

# Dr. James Howard MA (Cantab) MB BChir PhD MRCP

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*GMC No. 7080262*

## About me

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I am a Clinical Senior Lecturer and British Heart Foundation Intermediate Fellow at Imperial College London, and an Honorary Consultant Cardiologist at Hammersmith Hospital.

My research focuses on using novel computational approaches to solve important problems in heart disease. I am a computer scientist, and I was awarded my PhD, “Deep Learning Using Convolutional Neural Networks in Clinical Cardiology” in 2020. My academic and clinical training was supported by a prestigious Wellcome Trust PhD Fellowship and an NIHR Academic Clinical Fellowship and Clinical Lectureship.

I have published extensively in cardiovascular medicine and artificial intelligence (*h*-index 42), across diverse fields including MRI, echocardiography, electrophysiology and coronary physiology. I was awarded a \$40,000 prize by Facebook, Microsoft and Amazon for my work in AI for Deepfake identification, beating over 2000 teams, including Facebook’s own engineering team. I have won several Kaggle gold medals for AI solutions.

I am an expert in the Python programming language and the PyTorch machine learning framework. I have an excellent understanding of statistics, meta-analysis and R programming. I have authored several pieces of data analysis software.

I also have a keen interest in clinical trials and was joint first author and presenter of the SAMSON trial, published in *The New England Journal of Medicine* and *The Journal of the American College of Cardiology*. I run the website [cardiologytrials.org](http://cardiologytrials.org).

## Training & Employment

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2022 –	<b>BHF Intermediate Fellow – Imperial College London</b> <b>Honorary Consultant Cardiologist – Imperial College Healthcare NHS Trust</b>
2020 – 2022	<b>NIHR Clinical Lectureship – Imperial College London</b> <b>Specialist Registrar in Advanced Cardiac Imaging– Imperial College Healthcare NHS Trust</b>
2017 – 2020	<b>Wellcome Trust PhD Training Fellowship – Imperial College London – awarded January 2021</b> “Deep Learning Using Convolutional Neural Networks in Clinical Cardiology”
2015 – 2019	<b>PG Diploma – Clinical Trials – London School of Hygiene &amp; Tropical Medicine</b>
2014 – 2017	<b>NIHR Academic Clinical Fellowship in Cardiology – Imperial College, London</b>
2012 – 2013	<b>PG Cert - Medical Education (Distance Learning) – Cardiff University</b> <ul style="list-style-type: none"><li>• Awarded merit</li></ul>
2012 – 2014	<b>Core Medical Training – London Deanery, North West Thames</b>
2010 – 2012	<b>The Foundation Programme – North East Thames Foundation School</b>
2004 – 2010	<b>Trinity College, The University of Cambridge</b> <ul style="list-style-type: none"><li>• Bachelor of Medicine, Bachelor of Surgery - Clinical Medicine</li><li>• Bachelor &amp; Master of Arts - Physiology, Development and Neuroscience (Class 2.i)</li><li>• Champion prize</li></ul>

