
University of Manchester	£6.1m
University College London	£5.4m
University of Bristol	£4.3m
University of Leeds	£4.1m

BHF funds cardiovascular research across the UK, as indicated by the following map (International Territorial Level 1[12] used). Note that £7.6m has been allocated to research projects or resources across the UK, which is not represented.

[12] International Territorial Level 1, https://www.ons.gov.uk/methodology/geography/ukgeographies/eurostat#international-territorial-levels-itls-

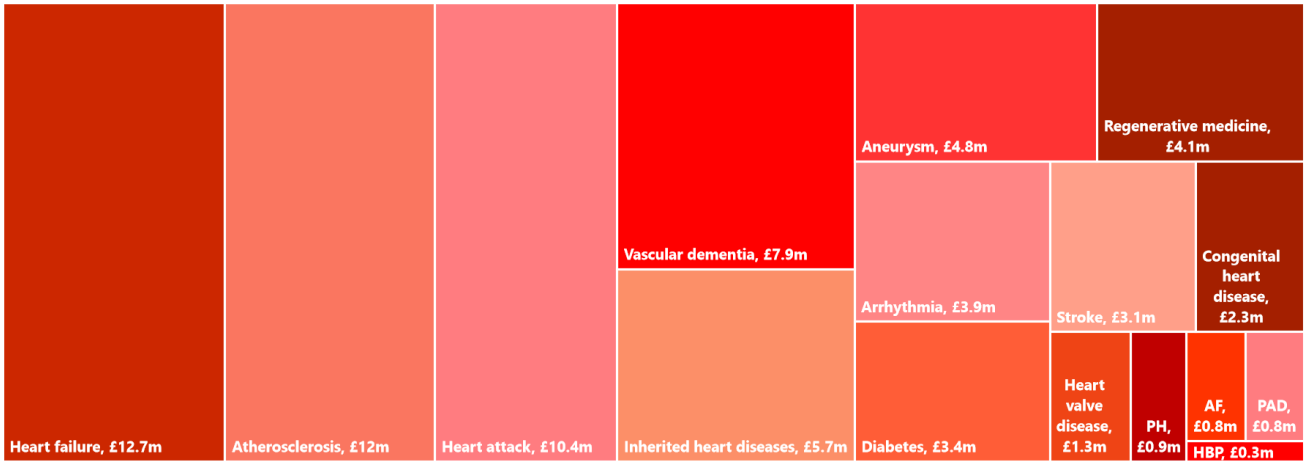
Amount awarded in 2023-2024 financial year by location



BHF funds research into all aspects of cardiovascular disease and related conditions[13]. The graph below represents funding in different disease areas by newly awarded grants proportional to financial year. Note that the range of conditions is not exhaustive, and the graph excludes grants worth £19.6m where there is a focus on better understanding basic biology or where such coding is not applicable (e.g. where there are multiple projects funded from a single grant).

BHF awards across selected disease areas 2023-2024 (total value of awards indicated)

PH, Pulmonary hypertension; AF, Atrial fibrillation; PAD, Peripheral arterial disease; HBP, Hypertension



[13] For more information, see BHF data visuals, https://www.bhf.org.uk/what-we-do/our-research/funding-across-the-uk-visual

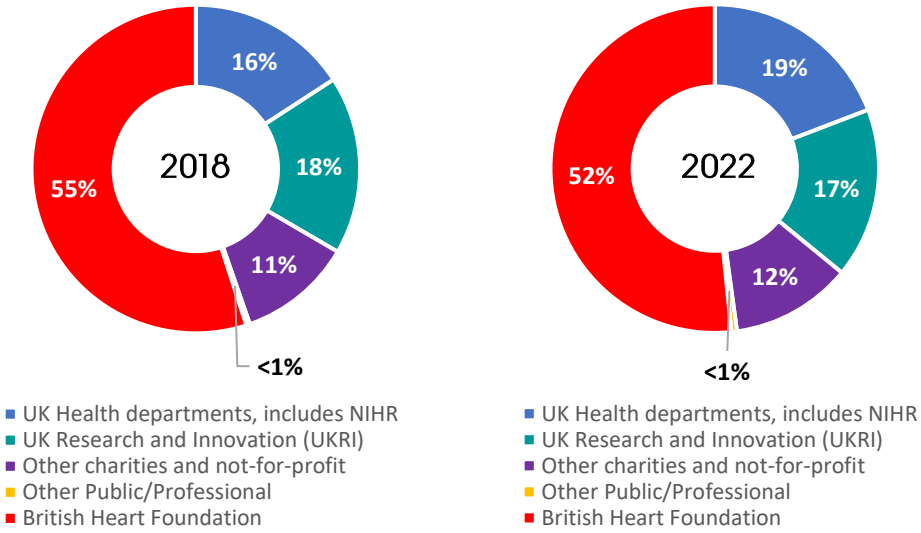
UKCRC Health Research Analysis 2022

UKCRC Health Research Analysis 2022[14] is a detailed overview of research funding from the public sector in the UK. Including research funding data from governments, charities, societies, and professional bodies, the report is the most comprehensive publicly available overview of research spend for the 2022 calendar year.

The 2022 report showed for the first time a decrease in both direct and indirect research spend[15], from £4.28bn in 2018 to £4.17bn in 2022 (-£110M real-term decrease). This is associated with a significant decrease in charity funding (-£209M real-term decrease compared to 2018).

The report also showed a small decrease in direct cardiovascular research spend[16] (-£5M real-term decrease compared to 2018). BHF remains the largest independent funder of cardiovascular research in the UK, with charities and not-for-profit organisation funding 64% of all cardiovascular research in the UK.

Direct cardiovascular reported spend reported in the UK Health Research Analysis in 2018 and 2022



Cardiovascular research is the sixth largest area of research funding, worth over £160m in the 2022 analysis by HRCS. Predominately supported by BHF, other major funders include UK Research and Innovation (UKRI), Department of Health and Social Care (via NIHR) and Wellcome Trust. It is to be noted that there is substantial indirect funding towards cardiovascular research provided by NIHR via the Biomedical Research Centres and other funding schemes, which were not included in the analysis.

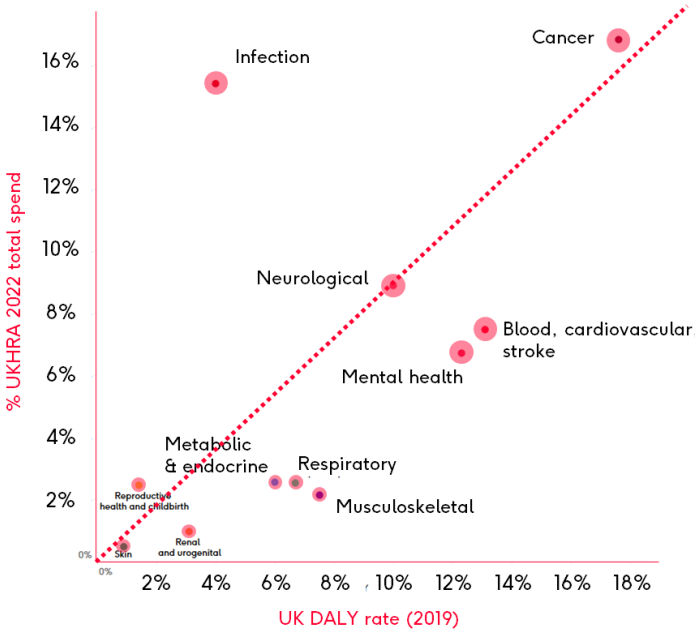
[14] UK Health Research Analysis 2022, (UK Clinical Research Collaboration, 2023) https://hrcsonline.net/reports/analysis-reports/uk-health-research-analysis-2022/

[15] "Direct funding" include funding towards projects with specific research aim; "indirect research funding" includes funding towards buildings, infrastructure, block grants, travel grants, etc

[16] Cardiovascular research identified in the UKCRC analysis using UKCRC Health Research Classification System Health Categories, https://hrcsonline.net/health-categories/. Note this excludes stroke research.

However, the report highlights poor matching of the UK's burden of disease in DALY rates (Disability-Adjusted Life Year) and blood/cardiovascular/stroke[17] research funding available, with a UK DALY rate of 13.1% vs 7.47% total research spend.

UK research funding relative to disease burden



The findings from the 2022 UKCRC Health Research Analysis, together with another BHF analysis revealing that cardiovascular disease research funding faces a shortfall of more than a quarter of a billion pounds between 2025 and 2035. BHF warned UK Government that future life saving scientific breakthroughs could be at risk and called on Government to commit to increase funding to safeguard the future of UK cardiovascular research and drive advances in some of the country's biggest killers, including heart disease and stroke[18].

[17] "blood/cardiovascular/stroke" research identified in the UKCRC analysis using UKCRC Health Research Classification System Health Categories; blood, cardiovascular and stroke combined, https://hrcsonline.net/health-categories/

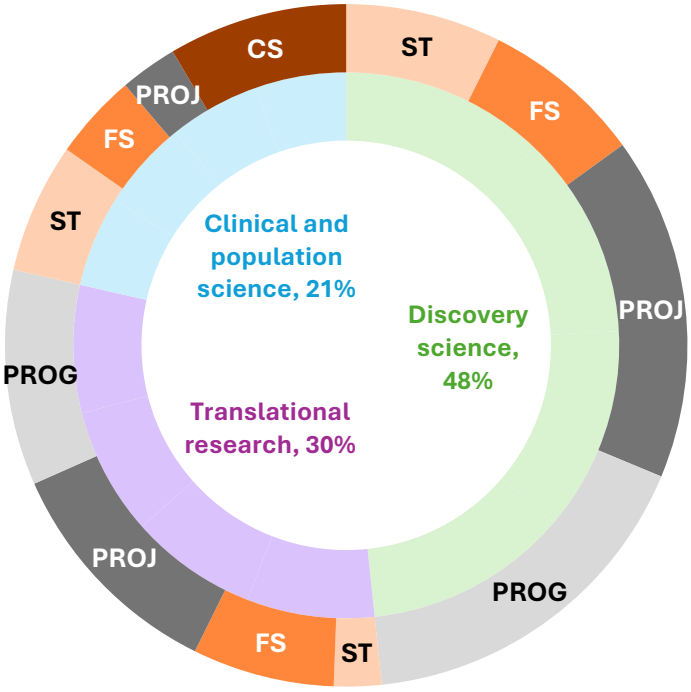
[18] https://www.bhf.org.uk/what-we-do/news-from-the-bhf/news-archive/2024/may/heart-research-breakthroughs-under-threat-from-funding-shortfall

Fund research across the full spectrum from discovery science to innovation in practice

Funding research from bench to bedside and beyond

BHF supports research across the full spectrum, from discovery science through to clinical studies. This full spectrum of research is funded through three funding committees, Chairs and Programme Grants, Fellowships and Project Grant committees. There are also two specialist committees dedicated to translational research (Translational Award Committee) and clinical studies (Clinical Studies Committee). Research funded in the last financial year has been coded into three types of research based on the Health Research Classification System[19], (see appendix). The proportion of spend in the three broad types of research is similar to the last financial year (excluding the Big Beat Challenge), although an increase in translational research over the last five years is observed. Note a large proportion of the 2023-24 financial year portfolio of new awards were not codable due to awards funding multiple projects, such as the Research Excellence Awards or Accelerator Awards, or were awards where coding was not appropriate, for example infrastructure awards or strategic initiatives (total awards not codable £49.5m out of £110.5m research funding).

2023-24 research spend categorised into discovery science, translational research and, clinical and population science based on HRCS coding



Studentship (ST)	includes all PhD studentship schemes
Fellowship (FS)	includes all fellowship schemes, excluding studentships
Project funding (PROJ)	includes Project Grants, Translational Awards, New Horizons Grants and International awards
Programme/special project funding (PROG)	includes Programme Grants and Special Project Grants
Clinical Study (CS)	includes Clinical Studies Grants only

[19] Health Research Classification System, Research Activity https://hrcsonline.net/research-activities/

Translational research and commercial partnerships

The aim of translational research is to use breakthroughs in discovery science to improve human health through the development of novel drugs, therapeutic approaches, diagnostics and devices. Translating scientific discoveries into clinical application is a complex and challenging process that requires numerous steps including pre-clinical research, technology development, clinical trials, and clinical implementation of novel products. Additionally, such translational research also relies on a multidisciplinary approach, and is often centred around collaborative teams of scientists, clinicians, engineers and commercialisation experts.

CardioStars

CardioStars[20] is a research translation and commercialisation educational programme run in partnership between the British Heart Foundation and Panacea Innovation. CardioStars is designed to give scientists and clinicians the tools they need to transform research breakthroughs into innovations that deliver real-world benefits for heart patients around the world.

Aligned with the strategic objective to increase the translation of the research we support, this program is structured into two distinct phases, Action and Develop. Each phase is specifically designed to support researchers at different stages in their journey of translating and commercialising their research.

'Action' is a four-week structured educational and engagement programme that aims to help researchers consider and begin to explore the translational potential of their research. It is aimed at those with little or no experience in research translation. Each participant in Action will be invited to an introductory one day "mini-bootcamp" covering research translation, commercialisation, and entrepreneurship.

Develop is an eight-week initiative highlighted by a comprehensive 2.5-day bootcamp designed to provide in-depth education in research translation, entrepreneurship and market entry strategies. Participants will also develop a business strategy to help pitch to their idea to investors. CardioStars programme will offer guidance on developing a business strategy to advance research discoveries, helping bridge the gap between idea, innovation and impact.

Translational Awards Committee

BHF Translational Awards provide up to £750,000 of funding for projects lasting up to 36 months. Applications should focus on an innovation that is novel, inventive and which addresses a significant unmet clinical need. The scheme allows innovations from all classes including therapeutics, devices, diagnostics, digital solutions and regenerative medicine. The Translational Awards Committee administer the Translational Awards at their 6 monthly meetings and consists of members from academic, clinical and commercial backgrounds. In the 2023-24 financial year, the Translational Awards Committee assessed 14 new preliminary applications and made one new award (details following).

[20] CardioStars, https://panacea-stars.com/projects/cardiostars/

Professor Damion Corrigan, University of Strathclyde
Development of a low cost and easy to use electrochemical detection platform for screening cardiac biomarkers at the point of need
Rapid action when someone is having a heart attack is essential to minimise tissue damage and reduce the risk of death. Currently, testing to confirm a suspected heart attack is carried out in the hospital using specialist equipment. This means a lengthy trip to hospital in an ambulance, followed by an assessment before the diagnosis can be confirmed. For people in remote communities, such as the Scottish Highlands and Islands, it often means transport by air ambulance which is stressful and extremely costly.

The technology proposed in this project offers an alternative approach, taking the diagnostic test out of the hospital environment, providing a faster time to confirmed diagnosis. The test will be lower cost, more accessible and available at the point of need. This will empower paramedics, community healthcare practitioners and first responders to make the best decisions for delivering healthcare to patients and help save lives.

New spin out company reported in 2023-24

Researchers reported 2 new spin out companies in 2023. An example of one of these spin out companies is XRnostics Ltd.

XRnostics Ltd is a spin out company that has been developed in part with support from a BHF translational research award led by Professor John Simpson and his team at King's College London and Evelina Children's Hospital, Guy's and St Thomas' NHS Foundation Trust. XRnostics Ltd developed the virtual reality technology Heart VR (TM), allowing clinicians to rapidly and intuitively immerse themselves in multimodal image volumes of a patient's heart, for improving interventional planning and medical device selection.

To plan catheter or surgical cardiac procedures, the clinical team need a detailed 3D understanding of the anatomy of the heart and the cardiac lesion to be addressed. The use of immersive extended reality imaging (virtual reality or augmented reality) facilitates such understanding. The core aim of research and product development has been to optimise such planning to the potential benefit of affected patients.

It is anticipated that the system will have multiple benefits for patients and the overall healthcare system globally, including improved procedure selection, time and financial savings and staff education and training.

Reported commercial investment and collaborations

In Researchfish researchers reported over £27.9m in commercial investment to continue BHF funded research. The majority of reported private further funding was from Pharma, with significant investments (over £2m) from Novo Nordisk, Pfizer Ltd, AstraZeneca plc. Normalised by value of BHF funding, the highest further investment reported from the private sector was for New Horizon Grant funding schemes. This in keeping with the remit of this scheme to support the development of new technologies.

Over 100 BHF funded researchers reported commercial collaborations contributing to approximately 9% of the awards in the annual BHF Researchfish submission (139 awards). The total number of unique collaborations with the private sector is 166, with the majority having been initiated since 2019. Translational Awards reported the most collaborations with the private sector[21]. Similar to reported commercial funding, the majority of collaborations were with Pharma companies, the most common being with AstraZeneca plc with 40% of reported collaborations with BHF funded researchers.

Collaborations by private sector type (Researchfish 2024)

Interactions with the private sector can also be evidenced through the listing of corporate organisations in publications. A private sector collaboration[22] is present in 9% of journal articles acknowledging BHF funding since 2019. The top 5 most frequent private sector collaborators are listed in the following table.

Top 5 industry collaborators found in publications (2019-2023)

Industry collaborator	Percentage of journal articles acknowledging BHF funding and an industry collaboration *(9% of all journal articles in total)*
AstraZeneca	15%
Siemens AG	8%
GlaxoSmithKline	7%
Pfizer	4%
Roche Holding	4%

[21] Normalised by the number of awards in included in the Researchfish submission

[22] Documents acknowledging BHF funding and published between 01/01/2019-31/12/2023 were retrieved from EuropePMC in July 2024 and uploaded in the bibliometric analytic platform InCites. Out of 11,992 publications uploaded, 11,073 (92%) were retrieved in InCites, of these 8,424 were classed as (research) articles. An industry collaborative publication is one that lists its organization type as "corporate" for one or more of the co-author's affiliations.

Clinical Studies Committee overview

In the 2023/24 financial year, the Clinical Studies Committee assessed 10 applications for Clinical Study Grants totalling ~£9.8m. The Committee approved funding for six Clinical Study Grants totalling £5.1m.

1. CS/F/23/190054: The Comparative Effectiveness of Contemporary Heart Failure Medical Management With vs. Without an ICD (CONTEMP-ICD) Study. £708,168 over 7 years. Professor Elijah Behr, St George's, University of London. UK arm of international trial led from the US. (GCRFF Multinational Clinical Trials Initiative endorsed, page 29). Conditional award subject to securing funding 70% of total trial recruitment. *Award closed after US funder declined to fund in partnership with BHF.*
2. CS/F/23/190055: Randomized comparison of the Outcomes of single vs Multiple Arterial grafts trial in Women (ROMA-Women). £311,192 over 6 years 8 months. Professor Gavin Murphy, University of Leicester. UK arm of international trial led from the US. (GCRFF Multinational Clinical Trials Initiative endorsed, page 29). Conditional award subject to securing funding to support 70% of total trial recruitment.
3. CS/F/23/190056: Women's Aneurysm Research: Repair Immediately Or Routine Surveillance: WARRIORS trial. £2,257,539 over 9 years, 6 months. Professor Janet Powell, Imperial College London. International trial led from the UK. (GCRFF Multinational Clinical Trials Initiative endorsed, page 29). Conditional award subject to securing funding to support 70% of total trial recruitment.
4. CS/F/23/190062: Remote screening for subclinical atrial fibrillation in elderly individuals with cardiovascular risk factors using 14-day continuous non-invasive monitoring - the Active Monitoring for Atrial Fibrillation (AMALFI) trial. £272,023 over 4 years. Professor Louise Bowman, University of Oxford.
5. CS/F/23/190063: The United Kingdom Metformin Aneurysm Trial (UKMAT). £1,290,726 over 5 years. Professor Matthew Bown, University of Leicester. UK arm of international trial led from Australia.
6. CS/F/23/190067: 10-year median follow-up of long-term stroke onset rates in ACST-2, the largest randomised trial of carotid surgery vs carotid stenting. £341,412 over 3 years. Professor Richard Bulbulia, University of Oxford. Follow up of an international trial led from the UK.

CS/F/23/190063 - The United Kingdom Metformin Aneurysm Trial (UKMAT)
Professor Matthew Bown, University of Leicester
An abdominal aortic aneurysm (AAA) is a swelling of the main artery in the abdomen, which can gradually grow over time. If an AAA gets too big, it can rupture and cause internal bleeding that can be fatal. If it gets large enough to be at risk of rupturing, an operation can be performed to repair the aorta. For most people this operation works well, but it does have risks and not everyone who may need surgery is able or willing to have the procedure. There are currently no drug treatments for AAA. Previous research has suggested that people who have both an AAA and diabetes and are taking the diabetes medication metformin may have slower growing aneurysms. The MAT trial is a collaboration between researchers in Australia, New Zealand and the UK, who want to find out whether metformin can slow down AAA growth in people who don't have diabetes. The trial will be led from Australia, and will involve 2000 people with a small AAA from across Australia, New Zealand and the UK. The UK part of the trial, funded by BHF, aims to enrol 1000 people across 10 UK hospitals. Participants will be randomly assigned to take either a daily metformin pill or a placebo pill, and the study aims to assess whether metformin reduces the need for AAA surgery. If the results are positive, metformin could be the first proven drug treatment for AAA, potentially benefiting thousands globally by reducing the need for surgery.

Clinical trials publishing results in 2023/24

ARREST - Where should people who have a cardiac arrest out of hospital be treated? CS/16/3/32615, Professor Simon Redwood (King's College London)

The ARREST trial showed that it is just as effective to treat people who've had a cardiac arrest out of hospital at their nearest emergency department as treating them at a Cardiac Arrest Centre. The trial recruited 860 participants from across London with the collaboration of London ambulance[23]. Half were treated at a Cardiac Arrest Centre and half at an emergency department. Despite Cardiac Arrest Centres having specialised staff and equipment on hand, patients in both groups had the same overall prognosis. The trial found no significant difference in 30-day mortality or 3-month outcomes between the two groups.

LACI-2 - Can two existing drugs help prevent dementia after lacunar stroke? CS/15/5/31475, Professor Joanna Wardlaw (University of Edinburgh)

Lacunar strokes affect at least 25,000 people in the UK each year and can lead to cognitive impairment and vascular dementia. LACI-2 was a pilot study that found that two 'off the shelf' drugs could become some of the first proven treatments for preventing cognitive decline after lacunar stroke[24]. The study enrolled 363 people with lacunar stroke, who were randomly assigned to take isosorbide mononitrate (ISMN), cilostazol, both drugs or neither drug for up to a year. LACI-2 showed that carrying out a larger scale trial to definitively test ISMN and cilostazol in this group would be safe and feasible, and provided some preliminary evidence of beneficial effects from these medications - particularly when they're used in combination.

UKGRIS - Can a risk score help improve care for NSTEMI heart attack and unstable angina? CS/16/2/32145, Professor Christopher Gale (University of Leeds)

Patients with NSTEMI or unstable angina, collectively known as NSTEACS, have a high risk of subsequent cardiovascular events. UKGRIS examined whether using the GRACE risk score – a tool that uses the patient's clinical and test information to help assess their cardiovascular risk – impacts the care that people receive when admitted with NSTEACS[25]. The study showed that while many people with NSTEACS received appropriate medications, many did not get other recommended treatment, e.g. angiography (an X ray of their coronary arteries) or a referral to cardiac rehabilitation. Ultimately, the trial found that using the GRACE risk score did not reduce cardiovascular events at 12 months compared with standard care.

[23] Cardiac arrest – ARREST https://www.bhf.org.uk/what-we-do/our-research/impact-of-clinical-trials/arrest-trial
[24] Stroke – LACI-2 https://www.bhf.org.uk/what-we-do/our-research/impact-of-clinical-trials/laci-2-trial
[25] Heart attack & Angina – UKGRIS https://www.bhf.org.uk/what-we-do/our-research/impact-of-clinical-trials/ukgris-trial

Attract, nurture and support the brightest minds and the best ideas

BHF Personal Awards

BHF fellowship schemes support researchers at all career stages, spanning the whole research lifetime of researchers in both non-clinical and clinical pathways. The success rates of fellowship applications are continuously monitored by BHF. In the financial year 2023-2024, BHF directly funded 60 personal fellowships and 2 jointly funded personal fellowships (74 "fellowships" in total including the 4-year PhD scheme (x12) which are awarded directly to universities and support up to three students each). Application numbers and award rates for non-clinical and clinical fellowships for this period are shown below:

Application and award number for non-clinical fellowships 2023-2024

Fellowship type	Awards/applications	Active awards*
3-year PhD Studentship	19†/32	50
4-year PhD Studentship	12 (2023 intake)	12 universities, <3 students per university
Advanced Training Award	0/1	1
Career Re-entry Fellowship	1‡/1	3§
Immediate Postdoctoral Basic Science Fellowship	5/14	10
Intermediate Basic Science Fellowship	9/25	32
Senior Basic Science Fellowship	0/5	12

**At end 03/2024; †Number of awards includes one joint NC3Rs PhD Studentship, one declined PhD Studentship and a PhD Studentship that ended prematurely; ‡One joint Daphne Jackson Fellowship was awarded; §Active awards include three jointly funded Daphne Jackson Trust Fellowships*

Application and award rates for clinical fellowships 2023-2024

Fellowship type	Awards/applications	Active awards*
MBPhD Studentship	0/2	3
Clinical Research Training Fellowship	24/52	62
Research Training Fellowship (Nurses & HPs)	2†/4	3
Clinical Research Leave Fellowship	N/A	2
Consultant Research Award	0/4	3
Intermediate Clinical Research Fellowship	2/13	12
Career Development Research Fellowship (Nurses & HPs)	0/0	2
Senior Clinical Research Fellowship	0/6	2

**At end 03/2024; †One Research Training Fellowship was declined.*

4-year PhD studentship review

BHF's competition for the 4-year PhD studentship programme has been postponed to the next academic year to allow BHF to explore the possibility of expanding the scope and scale of the scheme. Our aim is to enhance the impact of this flagship initiative. In the interim, resources that had been allocated to support the renewal of the programme during 2024-25 are available to support for additional studentship applications through the 3-year programme route. The competition is due to be launched in January 2025.

Mentorship: AMS mentorship scheme
BHF has agreed to join the Academy of Medical Sciences Mentoring programme to better support its fellowship holders. By joining the programme, BHF hopes to provide a platform for BHF fellows with one-on-one mentorship to equip them with confidence and knowledge as they go on to develop their career independently. The programme is due to start in late 2024 and we will survey uptake and satisfaction of those who decide to take part in the programme.

BHF Chair awards (BHF Professors)

We award personal chairs to individuals with outstanding cardiovascular research achievements and leadership qualities with the aim of supporting and enhancing their current and future research activities. The professors are expected to bring research leadership at an internationally competitive level and a commitment to training future cardiovascular scientists. Additional important considerations are how the candidate supports and enhances the overall cardiovascular research strategy of the university and the added value the chair brings to BHF.

While supporting the very best researchers, we aim to award personal chairs that cover a wide remit of cardiovascular research and a broad geographical distribution across the UK. One new appointment has been made in the last year, reflecting new expertise for the BHF Personal Chair cohort and emerging science and cutting-edge research techniques.

Professor Declan O'Regan, Imperial College London
The BHF Chair of Cardiovascular AI
£1,491,285 (CH/F/24/90015)

Understanding the transition from health to disease through imaging-genetics
This Chair will support a research program that harnesses advances in computer vision, AI and genomics to investigate causal genetic and environmental risk factors for cardiovascular disease. The Chair will support three main aims: (i) To discover mechanisms of cardiovascular ageing and loss of homeostatic reserve, (ii) Develop new approaches for disease classification, risk stratification and therapy responsiveness, and (iii) Understand how genes and environment interact to affect the expressivity of complex disease traits. Together, this program will prioritise new therapeutic targets for ageing, optimise patient management through individual-level predictions of modifiable disease trajectory, and stratify patients who may benefit from initiation of emerging therapies. This work is made possible through advances made by our lab in quantitative image phenotyping at scale, modelling the relationship between complex traits and genomic variation, and predictive analytics using deep phenotyping of cardiac function. A key aim of this Chair is to develop platforms and technologies that leverage investments in bio-banked populations to accelerate discovery and targeting of disease-modifying therapies as well as to foster the training and development of an emerging cadre of clinician scientists able to use data science to improve health outcomes.