## Selected Recent First & Senior Author Publications

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- Senior Cheung, Vimalasvaran, Zaman, Michaelides, Shun-Shin, Francis, Cole, Howard  
**Automating quality control in CMR: Artificial intelligence for discriminative assessment of planning and motion artifacts and real-time reacquisition guidance**  
*Journal of Cardiovascular Magnetic Resonance*, 2024;26(2):101067
- First Howard & Wood, Finegold J, Nowbar A, Thompson D, Arnold A, ... Francis DP.  
**N-of-1 Trial of a Statin, Placebo, or No Treatment to Assess Side Effects.**  
*The New England journal of medicine* 2020;383(22):2182-4 (research letter)
- First Howard JP & Wood FA, Finegold J, Nowbar A, Thompson D, Arnold A ... Francis DP.  
**Side Effect Patterns in a Crossover Trial of Statin, Placebo, and No Treatment.**  
*Journal of the American College of Cardiology* 2021;78(12):1210-22.
- First Howard, Vasudevan, Sarkar, Landman, Koehler, Keene  
**Dynamic Risk Stratification of worsening heart failure using a Deep learning enabled Implanted Ambulatory Single lead ECG**  
*European Heart Journal - Digital Health*, <https://doi.org/10.1093/ehjdh/ztae035>
- First Howard, Chow, Chacko, Fontana, Cole, Kellman, Xue  
**Automated Inline Myocardial Segmentation of Joint T1 and T2 Mapping Using Deep Learning**  
*Radiology. Artificial intelligence* 2022;5(1):e220050
- First Howard JP, Stowell CC, Cole GD, Ananthan K, Demetrescu CD ... Shun-Shin MJ.  
**Automated Left Ventricular Dimension Assessment Using Artificial Intelligence.**  
*Circulation. Cardiovascular imaging* 2021;14(5):e011951.
- First Howard JP, Fisher L, Shun-Shin MJ, Keene D, Arnold AD, Ahmad Y ... Francis DP.  
**Cardiac Rhythm Device Identification Using Neural Networks.**  
*JACC. Clinical electrophysiology* 2019;5(5):576-86.
- First Howard JP, Cook CM, van de Hoef TP, Meuwissen M, de Waard GA, ... Davies JE.  
**AI for Aortic Pressure Waveform Analysis During Coronary Angiography.**  
*JACC. Cardiovascular interventions* 2019;12(20):2093-101.
- First Howard JP, Zaman S, Ragavan A, Hall K, Leonard G, Sutanto S, Ramadoss V ... Cole G.  
**Automated analysis and detection of abnormalities in transaxial anatomical cardiovascular magnetic resonance images: a proof-of-concept study with potential to optimize image acquisition.**  
*The international journal of cardiovascular imaging* 2021;37(3):1033-42.
- Senior Zaman S, Vimalasvaran K, Chappell D, Varela M, Peters N, Shiwani H ... Howard JP  
**Quality assurance of late gadolinium enhancement cardiac magnetic resonance images: a deep learning classifier for confidence in the presence or absence of abnormality with potential to prompt real-time image optimization**  
*J Cardiovasc Magn Reson*. 2024; 26(1): 101040.
- Senior Patel R, Thong EHE, Batta V, Bharath AA, Francis D, Howard JP.  
**Automated identification of orthopedic implants on radiographs using deep learning**  
*Radiology. Artificial intelligence* 2021;3(4):e200183.
- Senior Ahmad Y, Madhavan MV, Stone GW, Francis D, Makkar R, Bhatt DL, Howard JP.  
**Sodium-glucose cotransporter 2 inhibitors in patients with heart failure: a systematic review and meta-analysis of randomized trials.**  
*European heart journal. Quality of care & clinical outcomes*, 2021

## Grants

Lead applicant £36,561 2023	<b>Autonomous cardiac MRI scanning using artificial intelligence: a randomised controlled trial.</b> UKRI & Rosetrees Impact Acceleration Funding (MR/X502959/1 & IAA 2023\1)
Lead applicant £894,223.59 2022	<b>Individualised and efficient cardiac magnetic resonance scanning with artificial intelligence.</b> British Heart Intermediate Clinical Research Fellowship (FS/ICRF/22/26039)
Co-applicant £1,499,538.07 2022	<b>UNITY: UK Collaborative for integrating AI into echocardiography</b> British Heart Foundation Programme Grant (RG/F/22/110059)
Co-applicant £42,956 2022	<b>Expanding clinical and research applicability of coronary flow measurements with novel signal processing tools and Artificial Intelligence</b> NIHR Imperial Biomedical Research Centre (BRC): project award
Lead applicant £28,540 2021	<b>Diastolic function assessment with cardiac magnetic resonance imaging and echocardiography: a scan-rescan study</b> Academy of Medical Sciences Starter Grants for Clinical Lecturers (SGL025\1051)
Co-applicant £197,023 2020	<b>Deep Learning to maximise the value of hand-held cardiac ultrasound in acutely unwell patients: leveraging Imperial's large-scale outcome-linked, echocardiography dataset.</b> NIHR Imperial Biomedical Research Centre (BRC) - Institute for Translational Medicine and Therapeutics (ITMAT)
Lead applicant £200,000 2017	<b>Wellcome Trust PhD Training Fellowship for Clinicians</b> Wellcome Trust / Imperial 4i programme, "Deep Learning Using Convolutional Neural Networks in Clinical Cardiology"
Collaborator £289,669 2015	<b>Statin side effect or not? A patient-empowering within-subject randomized controlled trial and development of a practical technology to support 21st century primary prevention decisions.</b> British Heart Foundation PG/15/7/31235

## Prizes & Awards

International	<b>Kaggle SETI Breakthrough Listen Challenge – Gold Medal - 2021</b> I was awarded 6 <sup>th</sup> place in a large international competition of 768 teams running over 3 months, using AI to process radio wave spectrograms to identify anomalous signals.
International	<b>Kaggle Deepfake Detection Challenge – \$40,000 prize - 2020</b> In this huge international AI competition, my solution to detect "deep faked" videos outperformed those of over 2200 other teams, including Facebook's own engineering team (the tournament organisers). I was invited to present my work at CVPR.
International	<b>Society of Cardiovascular Magnetic Resonance Travel Scholarship - 2019</b> I was awarded this scholarship to travel to Florida, USA to present my work on the automated interpretation of transaxial MRI images using artificial intelligence.
Regional	<b>Best presentation – Imperial College Clinical Academic Conference - 2019</b>

Local	<b>Best Project Supervisor, Computational Medicine BSc, Imperial College - 2018</b>
Local	<b>Local Teaching Hero – Nominated by final year medical students – 2017</b>
National	<b>UK research paper of the year – BMJ awards - 2015</b> Our team were awarded this prestigious award for our study in the <i>BMJ</i> on discrepancies in clinical trials.
National	<b>British Hypertension Society Young Investigator Award Finalist - 2013</b>
National	<b>Top Abstract - British Cardiovascular Society Annual Conference - 2012</b>
Local	<b>University of Cambridge Medical School – Champion Prize – 2010</b>
National	<b>British Association of Dermatologists’ Undergraduate Essay Prize - 2010</b>

## All MEDLINE/Pubmed Peer Reviewed Publications & Book Chapters

Paper 2024	<u>Howard</u> , Vasudevan, Sarkar, Landman, Koehler, Keene <b>“Dynamic Risk Stratification of worsening heart failure using a Deep learning enabled Implanted Ambulatory Single lead ECG”</b> <a href="https://doi.org/10.1093/ehjdh/ztae035">European Heart Journal - Digital Health, https://doi.org/10.1093/ehjdh/ztae035</a>
Paper 2024	Rajkumar, Foley, Ahmed-Jushuf, Simader, Mohsin, ... <u>Howard</u> ... Al-Lamee <b>“N-of-1 Trial of Angina Verification Before Percutaneous Coronary Intervention”</b> <a href="https://doi.org/10.1093/eurheartj/ehad035">J Am Coll Cardiol. 2024 May 8;S0735-1097(24)06824-4.</a>
Paper 2024	Zaman, Vimalasvaran, Chappell ... <u>Howard</u> JP <b>“Quality assurance of late gadolinium enhancement cardiac magnetic resonance images: a deep learning classifier for confidence in the presence or absence of abnormality with potential to prompt real-time image optimization”</b> <a href="https://doi.org/10.1016/j.jcmr.2024.101040">J Cardiovasc Magn Reson. 2024; 26(1): 101040.</a>
Paper 2024	Simader, Rajkumar, Foley ... <u>Howard</u> , Cole, Harrel, Francis, Shun-Shin, Al-Lamee <b>“Symptoms as a Predictor of the Placebo-Controlled Efficacy of PCI in Stable Coronary Artery Disease”</b> <a href="https://doi.org/10.1016/j.jacc.2024.03.035">JACC in press</a>
Paper 2024	Foley, Rajkumar, Ahmed-Jushuf, ... <u>Howard</u> , Cole, Shun-Shin, Al-Lamee <b>“Coronary sinus reducer for the treatment of refractory angina (ORBITA-COSMIC): a randomised, placebo-controlled trial”</b> <a href="https://doi.org/10.1016/S0140-6736(24)00670-3">Lancet. 2024 Apr 20;403(10436):1543-1553</a>
Paper 2024	Alshahrani, Harley, <u>Howard</u> , Hajhosseiny, Khawaja, Seligman, ... Khamis <b>“Remote Acute Assessment of Cardiac Patients Post-Acute Coronary Syndrome (TELE-ACS): A Randomized Controlled Trial”</b> <a href="https://doi.org/10.1016/j.jacc.2024.03.035">J Am Coll Cardiol. 2024 Mar 28;S0735-1097(24)06709-3.</a>