Training the next generation of cardiovascular scientists

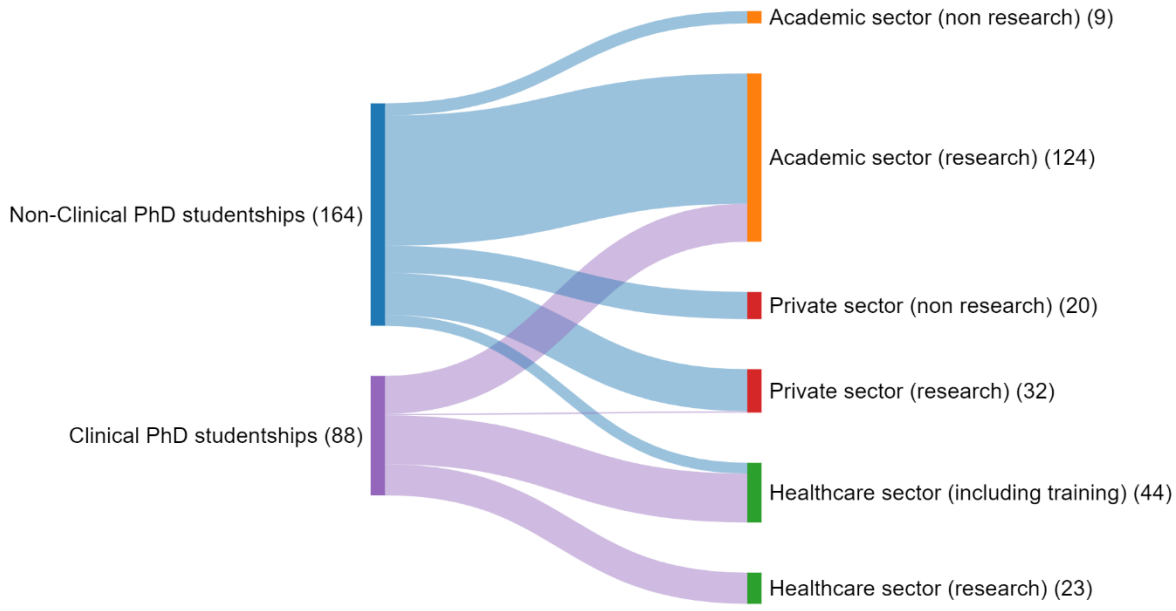
BHF fellowship funding schemes offers support for researchers throughout an academic career, from PhD to leading Professors. At the end of the 2023-2024 financial year, BHF supported around 300 active PhD students.

Researchfish is used to monitor completion rates and the next destination of students (note that PhD studentships funded through BHF personal chairs and Research Excellence Awards are not included in the Researchfish submission). 93% of BHF PhD studentships ending between 2019 and 2023, had either completed or were awaiting their viva at the time of the Researchfish submission in March 2024 (data augmented using Final reports, excludes 4 year PhD studentships where 38% of completion data are unknown).

Researchfish and Final reports were used to categorise the immediate next destination of BHF PhD students/graduates. The first employment recorded after PhD is displayed in the following Sankey diagram, however, for 38% of students/graduates the next destination was unknown or unclear from the report (159/414). Also not shown on the graph, 3 students/graduates reported to be working in the education and public sectors.

It is also important to note that the first post after PhD has been recorded and does not reflect the future intentions of the student/graduate. Whilst many clinical PhD students reported their intentions to go into academic research, their first step was to return to clinical training as indicated in the graph. Nevertheless, 71% of BHF PhD students (where the next destination is known) continue in research.

Sankey diagram showing first career destinations of Clinical and Non-Clinical PhD studentships ending between 2019 and 2023, where known[26]



Non-Clinical PhD studentships; 3 and 4-year PhD studentships
Clinical PhD studentships; Clinical Research Training Fellowships and MB PhD Studentships

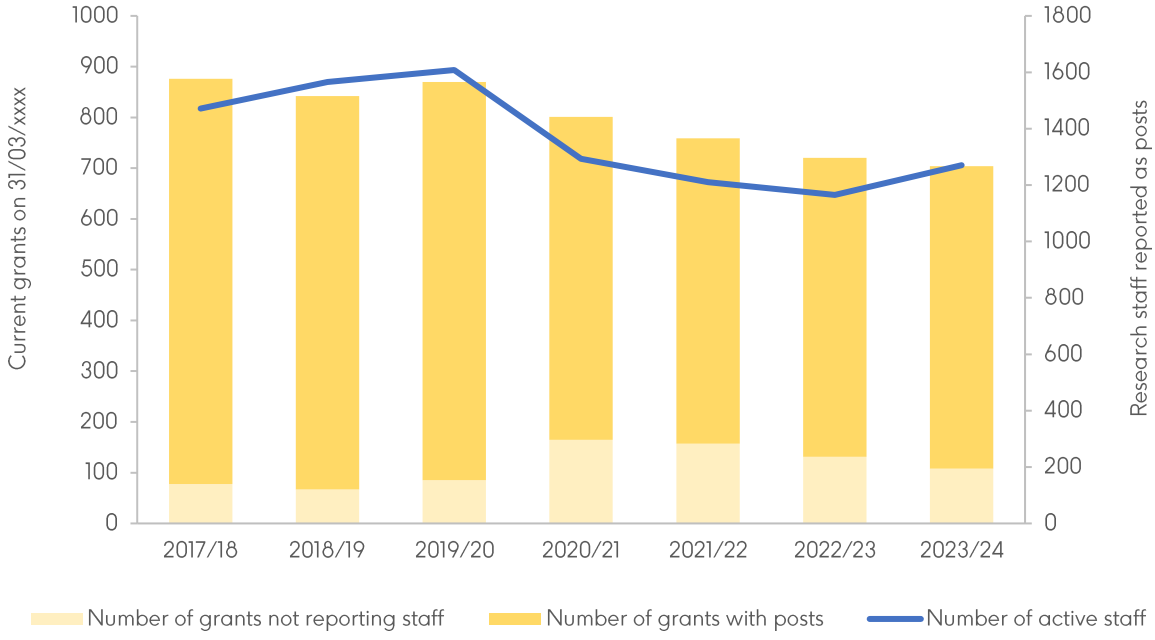
[26] Sankey diagram produced using free online software, https://sankeymatic.com/

The wider BHF research workforce

The number of research staff employed in current research grants is showing the first signs of recovery since 2020/21[27]. The overall reduction in research staff since 2019/20 can be partly explained by the reduction in the number of active research grants caused by the pandemic, a reduction in the number of posts costed in successful applications, and an increase in the proportion of active research grants not reporting staff. Contributing factors to a reduction in number of posts supported by BHF include;

- budgetary constraints confounded by increasing salary costs reducing the number of posts requested in applications
- extended grants continuing short term without salary support
- the increased involvement of research services e.g. Clinical Trial Units, resulting in research staff being costed as services rather than posts
- administrative delays in informing BHF of employment (~10% of current grants)

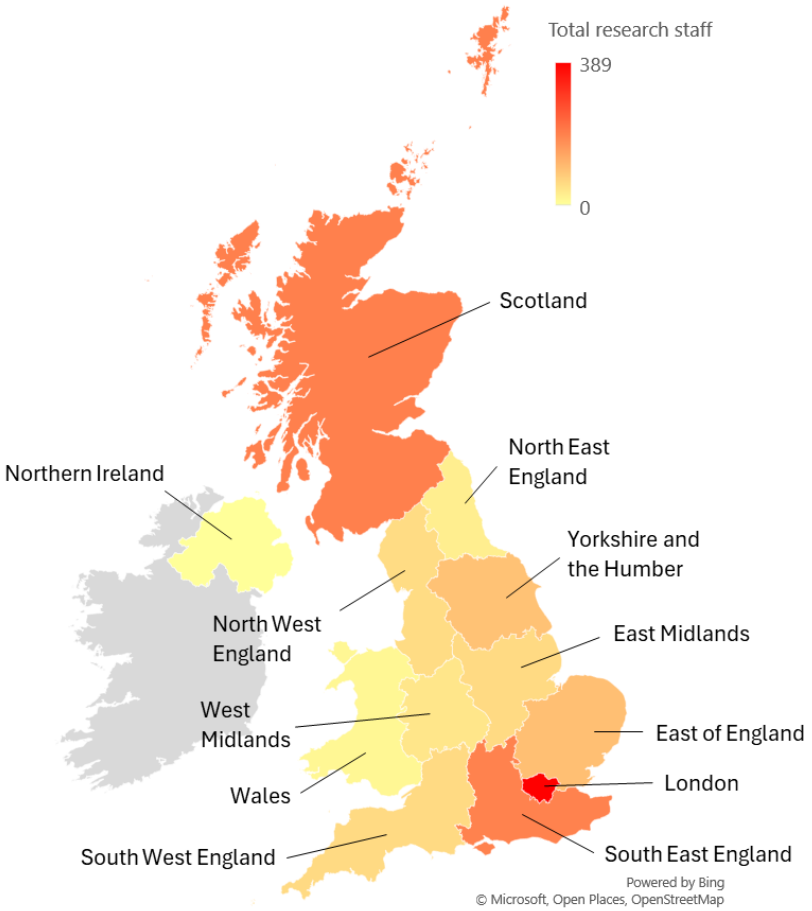
Trends in BHF research workforce

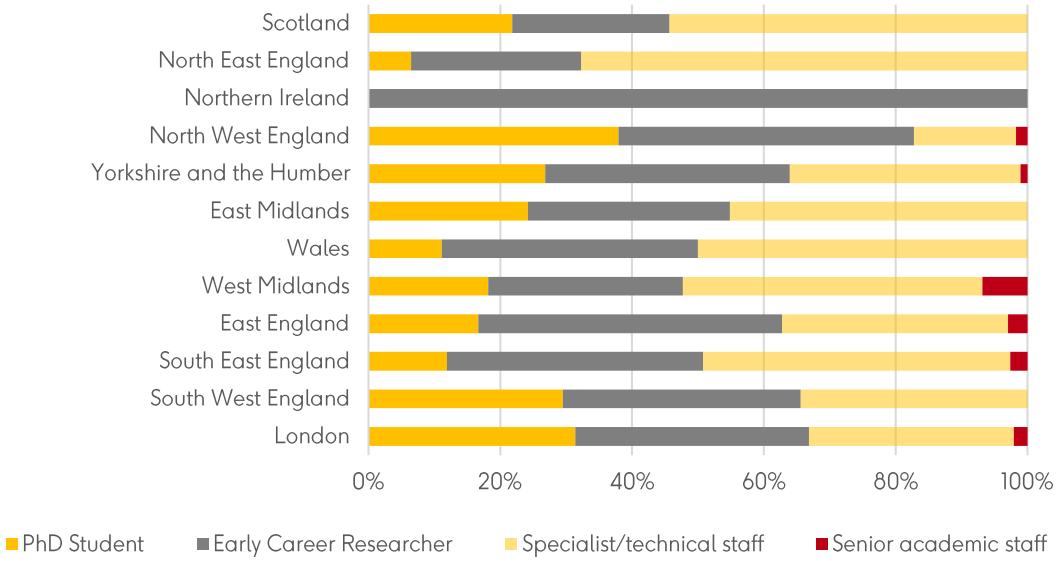


BHF supports research staff based in institutions across the UK through research grants (see map below). This includes over 700 early career researchers[28] (ECRs) and PhD students, which make up the majority of research staff supported (59%). Similar to last year, just over half of BHF supported research staff are based in the Greater Southeast, (54% based in institutions in East of England, South East England and London).

[27] Data obtained from budget information within FlexiGrant. Only includes research staff with enabled BHF salary invoicing on 31/03/2024.
[28] Early career researchers were identified using job titles assigned at application and include postdoctoral research associates, fellows and Non-clinical/Clinical Lecturers.

BHF funded research staff by location across the UK (31 March 2024)[29]





[29] Research roles were identified using job titles assigned at application: early career researchers include postdoctoral research associates, fellows and non-clinical/clinical lecturers; specialist/technical staff include staff with specialist expertise such as statisticians, technicians, research nurses; senior academic staff include professors, senior lecturers, readers and clinical consultants.

Make strategic investments to address unmet needs and seize new opportunities

BHF/UK DRI Centre for Vascular Dementia Research

Following a series of discussions and a joint workshop, BHF and UK Dementia Research Institute (DRI) identified a common desire to significantly expand work on understanding and preventing vascular dementia. A new virtual centre for vascular dementia research was proposed, to be funded via significant new investments by BHF and UK DRI and building upon the UK DRIs extensive existing investment in vascular dementia research. UK DRI has significant existing expertise in blood brain barrier integrity, vascular contributions to amyloid disease and molecular analyses of the crosstalk between different vascular cells in health and disease. The Centre for Vascular Dementia Research (CVDR) will extend this expertise and be devoted to uncovering the causative factors leading directly to vascular dementia and translating that emerging knowledge into meaningful patient impact. The new BHF/UK DRI virtual centre will be fully embedded in the UK DRI research landscape and benefit from the extensive UK DRI opportunities and resources.

Key features of the BHF/DRI Centre for Vascular Dementia Research

At the heart of the new virtual centre will be five new UK DRI Group Leaders to be jointly identified and recruited by BHF and UK DRI. The centre also includes four existing UK DRI Group Leaders whose research is primarily focused on vascular contributions to dementia. The CVDR is overseen by Professor David Attwell FRS (University College London) as Director.

All new group leaders are members of the BHF/DRI Centre for Vascular Dementia Research. Existing DRI group leaders will retain their affiliation to a geographical DRI centre and newly appointed group leaders will become affiliated to whichever geographical DRI centre is most appropriate to their research programme.

BHF has invested £7.5M over an initial five-year period to be complemented by £1.5M of new investment from UK DRI to support the research programmes and operational budgets of the newly recruited group leaders.

The Director of the BHF/DRI Centre for Vascular Dementia Research has control of the operational budgets of all members of the centre and is responsible for the strategic direction of the centre.

All members of the newly created centre have access to DRI platform technologies and internal resources. The CVDR's researchers also have full access to the UK DRI's technology platforms and expertise and funding and support programmes such as pilot project grants, and special project funding. They also have access to the new £30m LifeArc Translational programme and other UK DRI translation awards. The estimated value of this commitment is £850K per group over a five year period leveraging a total of £4.25M of additional resource for vascular dementia research within UK DRI.

BHF Research Excellence and Accelerator awards

Nine leading universities will benefit from a £35 million funding injection from the British Heart Foundation's highly competitive Research Excellence Awards funding scheme, which aims to help to strengthen world-leading cardiovascular disease research in the UK. The nine universities, which will each receive between £1 million and £5 million, are: Imperial College London, King's College London, University of Cambridge, University of Edinburgh, University of Leeds, University of Leicester, University of Manchester, University of Oxford and University College London. The awards will provide funding over the next five years.

BHF Research Excellence and Accelerator award funding

Leading institution	Type of award	Value of award
Oxford	Research Excellence Award	£5,000,000
Cambridge	Research Excellence Award	£5,000,000
Edinburgh	Research Excellence Award	£5,000,000
Imperial	Research Excellence Award	£5,000,000
King's	Research Excellence Award	£4,000,000
Manchester	Research Excellence Award	£4,000,000
Leicester	Research Excellence Award	£3,000,000
UCL	Research Excellence Award	£3,000,000
Leeds	Accelerator Award	£1,000,000

BHF Research Excellence Awards will support universities to cultivate world-class research environments that encourage collaboration, inclusion and innovation, and enable visionary scientists to drive lifesaving breakthroughs.

The funding will enable cutting-edge research to address some of the most pressing issues in cardiovascular disease, including:

- regenerative medicine to prevent and treat heart failure
- improving diagnosis with artificial intelligence
- the impact of health inequalities
- genes and the risk of heart disease
- vascular dementia
- the role of the immune system in heart disease
- how type 2 diabetes can lead to heart failure.

Research Excellence Awards offer researchers greater flexibility than traditional research funding, allowing scientists to quickly launch ambitious projects that can act as a springboard for larger, transformative funding applications.

The funding also aims to break down the silos that have traditionally existed in research, encouraging collaboration between experts from diverse fields. From clinicians to data scientists, and biologists to engineers, the funding will support universities to attract the brightest minds, nurture new talent and foster collaboration to tackle the biggest questions in cardiovascular disease research.

Leveraging of additional investment to continue BHF funded research

The latest UKCRC Health Research Analysis[30] confirmed BHF's continued support of over 50% of cardiovascular research in the UK. However, it is important to remember that BHF funded research exists within an ecosystem of research supported by other funders, either directly or indirectly. A measure of success of BHF funded research is the ability to leverage further support from other funders to continue the work. Researchers report further funding attributable to BHF funded research through Researchfish. The following is an overview of further funding reported in the 2024 BHF Researchfish submission.

In total, BHF researchers reported just under £2.4bn of further funding, which excluding BHF funding (either directly or through BHF Centres of Research Excellence, Regenerative Medicine and Accelerator Awards) is just over £1.9bn. Of note, £0.7bn (£681m) of this total relates to the major renewal of NIHR Biomedical Research Centres (NIHR BRC), many of which have a designated cardiovascular component. The leverage of further funding from sources outside BHF is equivalent to a return of £2.04 for every £1 of BHF investment (excluding NIHR BRC funding and BHF continued support). This is lower than last year's figures due to the inclusion of the BHF Big Beat Challenge (which has not reported additional funding at this stage) and improved identification of funder information allowing for the removal of all BHF and NIHR BRC funding.

Top 10 funders by value of follow-on funding
(BHF included for context, NIHR BRC excluded)

Organisation	Further funding	Percentage of total funding†
British Heart Foundation*	£470.6m	N/A
European Research Council/Commission	£252.7m	21%
National Institute for Health Research	£206.9m	17%
Medical Research Council (MRC)	£190.0m	15%
Wellcome Trust	£135.3m	11%
Government of the UK	£68.0m	6%
Engineering and Physical Sciences Research Council (EPSRC)	£47.4m	4%
BHF centre/partnership	£27.1m	2%
Biotechnology and Biological Sciences Research Council (BBSRC)	£23.0m	2%
Innovate UK	£22.0m	2%

*Values are rounded to nearest £0.1m; *Includes indirect funding from BHF Centres of Research Excellence, Regenerative Medicine and Accelerator Awards; †Percentage of total further funding excluding BHF and NIHR BRC*

Similar to last year, the BHF personal Chair awards received the highest return on investment, attracting £6.93 per £1 of BHF support, followed by Translational Awards (£5.32 per £1 of BHF support, all figures exclude BHF and NIHR BRC funding). However, these figures are taken from total award values, and do not necessarily reflect the level of support offered to the individual researcher. For example, BHF Chair Award holders have reported European Research Council

[30] UKCRC Health Research Analysis 2022, https://hrcsonline.net/reports/analysis-reports/uk-health-research-analysis-2022/

funding worth £69.0m, of which £26.0m directly supports further research by the BHF Chair Award holder. The reporting of proportional figures is inconsistent, but more significantly affect the value reported by BHF Chair Award holders who are more likely to be involved in large consortium funding. The top 10 funders of reported funding leveraged from BHF research in the 2024 Researchfish submission is consistent with last year and are shown in the table above.

Actively develop new national and international partnerships to maximise our impact

BHF National partnerships

British Heart Foundation Data Science Centre
Led by Health Data Research UK

The BHF Data Science Centre has formed partnerships with several disease specific research funders where there is an area of shared interest with BHF. New funding from these organisations will enhance BHF's existing investment in the BHF Data Science Centre and drive research in these specific areas.

Stroke Data Science Catalyst[31] This five-year partnership between the British Heart Foundation (BHF) Data Science Centre, Health Data Research UK (HDR UK), the Stroke Association, and BHF – will enable approved research teams to use data from real-world settings, including hospitals, GPs and pharmacies, to improve our understanding of stroke risk factors and open the door to better prevention and treatment.

Diabetes Data Science Catalyst[32] This exciting partnership between the BHF Data Science Centre, Diabetes UK and HDR UK aims to develop improvements in our understanding of the link between cardiovascular diseases and diabetes.

Kidney Disease Data Science Catalyst[33] The fight against kidney disease, which affects over 10% of the UK population, has received a significant boost as the British Heart Foundation (BHF) Data Science Centre, led by Health Data Research UK (HDR UK) and in partnership with Kidney Research UK, launch the new Kidney Data Science Catalyst.

THE FRANCIS CRICK INSTITUTE

BHF and the Fracis Crick Institute launched a jointly funded BHF-Crick programme for Group Leaders wishing to establish laboratories in fields of broad relevance to cardiovascular research at the Crick.

The proposal aims to appoint Early Career Leaders for up to 12 (6 + 6) years, subject to successful renewal in year 6. Individual support will include a competitive salary and 4-5 core funded posts working in high-quality well-equipped laboratory space.

[31] Stroke Data Science Catalyst, https://bhfdatasciencecentre.org/areas/stroke-data-science-catalyst/
[32] Diabetes Data Science Catalyst, https://bhfdatasciencecentre.org/areas/diabetes-data-science-catalyst/
[33] Kidney Disease Data Science Catalyst, https://bhfdatasciencecentre.org/news-and-events/kidney-catalyst-to-accelerate-the-search-for-kidney-disease-treatment/

BHF has approved, in principle, a contribution of up to £2M for each award towards an estimated maximum total cost for each of £4M (50% BHF: 50% Crick) over 12 years. The overall indicative costs have increased since initial discussions. This increase can be attributed to general annual increases in the cost of research, including the impact of inflation and changes to the Crick research costing methodology. Two appointments have been made to date:

Dr Rashmi Priya - Design principles of heart morphogenesis: forces and fate (16/02/2021 - 15/02/2027) SP/F/20/150014
BHF contribution £671,496 – to cover Dr Priya's salary for six years. The proportion of BHF funding for this appointment was reduced in light of the financial pressures on BHF during the COVID-19 pandemic. Total Financial Contribution to be contributed by the Crick £3,115,500.

Summary of research: The central aim of Dr Priya's work is to understand how simpler structures like a sheet of cells generate intricate 3-D architecture of organs using a well-suited model system – the developing zebrafish heart. A critical step during vertebrate heart development is trabeculation, during which a primitive heart transforms from a simple epithelium to a complex topological structure consisting of distinct cell types. Trabeculation defects cause cardiomyopathies and embryonic lethality, yet we don't know how trabecular cells are specified during heart development. Integrating cell biology, developmental biology and biophysics, this work will deconstruct the design principles of heart morphogenesis across length scales – from cells to tissues to organ. Taking advantages of optically and genetically amenable zebrafish embryos, this project will analyse the morphological changes across time and space, as it happens, and dissect mechanical, molecular and geometric interactions that transforms the myocardial wall from a simple epithelium into a highly patterned tissue. The outcomes from this work will advance our understanding of aetiology of cardiac defects, thus facilitating the diagnosis and discovery of potential therapies.

Dr Jose Androver - Tumour-host reprogramming of the innate immune compartment (start date tbc) SP/J/24/285006
BHF contribution £2,508,765 to cover 50% of the estimated total cost of the appointment.

Summary of research: Despite recent advances, metastasis remains the leading cause of death among cancer patients. Understanding how the tumour reprograms its host is critical to advance therapeutic options. Dr Androver envisions that controlling the tumour-host reprogramming routes, especially regarding hematopoiesis, will be key for broader cancer therapies. He is particularly interested in neutrophils (PMNs) and their relationship with tumour necrosis, because necrosis in tumours associates with metastasis and poor prognosis. Necrosis is believed to occur passively when tumour growth outpaces nutrient supply. However, it was found that necrosis is an active process driven by a novel vascular-restricted population of neutrophils (vrPMNs), that are tumour-elicited, form intravascular neutrophil extracellular traps (NETs) and block the tumoral blood flow, causing necrosis and endowing cancer cells in adjacent perinecrotic regions with pro-metastatic traits. Blocking NETs reduced both necrosis and metastasis.

Cancer and CVD are the main causes of death and share many risk factors (smoking, low activity, high-fat diet, inflammation, hypertension or clonal hematopoiesis). Clinical reports show that

cancer increases the risk of CVD: lung cancer patients have a 90% increase in the risk of coronary artery disease, and the main cause of death of breast cancer survivors is CVD. Interestingly, the relationship is reciprocal: colorectal cancer is more prevalent in CVD patients, and the cardiovascular-health index inversely correlates with the incidence of cancer. Hence, there is a bidirectional interplay between cancer and CVD. The risk factors shared between these two conditions also affect PMNs in a specific way: obesity, high fat diet, hypercholesterolemia, smoking, clonal hematopoiesis and hypertension, all increase NET-formation in PMNs. NETs are involved in all steps of tumorigenesis and metastasis but also in atherosclerosis, myocardial infarction, thrombosis and CVD more broadly. Dr Androver will investigate whether vrPMN-NETs are responsible for the link between CVD and cancer progression. He will study the ontogeny of vrPMNs, their physiological role and their relationship with CVD.

BHF International partnership funding schemes

CureHeart

In 2018, BHF launched the Big Beat Challenge, a competition for researchers to form international, multi-disciplinary teams and identify and propose transformative solutions to significant problems in heart and circulatory diseases, with a clear route to patient benefit. The successful programme, CureHeart, aims to develop advanced genetic therapies that directly address faulty genes in heart cells to treat, and ultimately cure, inherited cardiomyopathies. In its first year, Professor Watkins (Oxford) and Professor Seidman (Harvard) have co-led an international world-leading team of scientists and clinicians working on complementary work packages towards delivering the programme's ultimate aims.

One work package of the CureHeart programme has focused on forging strong partnerships with the cardiomyopathy patient community, gaining insights into attitudes towards genetic therapies, the true burden of living with cardiomyopathy and access to healthcare. Findings from these surveys will inform the strategy and design of clinical trials in future years.

Other work packages have focused on combining genetic studies with novel heart imaging approaches to better understand the mechanisms and progression of different forms of inherited cardiomyopathy. Complementary to this work, the team have been developing new gene therapy strategies and tools to target the different disease mechanisms and have generated encouraging pre-clinical evidence for the potential of gene editing.

The CureHeart team have progressed through their first-year review by the BHF Oversight Panel, who have commended the progress made and provided recommendations about future work towards developing treatments and cures for inherited cardiomyopathy.

International Cardiovascular Research Partnership Awards

Launched in 2018, the principle aim of the International Cardiovascular Research Partnership Awards (ICRPA) has been to support international collaboration to deliver ambitious, high-quality

cardiovascular research programmes[34]. Since 2022, the ICRPA scheme has sought to provide support specifically for mid-career researchers in participating countries, who have demonstrable potential to become future research leaders but are at vulnerable career stage. The current scheme is a partnership between four leading European cardiovascular research funders; British Heart Foundation (BHF) in the UK, Dutch Heart Foundation (DHF) in The Netherlands, German Centre for Cardiovascular Research (DZHK) in Germany and Lefoulon-Delalande Foundation (LDF) in France.

Since 2022, the refocused ICRPA scheme has attracted 43 applications engaging 101 mid-career researchers from 68 different organisations (universities and other research institutions) in participating countries. The overall success rate has been 18.6%, with funding totalling almost €11 million awarded to support 8 collaborative projects, which are addressing a diverse range of important issues in research into cardiovascular diseases.

Global Cardiovascular Research Funders Forum

Founded in 2018, the Global Cardiovascular Research Funders Forum was created to improve global cardiovascular health by speeding up, supporting and promoting transformational international research efforts in heart, stroke and circulatory diseases. An alliance of 12 major cardiovascular research funders from 9 different countries, the GCRFF is co-ordinating three main projects;

- International clinical trials initiative
- Women's Cardiovascular Health Initiative
- Data Challenge

International Clinical Trials Initiative

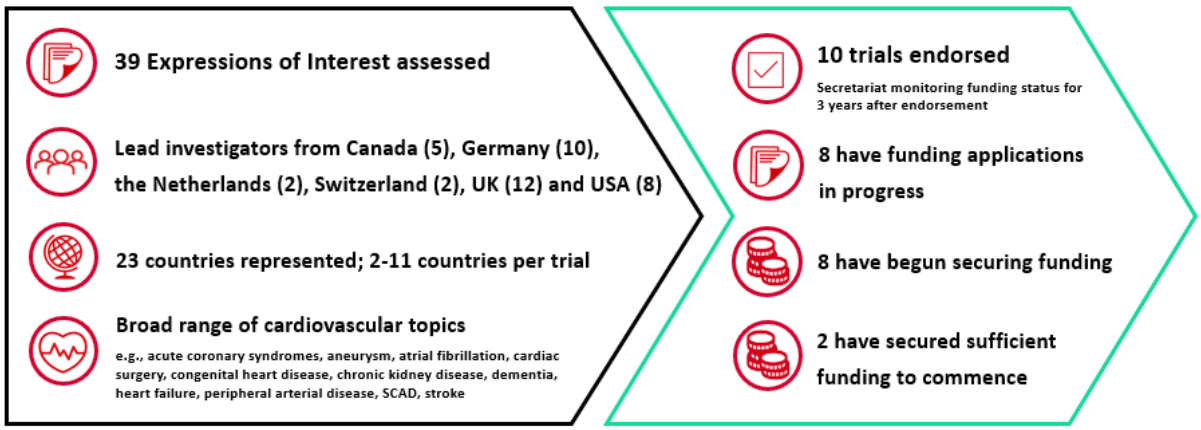
The GCRFF Multinational Clinical Trials Initiative[35] was launched in 2021, aiming to help increase the likelihood of academic-led, multinational clinical trials securing the funding they need to be delivered successfully. It involves researchers submitting an Expression of Interest summarising their proposed trial for review by an Expert Advisory Panel (EAP)[36], which includes independent scientific experts and representatives of the eight research funders involved (see above). Trials considered to have merit receive endorsement from the panel, and the idea is that having expert input into a trial and its design - before any funding applications are made - helps put the trial in a competitive position to secure funding.

[34] International Cardiovascular Research Partnership Awards, https://www.bhf.org.uk/for-professionals/information-for-researchers/what-we-fund/partnership-funding/bhf-dzhk-dhf/previous-awards

[35] GCRFF Multinational Clinical Trials Initiative https://www.bhf.org.uk/for- professionals/information-for-researchers/gcrff-multinational-clinical-trials-initiative

[36] GCRFF Multinational Clinical Trials Initiative - Expert Advisory Panel - https://www.bhf.org.uk/for-professionals/information-for-researchers/gcrff-multinational-clinical-trials-initiative/gcrff-eap

As of March 2024, the EAP has held 8 meetings (November 2021, March/July/November 2022, March/July/November 2023, March 2024), assessing 39 EOIs, of which 10 were endorsed (see figure below). All trials endorsed to date have proposed recruiting participants in the UK, and have planned to apply for BHF funding to support the UK component. To date, the BHF Clinical Studies Committee (see Clinical Studies Committee overview page 15) has approved funding for five trials endorsed by the GCRFF (see table below). BHF funding is not released until sufficient funding is secured to cover ~70% of the planned international recruitment.



BHF plans to conduct an evaluation of the initiative in Autumn 2024. This will include surveying applicants and funders for their views on whether and how the current process impacts the likelihood of research teams securing funding for their clinical trial. The funders involved in the initiative are also exploring potential models for common/shared review of follow-on funding applications for endorsed trials, which could help to streamline the process of these trials securing the funding they need to be delivered successfully. The evaluation will therefore also include seeking views on how the current process could be improved, to inform any future changes to the initiative.

GCRFF-endorsed trials with funding approved by BHF
LEADER-PAD - Can the cheap anti-inflammatory drug colchicine prevent cardiovascular and limb events among people with peripheral arterial disease? GCRFF reference: GCRFF/21/270035 **BHF award**: CS/F/22/190051; £1,278,758 over 4 years, 9 months; Professor Robert Hinchliffe (University of Bristol) **Sample size**: 6150 (1500 in UK) **Recruitment planned**: Canada (lead country), Ecuador, Argentina, India, Belgium, Italy, Brazil, UK, the Netherlands **Other confirmed funders**: Canadian Institutes of Health Research (CIHR), ZonMw
ASPIRING - Is restarting antiplatelet drugs after intracerebral haemorrhage safe and effective at preventing major cardiovascular events? **GCRFF reference**: GCRFF/21/270024 **BHF award**: CS/F/22/190053; £2,333,936 over 6 years; Professor Rustam Salman (University of Edinburgh) **Sample size**: 4148 (2828 in UK) **Recruitment planned**: UK (lead country), Canada, Australia, the Netherlands **Other confirmed funders**: CIHR, Dutch Heart Foundation (DHF), Medical Research Futures Fund

CONTEMP-ICD – Can the use of implantable cardioverter defibrillators among people with heart failure be reduced, in light of contemporary heart failure medications?
GCRFF reference: GCRFF/21/270056
BHF award: CS/F/22/190054; £708,168 over 6 years, 10 months; PI: Professor Elijah Behr (St George's, University of London) *Award closed after US funder declined to partnership fund with BHF*
Sample size: 2850
Recruitment planned: USA (lead country), Canada, Slovenia
Other confirmed funder: Patient-Centred Outcomes Research Institute

ROMA-Women – Should women undergoing coronary artery bypass grafting receive multiple arterial grafts?
BHF award: CS/F/22/190055; £311,191 over 6 years, 6 months; PI: Professor Gavin Murphy (University of Leicester)
GCRFF reference: GCRFF/21/270055
Sample size: 2000 (216 in UK)
Recruitment planned: USA (lead country), UK, Australia, Canada, Germany, Austria, Sweden, Netherlands
Other confirmed funders: CIHR, German Centre for Cardiovascular Research (DZHK), Austrian Science Fund, Starr Foundation

WARRIORS – Should abdominal aortic aneurysms be repaired at a smaller diameter in women?
BHF award: CS/F/22/190056; £2,257,539 over 9 years, 6 months; PI: Professor Janet Powell, Imperial College London
GCRFF reference: GCRFF/21/270056
Sample size: 1112 (150 in UK)
Recruitment planned: UK (lead country), USA, Canada, Germany, The Netherlands, Denmark, Finland, Sweden, Australia, New Zealand
Other confirmed funders: DHF, Swedish Heart & Lung Foundation, Finnish Heart Foundation, Independent Research Fund Denmark, German Society for Vascular Surgery & Vascular Medicine German Vascular Research Institute, Novo Nordisk, Medtronic, Terumo

Women's Cardiovascular Health Initiative

As part of the GCRFF's objective to address gaps in cardiovascular health on a global scale, the Women's Cardiovascular Health Initiative is GCRFF's first flagship research-oriented action.

Cardiovascular disease is a leading cause of death among women in all GCRFF member countries[37,38,39,40,41,42,43]. Historically, however, much of cardiovascular research has either used male biological models to understand the disease or involved clinical trials with predominately male volunteers. In 2023, to help address this unbalance, the GCRFF reached out to the international cardiovascular research community to understand the most urgent research needs

[37] Death registration summary statistics, England and Wales: 2022 https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/deathregistrationsummarystatisticsenglandandwales/2022#number-of-deaths-by-leading-cause-of-death
[38] Eurostat, Causes of death statistics, European Union https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Causes_of_death_statistics
[39] Australian Institute of Health and Welfare, https://www.aihw.gov.au/reports/life-expectancy-deaths/deaths-in-australia/contents/leading-causes-of-death
[40] US Centers for Disease Control and Prevention, https://www.cdc.gov/heart-disease/about/women-and-heart-disease.html
[41] Statistics Canada, https://www150.statcan.gc.ca/n1/daily-quotidien/230828/dq230828b-eng.htm
[42] Federal Statistical Office, Switzerland, https://www.bfs.admin.ch/bfs/en/home/statistics/health/state-health/mortality-causes-death/specific.html
[43] Ministry of Health – Manatū Hauora, New Zealand, https://www.health.govt.nz/publication/mortality-2016-data-tables

for women's cardiovascular health. Researchers were encouraged to complete a request for information, consisting of 8 short answer questions, to contribute to shaping future funding priorities. Submissions received will inform research priorities and funding opportunities, including collaborations, and building international networks. Results of the consultation is expected to be published in late 2024.

Data Challenge

In an extraordinary and unprecedented collaborative action, each GCRFF organisation has agreed to share funding data from 2017 to 2024. Through this, the GCRFF has collated a rich dataset of grant funding information from GCRFF organisations using the American Heart Association's Precision Medicine Platform[44]. To take advantage of this unique opportunity, the GCRFF launched a data challenge to better accelerate cardiovascular science through understanding how is it funded internationally. The challenge aims to explore how much benefit we get from investing in cardiovascular and stroke research, and to find areas where more research funding is needed. Participants will be asked to use AI technology and potentially supplement with additional data to understand what has been successful, what has not, and to identify any gaps in cardiovascular and stroke research programmes.

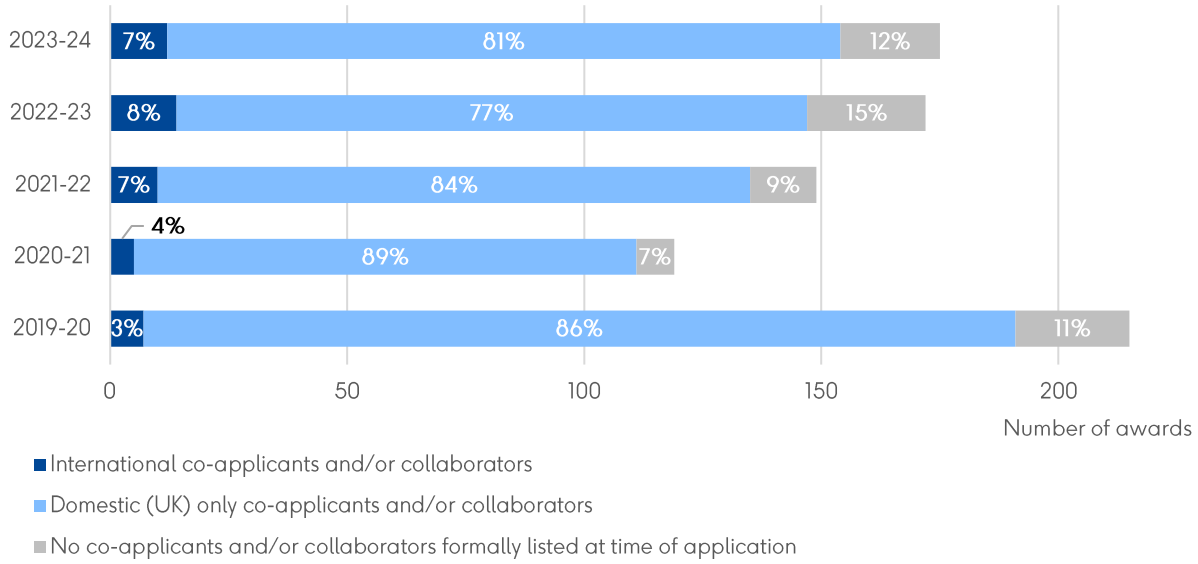
Challenge applicants will have to answer the question, "How can the organisations that fund cardiovascular and stroke science most effectively fund research to drive discoveries and improve lives?". The deadline for the GCRFF Data Challenge has been extended to 30 September 2024 and the winning project is eligible to receive a $20,000 USD cash prize[45].

BHF funded researcher collaborations

Strong collaborations enable researchers to maximise their reach and impact by combining expertise and resources. Overall, the number of awards with associated co-applicants and collaborators has continued to rise with the number of applications since the pandemic. Proportionally, the percentage of awards with associated co-applicants and collaborators has remained consistent, with a slight increase in proportion of awards involving international co-applicants and collaborators since 2019. This is in line with BHF's efforts to increase international collaboration, such as the International Cardiovascular Research Partnership Awards. Note that the graph includes grants where co-applicant/collaborator details are limited (such as for joint awards) and may therefore be an underestimation.

[44] AHA's Precision Medicine Platform, https://precision.heart.org/
[45] Global Cardiovascular Research Funders Forum Data Challenge, https://precision.heart.org/gcrffdatachallenge

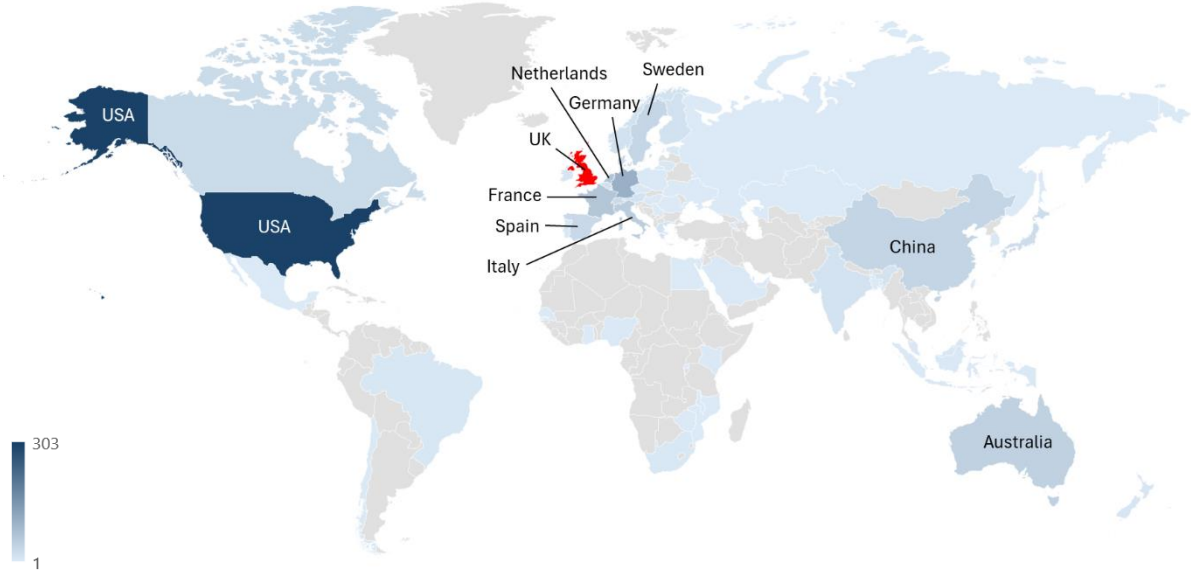
Numbers and proportion of grants with international and domestic (UK) co-applicants and collaborators



Researchers report collaborations attributed to BHF funded research in Researchfish. These may be existing collaborations that have been strengthened or new collaborations arisen in the course of BHF funded research. Whereas collaboration figures from applications indicate direct roles and responsibilities set up at the application stage, the contribution of collaborators reported in Researchfish can be variable and may have developed at any point during the lifetime of the grant and 5 years thereafter. It is also worth noting that collaboration data within Researchfish are cumulative.

Similar to last year, just under 2500 unique collaborations (212 arising in 2023 alone) were reported in Researchfish for 42% of the awards in the submission (677 awards out of 1546 reported a collaboration). Again, the schemes attracted the highest reported collaborations were Personal Chair Awards, with a mean of 8 collaborations per grant and Clinical Studies, with 7 collaborations. Just under half of the reported collaborations (44%) were international, with 20% based in European Union member countries. International collaborators were based in 61 countries around the world, with the United States being the most common single country location outside the UK (12% of reported collaborations were with collaborators based in the United States).

Collaborations reported in Researchfish (top 10 countries labelled, UK = 1342 (red))



International co-authorship in publications[46]

Between 2019 and 2023, roughly two thirds of articles acknowledging BHF funding, included one or more co-author from a non-UK institution. As in previous years and consistent with Researchfish reported collaborations, the USA is the most frequent location for an international collaborator.

The top 5 countries with the most frequent location of collaborators (2019-2023)

Country	Percentage of research articles with international collaboration
USA	24.18%
Germany	12.63%
Netherlands	10.42%
Italy	9.93%
Australia	8.03%

Funding attribution in research articles

Between 2019-2023, 86% of research articles [47] that acknowledged BHF funding also acknowledged at least one other funder. Larger programmes of work are often supported by more than one source of funding, especially those with a significant contribution from collaborators. The top 10 most frequent funders[48] that are acknowledged alongside BHF funding are listed in the following table. The top 10 most frequently co-acknowledged funders are UK based, except for the National Institutes of Health (NIH, USA) and European Commission/European Research Council. The research funders named here are similar to those

[46] Documents acknowledging BHF funding and published between 01/01/2019-31/12/2023 were retrieved from EuropePMC in July 2024 and uploaded in the bibliometric analytic platform InCites. Out of 11,992 publications uploaded, 11,073 (92%) were retrieved in InCites, of these 8,424 were classed as (research) articles.
[47] Bibliometric detail as above, BHF acknowledgement data were retrieved from Europe PMC.
[48] Other funder acknowledgement data were retrieved from InCites

in reported further funding, highlighting the close ties UK cardiovascular research has with Europe and USA.

Top 10 funders jointly acknowledged with BHF in publications 2019-2023

Funder	Number of publications
Medical Research Council, UKRI	3483
Wellcome Trust	2399
National Institute for Health and Care Research (NIHR)	1704
University of Cambridge	1212
National Institutes of Health (NIH)	1069
European Research Council/European Commission	1021
Engineering and Physical Sciences Research Council (EPSRC)	900
Cancer Research UK	565
Economic and Social Research Council (ESRC)	546
Biotechnology and Biological Sciences Research Council (BBSRC)	522

Use our position as a major research funder to influence the research environment

Research culture

EDI strategy update

BHF launched its equality, diversity and inclusion (EDI) strategy in May 2022, with the aim of delivering a more representative and inclusive cardiovascular research community and being more inclusive in how research funding decisions are made. Since launch, we have made great strides in achieving our aims. These include:

- 11/2023: Implementation of a new Expression of Interest process for committee members, encouraging applications from currently under-represented groups
- 06/2023: Adding sections to most BHF funding scheme applications to understand how applicants are giving appropriate consideration to increasing diversity in their research
- 04/2024: Started the collection of demographic data for principal grant applicants, co-applicants and most committee members
- 07/2023: Publication of our first diversity data report, including data related to age, disability status, ethnicity and gender of our grant applicants, award holders and funding committee members (page 38)
- 07/2023: Kick-off of our UK Cardiovascular research workforce project, developing longitudinal demographic data to understand trends in this workforce
- Ongoing: Cross organisation work through the Research Inequalities Working Group and DORA working group to ensure BHF funding and research evaluation processes uphold the DORA principles of fairness, transparency and responsibility in bibliometrics (page 39)
- 09/2024: Launch of our Women in Science programme – starting with the Women in Science supper for cardiovascular researchers to connect, providing advice on improving under-representation in cardiology and cardiovascular research

However, we know that our work to achieve our EDI aims are far from finished. To get us closer to our goals in the next year, we aim to:

- Publish findings of the BHF UK Cardiovascular research workforce project, including accompanying policy recommendations (page 36)
- Hold engagement sessions to better understand the experiences of women in CVD research
- Continue working with the MESSAGE project to develop and implement a policy framework for sex and gender best practice at BHF
- Investigate the use and impact of specific award funds for underrepresented groups
- Work with key stakeholders in Trusts and Institutions to increase award applications from underrepresented groups

Estimating cardiovascular research workforce

The BHF policy team has undertaken two workforce projects in 2024 with the aim of better understanding the UK's cardiovascular research and health workforce.

The UK Cardiovascular research workforce

For this project, BHF commissioned the Careers Research and Advisory Centre (CRAC) to analyse and model all currently available data on the UK cardiovascular research workforce. This report will provide data on the following:

- Demographic and employment profiles of clinical academic staff based at UK universities with a cardiovascular specialty, 2021/22
- Demographic profiles of HE students (the future potential cardiovascular workforce), including students at undergraduate and Masters level (2021/22) and PhD students (2012–22)
- Demographic and employment profiles of non-clinical academic staff at UK universities with a cardiovascular specialty, 2019–2022
- Some demographic data on consultant cardiologists and higher specialty trainees in the UK, 2022
- The number of research nurses with a cardiology speciality in the UK, 2021
- Prediction of workforce profile in 2030

CRAC also conducted targeted qualitative engagement with the following groups to better understand the issues behind the data: PhD students, Professors and senior academics, mid-career academics, early career researchers, consultants, clinicians at other levels, and Allied Health Professionals.

BHF will use the outputs of this project to influence our research funding, EDI and policy and influencing work over the coming years.

Cardiologist and specialist cardiac nursing workforce in England

In 2023, supported by the British Cardiovascular Society, BHF undertook a census of the cardiac workforce in secondary care in England[49]. This was a first step towards building a comprehensive overview of the cardiac workforce. We will eventually use this project to engage with NHSE and the sector on workforce planning and supporting clinical research.

BHF is committed to raising awareness of the challenges facing the NHS cardiac workforce and encouraging Government to invest in and support effective workforce planning. Our previous research highlighted a lack of accessible, robust data to tell us about vacancy rates, number of clinicians in each subspecialty, and the demographics of the workforce. These are data that we believe are critical to enable proper workforce planning and to design policies to train, retain and sustain the pipeline of talent that we need across cardiac clinical and research activity.

126 NHS Trusts with a cardiology department in England were asked to provide information about their cardiologist and cardiac specialist nursing posts on 19 June 2023.

There was a 57% response rate from the Trusts contacted as part of the census. Data were collected on 1,804 cardiologist posts and 1,449 cardiac specialist nurse posts. These provided new insights into the workforce, including cardiac subspeciality and demographic information,

[49] Cardiac Workforce Census 2023-2024, https://www.bhf.org.uk/what-we-do/policy-and-public-affairs/transforming-healthcare/cardiovascular-workforce/bhf-bcs-cardiac-workforce-census

and data on how demographics interact with factors like working patterns and clinical subspecialties. Of note, the results showed that 84% of consultant cardiologists had no weekly work time dedicated to clinical research in their job plans.

Diversity data update

Our aim is to support a diverse and inclusive research environment to help us achieve our vision of a world free from the fear of heart and circulatory disease. In our Equality, Diversity and Inclusion (EDI) strategy Igniting Change, launched in 2022, we outlined clear commitments to addressing inequalities within the research ecosystem, ensuring that BHF plays its part in creating a diverse and inclusive research environment.

Since April 2020, we have been capturing information about legally protected characteristics, including age, disability, ethnicity and gender of researchers applying for funding. These data form an anonymised and confidential statistical record, allowing us to perform further analysis and comparison with sector wide information. The aggregated analysis of these data has been published in July 2023 in our first research funding diversity report. The report provided valuable insight that is helping us shape our future actions to address under-representation in our research community.

But we were aware of the limitations of our current data capture practices. It is known that under-representation or inequalities exist in the Science, Technology, Engineering, Maths and Medicine (STEMM) sector in the UK for other legally protected characteristics.
That is why since March 2024, researchers applying for funding are asked to complete new questions about their gender reassignment and sexual orientation, religious beliefs, caring responsibilities and socio-economic background. We have followed sector-wide best practice guidelines (DAISY guidance, Advance HE, ONS Census) when designing the questions.

In addition to capturing and analysing diversity information from grant applicants and our funding committee members, we will also soon start capturing diversity information from independent expert reviewers, to better understand the demographic characteristics of the people informing our funding decision-making process.

We are mindful that some of these questions might seem intrusive, which is why researchers can always select 'Prefer not to say' to any of these questions. However, the more information researchers share with us, the better we can assess inclusivity in how our research funding decisions are made and allow us to identify under-representation across different groups. This will allow us to focus on barriers and plan targeted interventions to remove these, so that we can achieve a more representative and inclusive heart and circulatory disease research community.

Call for expressions of interest to become BHF expert reviewer

In November 2023, BHF launched a call for expressions of interest to become an BHF independent expert reviewer and research funding committee members. Anyone can submit an expression of interest at any time and BHF will keep their contact details on file for when appropriate opportunities arise. The purpose of this is to encourage participation from the wider groups of the cardiovascular research community, including women and underrepresented members of the research community. Since its launch, BHF has received eight expressions of interest and half of

these have already been invited to peer review and contribute to the BHF independent expert review process.

DORA

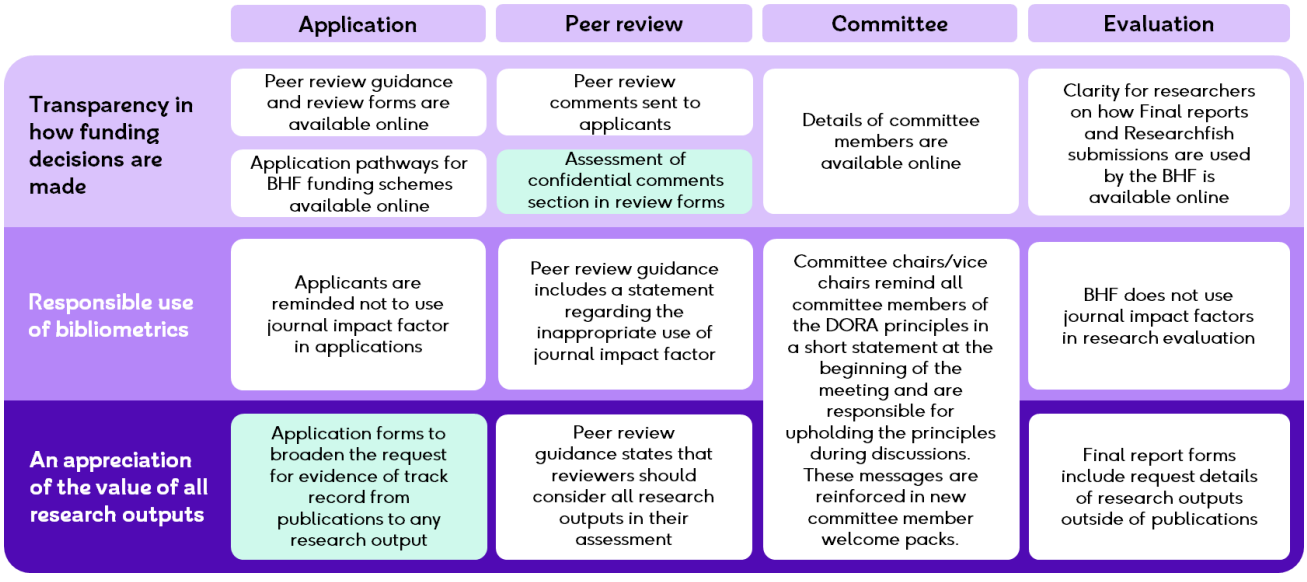
In 2021, BHF signed the San Francisco Declaration of Research Assessment (DORA) - a set of principles designed to ensure that the quality and impact of scientific outputs are measured and evaluated appropriately. By committing to the DORA principles, BHF is working to make its research funding processes fairer and more transparent. The aim is to help support researchers to develop to their full potential and encourage nurturing and open research environments for good science and research integrity to thrive.

Signing the declaration meant committing to the DORA principles which are in essence:

- **Transparency in how funding applications and grants are assessed.** Applicants should understand how their grant applications are assessed, and once awarded, how progress is judged.
- **Responsible use of bibliometrics.** Guarding against the inappropriate use of journal impact factor is the founding principle of DORA. A research article should be judged by its own scientific merit, not that of the journal that it is published in.
- **An appreciation of the value of all research outputs.** Narrow measures of academic success have been shown to have a detrimental influence on research integrity and environment. A greater appreciation of all research outputs is therefore recommended.

Since 2021, BHF has worked to ensure the DORA principles are embedded in its research funding and evaluation processes. Summarised in the figure below, opportunities for DORA implementation were identified by an internal review looking at an applicant's journey from submission to outcome to monitoring research outputs.

BHF progress with DORA at a glance (green sections to be implemented from early 2025)



Transparency in how funding applications and grants are assessed

Improving transparency how funding decisions are made at BHF was the first aim in ensuring that BHF's funding processes are in line with the DORA principles. To improve transparency, BHF application pathways and review forms are now available on BHF funding scheme webpages. In addition, consolidating BHF's expert review guidelines and making them available for applicants, help researchers to understand how their proposals will be assessed before they apply.

BHF's expert review guidelines includes statements of expectations for standards in independent expert review and highlight to reviewers that their written reviews will be included in feedback to the applicants. Complementary to existing BHF policy in providing applicants with independent expert review feedback, in early 2025 we will assess the appropriateness of our review forms. The aim of this assessment is to improve clarity around the discussion points that lead to the funding decision. Transparency in independent expert review has also been improved by providing details of funding committee memberships online.

Whilst BHF tries to minimise administrative burden for researchers, many funding schemes require the completion of reporting forms, such as milestone, midterm, or annual report forms. How these are assessed post submission was often unclear and can vary between funding schemes. BHF's reporting progress webpages have been updated to include information on all types of progress and final reports, and clarity on how these reports will be assessed. Similarly, the research evaluation webpage has been updated to help researchers understand how BHF uses their Researchfish submissions.

Responsible use of bibliometrics

BHF does not use journal impact factors in the assessment of a researcher's track record or research quality, nor are they used in any bibliometric evaluations. Furthermore, applicants and independent expert reviewers are reminded not to use journal impact factors in applications forms and their consideration. Statements outlining the DORA principles and why these are important at BHF are presented at the beginning of discussions in funding committee meetings. BHF committee Chairs and Vice-chairs further enforce of these statements by ensuring that committee discussions maintain the DORA principles and other BHF standards in independent expert review.

An appreciation of the value of all research outputs

From January 2025, applicants will not be asked for a list of publications in the majority of BHF application forms. Instead, applicants will be asked to evidence their ability to deliver the proposed work through a limited number of relevant research outputs and their contribution to the research output. These changes to the application forms are complemented by already in place guidance to committee members and independent expert reviewers within BHF's expert review guidelines and DORA committee meeting statements.

Narrative CV

As part of the DORA initiative, BHF appraised the use of the Narrative CV in its application forms. The narrative CV is designed to enable researchers to showcase a broad range of outputs and outcomes from their research. It involves individuals providing written overviews of their career

paths, achievements and contributions to research. The Royal Society were early promoters of the narrative CV and have developed a standardised template called the Résumé for Researchers (R4R).[50]

Whilst the Narrative CV could help shift the balance of value in research outputs, there has been some concern that certain groups may be disadvantaged. For example, scientists for whom English is an additional language may struggle to describe their contributions as eloquently as native speakers. Moreover, there is evidence that women and applicants from some ethnicities may tend to be more modest, and less likely to promote their achievements.[51,52] This could be more of an issue in longer form answers compared to a traditional CV that has a list of roles and publications, which is seen as more objective.

Implementation of a Narrative CV remains a divisive issue, and the results of the BHF research community consultation was inconclusive for the acceptability of the Narrative CV. Whilst early to mid-career researchers were more open to introducing the Narrative CV, there were serious concerns regarding additional workload and pressures to "fill blank boxes". More established researchers felt the Narrative CV would not reduce bias and improve EDI, but may add to inequities for applicants who are less confident in writing.

BHF has therefore decided not to implement the Narrative CV now, but will review in 2 years. Whilst it is clear that the narrative CV offers applicants and independent expert reviewers an opportunity to consider a wider range of skills, experiences and research outputs, there is a lack of evidence supporting a role in creating a more inclusive research community. In addition, although significant concerns have been raised regarding unintended negative consequences, these have not been demonstrated. Therefore, in acknowledgement that introducing the narrative CV would mean a substantial increase in workload for both applicants and independent expert reviewers, BHF will hold back from introducing the narrative CV and will review this decision in 2 years.

[50] The Royal Society, *Resume for Researchers,* https://royalsociety.org/topics-policy/projects/research-culture/tools-for-support/resume-for-researchers/
[51] Exley and Kessler, Harvard Business Review, *Why Don't Women Self-Promote As Much As Men?*, 2019, https://hbr.org/2019/12/why-dont-women-self-promote-as-much-as-men
[52] Involve, *what role do cultural differences play in self-promotion*, 2023, https://www.involvepeople.org/what-role-do-cultural-differences-play-in-self-promotion/

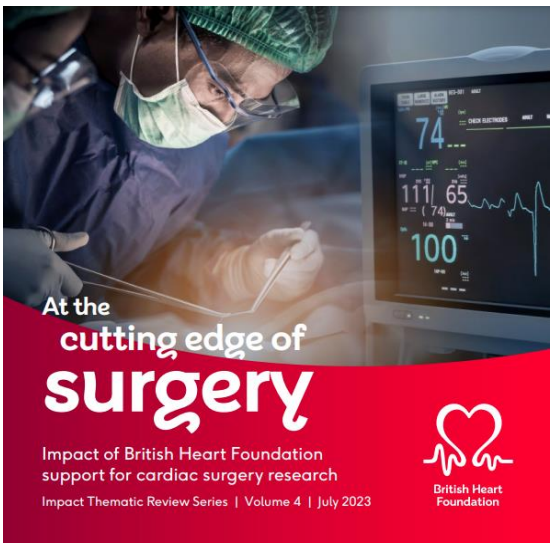
Measure and share the impact of the research we fund

Measuring the impact of BHF funded research

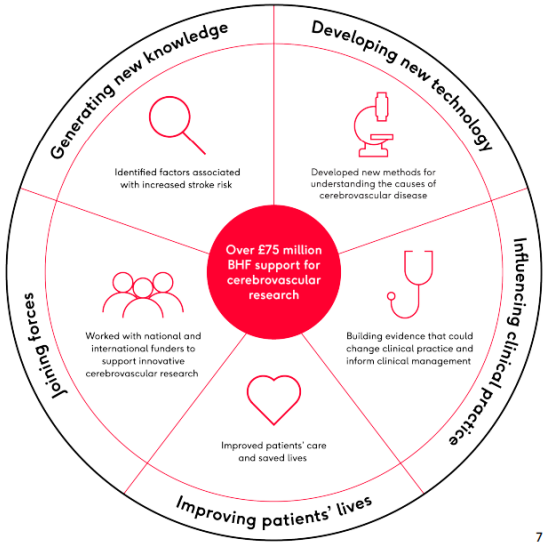
Impact thematic reviews

In 2022, BHF launched a new series of impact thematic reviews—reports that articulate the impact arising from historic and long-term BHF support. Each report is focussed on a specific disease area, field of science, or technology, in each case assessing impact all the way from generation of new knowledge to improving patients' lives. This year, BHF has published two reviews.

The first review focused on the impact of BHF-funded research in cardiac surgery, with contributions from Gianni Angelini, BHF Professor of Cardiac Surgery at the Bristol Heart Institute, John Dark, Professor of Cardiothoracic Surgery at Newcastle University, and Former BHF Professor Robert Anderson, Newcastle University.



The second focused on cerebrovascular disease, with contributions from Joanna Wardlaw, Professor of Applied Neuroimaging, University of Edinburgh and Philip Bath, Professor of Stroke Medicine at the University of Nottingham.



All five reviews can be accessed on our website[53].

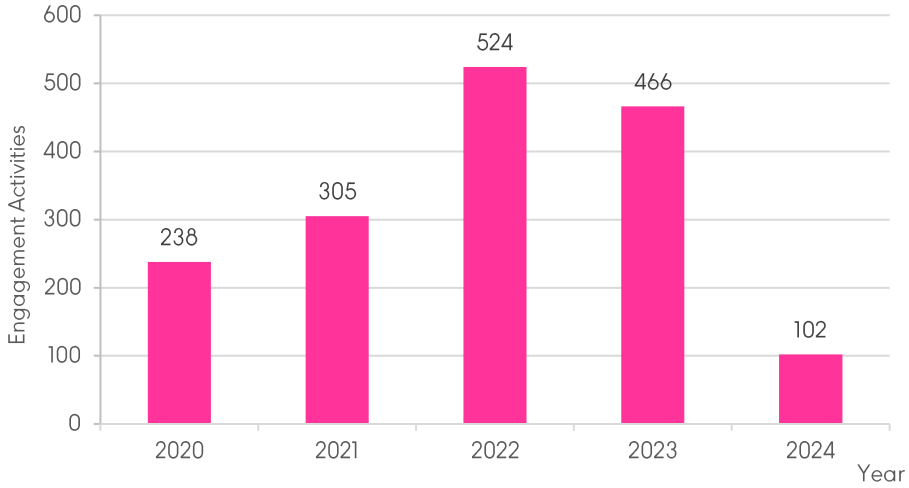
Researcher outreach activities

BHF encourages researchers to engage with the public with the aim to generate mutual benefit by enhancing the quality and impact of research. Researchers communicate and promote BHF-funded research through institutional open days, talks at schools, participation in fundraising events, science festivals, blogging or any contact with the media.

Public engagement activities ranged from improving public understanding of scientific advances to inspiring the next generation of scientists. The dissemination of research findings to academic peers (conference attendance), although integral to the progression of research, has been excluded from the Researchfish engagement question set. Here we report on engagement outside of academia (but including Undergraduate and Postgraduate outreach).

The Covid-19 pandemic has brought significant challenges to the BHF research community, as observed from the 2020 Researchfish data. Since 2022, the BHF research community showed significantly recovery, 1804 unique activities were reported from 504 awards (35% of a total of 1455 awards returned in the 2024 submission). Note that the 2024 Researchfish submission period closed in March 2024, 102 activities that took place in early 2024 were included in the Researchfish submission.

Number of engagement activities reported in Researchfish by year



In the Researchfish 2024 submission period, the most frequently used method of engagement activity was a talk or presentation (30.8%), this included both face to face and virtual events. While public engagement is important across all areas of research, it has particular importance for healthcare. Patients and other people with lived experience, such as carers, can offer valuable insights into the reality of living or facing with a condition and can help researchers better characterise the challenges. Around 60% of primary audiences reported in the 2024 Researchfish submission period were public engagement, including the use of social media, a talk or presentation to public audiences, university open days for students, and special events for

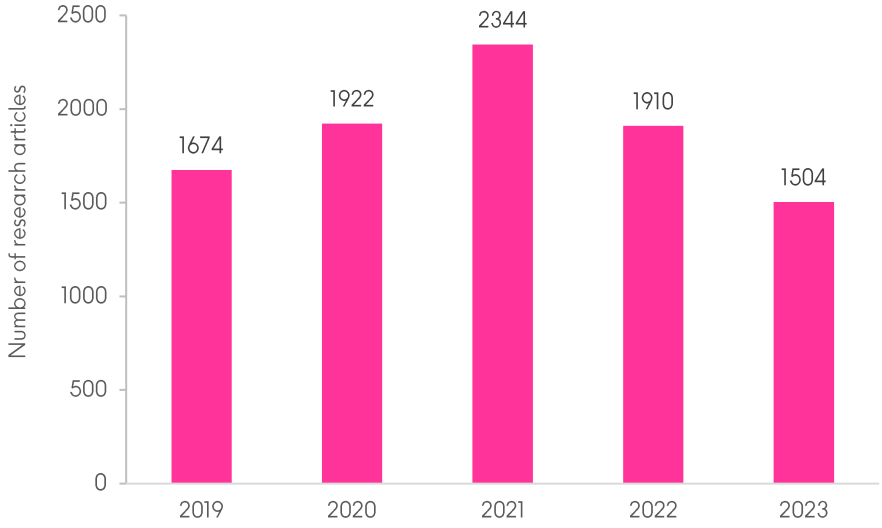
[53]BHF Thematic Reviews, https://www.bhf.org.uk/what-we-do/our-research/research-successes/our-research-impact-reports

patients and carers groups. Public engagement with research has proven to bring huge benefit to the research community and continues to be an important aspect of BHF's fundraising activity.

Publications

Research publications remain one of the most common outcomes of scientific communication and play a central role in supporting researchers and advancing scientific progress. Since 2019, over 1500 research articles acknowledge funding from BHF have been published every year[54]. The number of research articles acknowledging BHF funding rose between 2019 and 2021, and appears to have decreased since 2021. However, this decrease is likely to be artificial, due to delays in funder attribution information being included in article metadata and changes in publishing practices during the pandemic. Similarly, the increase in research articles in 2021 may be partially explained by the increased number of research articles published related to COVID-19[55].

Number of BHF funded research articles and average category normalized citation index (CNCI), 2019-2023

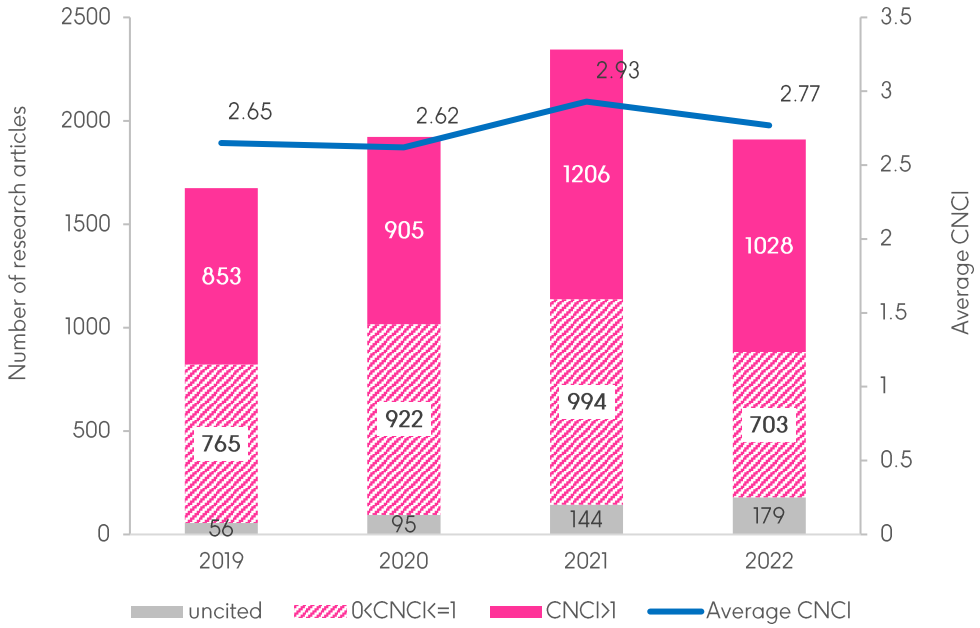


Category normalized citation index (CNCI)[56] calculates the influence of a publication by dividing an actual citation count by an expected citation rate for documents with the same document type, year of publication, and subject area. CNCI values are only stable two years after publication. A CNCI value of 1 indicates that the publication has been cited the same number of times as the world average for similar publications. Values less than 1 indicate that the publication has been cited less than would be expected based on the world average for similar publication, whereas CNCI values above 1, indicates the publication has been cited more than world average.

[54] A total of 12,035 publications acknowledged BHF funding between 01/01/2019 – 31/12/2023 were retrieved from Europe PMC in July 2024. Primary research articles (9,749) were uploaded in the bibliometric analytic platform InCites, and 9,354 (96%) were retrieved in InCites, excluding 1,950 review articles and 336 preprints.
[55] Europe PMC data extracted Sept 2024; [((GRANT_AGENCY:"British Heart Foundation") AND ((TITLE:"covid") OR (ABSTRACT:"covid"))) AND (((SRC:MED OR SRC:PMC OR SRC:AGR OR SRC:CBA) NOT (PUB_TYPE:"Review")))]. BHF acknowledging research articles mentioning "covid" in the title or abstract; 2020 – 80, 2021 – 161, 2022 – 149, 2023 – 99.
[56] Category normalized citation index, InCites, https://incites.help.clarivate.com/Content/Indicators-Handbook/ih-normalized-indicators.htm?Highlight=Category%20Normalized%20Citation%20Impact%20#

The CNCI of BHF funded research articles has scored between 2.6-2.9 between 2019 and 2022, indicating that these publications are cited over 2.5 times the world average.

Distribution of category normalized citation, 2019-2022



Consistent with previous findings, most research articles acknowledging BHF funding have been cited at least once between 2019 and 2022. The percentage of uncited BHF-funded research articles ranges from 3% in 2019 to 10% in 2022. More recent publications are less likely to be cited than slightly older publications. 54% of BHF-funded research articles have achieved a CNCI score of 1 or more, indicating they have performed over the world average between 2019 and 2022.

BHF Open access overview

The research BHF funds should be made freely available to the broader scientific community and to the public to maximise its reach and benefit. An open access publication is one that is free for anyone to read and re-use for any reasonable purpose. BHF supports open access publication and expects BHF funded researchers to publish in accordance with its open access policy as a condition of award. BHF's open access policy mandates that primary research articles are published under an open access licence (CC-BY) or that the accepted version of manuscript is made available within 6 months of publication on Europe PubMed Central. BHF provides block grant funding to all research institutions funded in the last 5 years to support open access. The policy is in line with the principle that BHF does not dictate where researchers publish their work - researchers should be free to publish their research in the best place to maximise the impact.

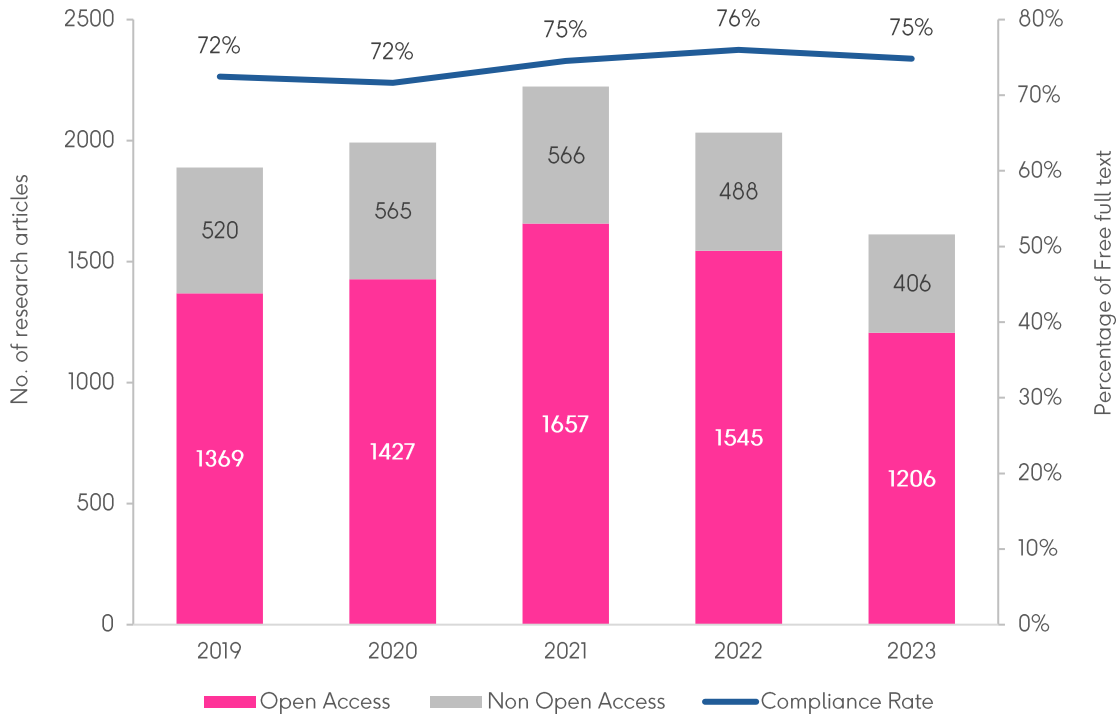
Research articles acknowledge BHF funding and published between 01/01/2019 and 31/12/2023 were retrieved from Europe PMC in July 2024, and open access status were calculated based on the full text availability in Europe PMC. Open access compliance rate rose steadily from 49% to 70% between 2012 to 2018, and a continuing trend of open access compliance average at 74%

between 2019 to 2023. Note that 2023 data may be inaccurate as open access status may take time to be updated in the article metadata.

Whilst 74% compliance is encouraging, there does appear to be a consistent number of research articles that remain non-open access, suggesting some barriers for researchers to publish open access remain.

Transformative agreements are contracts negotiated by JISC between UK institutions and publishers that transform the business model underlying researchers publishing towards a fully open access model. Of those research articles that are not currently published OA, around 27% are published in journals that have JISC negotiated agreements. Transformative agreements are increasing in popularity, and more journals being added to the scheme albeit at a slow pace. BHF is supporting transformative agreements through its Block grants.

Number of free full text research articles acknowledging BHF funding



Europe PMC is committed to providing open data has made some progress in recent years in open access field, including introducing new search filters for "Full text in Europe PMC" and "Link to free full text" have been released, with the latter including articles with a free, legal copy of the full text available from another source via Unpaywall.

By including this new "Link to free full text" option, open access compliance rate for primary research articles that acknowledge BHF funding between 2019 and 2023 retrieved from Europe PMC reached an exceptionally high level - an average of 93%.

Appendix

BHF 2024 Researchfish submission period

BHF funded researchers are asked to report on outcome and impact of their research during the lifetime and up to five years after the end of their award. The awards in the 2024 Researchfish submission included those that were open for any amount of time between 2019 and 2023. All awards on Researchfish are given a response code to allow funders to determine the awards to be included in the submission period. The response codes and the repartition of BHF portfolio are presented in the table below. Response code 5 awards ended up more than five years ago and were not included in the 2024 Researchfish submission period.

During the tenth Researchfish submission period (5th February to 14th March 2024), the outputs and impacts of 1546 awards were requested from 772 principal investigators at 54 institutions. There was an overall compliance rate of 94% for awards and 91% for principal investigators; with output and impact information provided on 1455 awards worth £576 million and held by 704 principal investigators at 53 institutions.

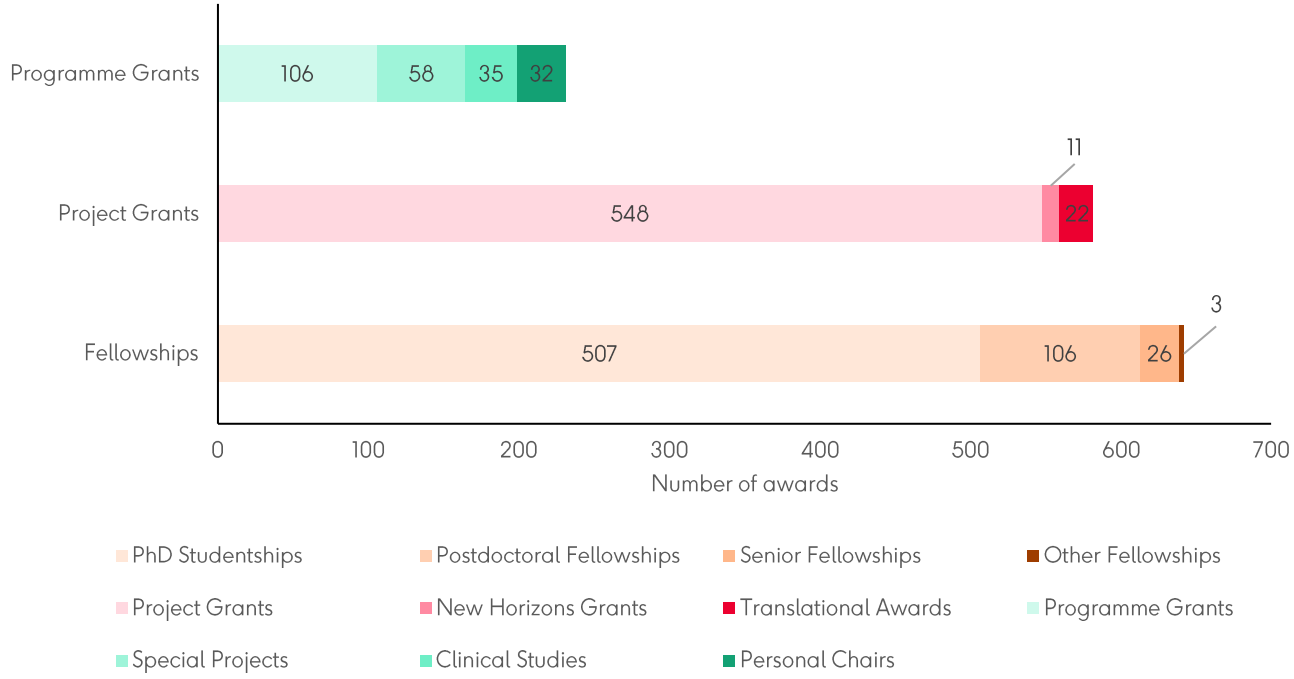
Over half of the £605 million of funding included in the Researchfish 2024 submission portfolio was awarded to principal investigators based at five institutions: University of Oxford (£113 million), King's College London (£63 million), Imperial College London (£60 million), University of Cambridge (£52 million), and University College London (£41 million).

BHF Centres of Research Excellence, Centres of Regenerative Medicine, Infrastructure Grants, Strategic Initiatives, and joint awards administered by other funders are not included in the submission (with the exception of BHF-Turing Cardiovascular Data Science Awards).

Table of response codes of BHF Researchfish portfolio

Response code	Description	Number of awards / PI	Compliance rate by response code for award/PI
1	A submission is expected this year	1440/703	96.6% (1391) / 95.2% (669)
2	No submission is expected this year. The PI has a one year exemption as a result of long term leave e.g. maternity/paternity/sickness	6 /5	0% (0) / 0% (0)
3	No further submissions are expected against this award – the PI is retired/no longer active in research	14 / 11	28.6% (4) /27.3% (3)
4	A submission is expected this year but the PI is no longer working at the funded organisation	84 / 65	71.4% (60) / 70.8% (46)

Grant types in 2024 Researchfish submission



Around 40% within the Researchfish 2024 submission portfolio are Project Grants, including also 11 New Horizon grants and 22 Translational Awards. 44.1% of this year's submission are Fellowships. Programme Grants make up 15.9% of the submission portfolio, including also 58 Special Project Grants, 35 Clinical Studies, and 32 Personal Chairs.

Table of grant types in 2024 Researchfish submission

Grant Type		Number of Grants	Percentage of Total (%)
Fellowships	PhD Studentships*	507	34.8
	Postdoctoral Fellowships†	106	7.3
	Senior Fellowships‡	26	1.8
	Other Fellowships	3	0.2
	Total Fellowships	642	44.1
Project Grants	Project Grants	548	37.7
	New Horizons Grants	11	0.8
	Translational Awards	22	1.5
	Total Project Grants	581	39.9
Programme Grants	Programme Grants	106	7.3
	Special Project Grants	58	4
	Clinical Studies	35	2.4
	Personal Chairs	32	2.2
	Total Programme Grants	231	15.9

*PhD studentships include 3 year non-clinical PhD studentships, 4 year PhD studentships, Clinical Research Training Fellowships, MBPhD studentships, and Research Training Fellowships (for nurses and health professionals); †Postdoctoral fellowships include Advanced Training Awards, Career Development Research Fellowship for Nurses and Allied Health Professionals, Career Re-entry Fellowships, Clinical Research Leave Fellowship (Consultant Research Awards), Immediate Postdoctoral Basic Science Research Fellowships, Intermediate Basic Science Research Fellowships, and Intermediate Clinical

Research Fellowships; ‡Senior Fellowships include Senior Basic Science Research Fellowships and Senior Clinical Research Fellowships.

Discovery, translational, clinical and population research auto-coding

UKCRC Health Research Classification System (HRCS) Research activity[57] are used to classify BHF awards (1 research activity code per award) and are manually revised following applicant input. HRCS Research activity codes were auto-coded into discovery, translational, clinical and population research using the following rules.

HRCS Research activity code	Discovery, translational, clinical and population research classification
1.1 – 1.4 Underpinning research	Discovery science
2.1 Biological and endogenous factors	Discovery science
2.2 Factors relating to physical environment	Clinical and population research
2.3 Psychological, social and economic factors	Clinical and population research
2.4 Surveillance and distribution	Clinical and population research
2.5 Research design and methodologies (aetiology)	Discovery science
3.1 – 3.4 Prevention of disease and conditions	Clinical and population research
4.1 Discovery and preclinical testing of markers and technologies	Translational research
4.2 Evaluation of markers and technologies	Clinical and population research
4.4 Population screening	Clinical and population research
5.1 – 5.7 Development of treatments and therapeutic interventions	Translational research
6.1 – 6.7 Evaluation of treatments and therapeutic interventions	Clinical and population research
7.1 – 7.3 Management of diseases and conditions	Clinical and population research
8.1 – 8.5 Health and social care research	Clinical and population research

[57] Health Research Classification System (HRCS) Research activity, https://hrcsonline.net/research-activities/