- Paper 2024 Sreenivasan, Reddy, Jamil, Malik, Chamie, Howard, Nanna, ... Ahmed  
**"Intravascular imaging-guided versus angiography-guided percutaneous coronary intervention: systematic review and meta-analysis of randomized trials"**  
[\*J Am Heart Assoc.\* 2024 Jan 16;13\(2\):e031111. doi: 10.1161/JAHA.123.031111](#)
- Paper 2024 Stowell, Kallassy, Lane, Abbott, ... Howard, Shun-Shin, Francis, Fuentes  
**"Automated echocardiographic left ventricular dimension assessment in dogs using artificial intelligence: Development and validation"**  
[\*J Vet Intern Med.\* 2024 Mar-Apr;38\(2\):922-930.](#)
- Paper 2024 Warisawa, Cook, Ahmed, Howard, Seligman, Rajkumar ... Davies  
**"Physiological Assessment with iFR prior to FFR Measurement in Left Main Disease"**  
[\*Cardiovasc Interv Ther.\* 2024 Apr 20.](#)
- Paper 2023 Reddy, Ahmed, Arnold, Howard  
**"Cerebral Embolic Protection Devices During Transcatheter Aortic Valve Replacement: A Meta-analysis of Randomized Controlled Trials"**  
[\*J. Soc. Cardiovascular Angiography & Interventions.\* 2;5,101031.](#)
- Paper 2023 Rajkumar, Foley, Ahmed-Jushuf, ..., Howard, Francis, Shun-Shin, Lamee  
**"A Placebo-Controlled Trial of Percutaneous Coronary Intervention for Stable Angina"**  
[\*N Engl J Med.\* 2023 Dec 21;389\(25\):2319-2330.](#)
- Paper 2023 Ahmad, Howard, ... Leon  
**"Transcatheter versus surgical aortic valve replacement in lower-risk and higher-risk patients: a meta-analysis of randomized trials"**  
[\*European Heart Journal, Volume 44, Issue 10, 7 March 2023\*](#)
- Paper 2023 Reddy, Howard, Ahmad, Shun-Shin, Simader, ... Arnold  
**"Catheter Ablation for Ventricular Tachycardia After MI: A Reconstructed Individual Patient Data Meta-analysis of Randomised Controlled Trials"**  
[\*Arrhythm Electrophysiol Rev.\* 2023 Nov 22;12:e26.](#)
- Paper 2023 Whinnett, Shun-Shin, ... Howard, ... Keene  
**"Effects of haemodynamically atrio - ventricular optimized His bundle pacing on heart failure symptoms and exercise capacity: the His Optimized Pacing Evaluated for Heart Failure (HOPE-HF) randomized, double-blind, cross-over trial"**  
[\*European Journal of Heart Failure\* \(2023\) 25, 274–283](#)
- Paper 2023 Sau, Kapadia, Al-Aidarous, Howard, Sohaib, Sikkil, Arnold, Waks, Kramer, Peters, Nh  
**"Temporal Trends and Lesion Sets for Persistent Atrial Fibrillation Ablation: A Meta-Analysis With Trial Sequential Analysis and Meta-Regression"**  
[\*Circ Arrhythm Electrophysiol.\* 2023 Sep;16\(9\):e011861.](#)
- Paper 2023 Shi, Sau, Li, Patel, Bajaj, Varela, Wu, Handa, ... Howard ... Jensen, Ng  
**"Information theory-based direct causality measure to assess cardiac fibrillation dynamics"**  
[\*J R Soc Interface.\* 2023 Oct;20\(207\):20230443.](#)

- Paper 2023 Simader, Howard, Ahmad, Saleh, ... Arnold  
**"Catheter ablation improves cardiovascular outcomes in patients with atrial fibrillation and heart failure: a meta-analysis of randomized controlled trials"**  
[\*Europace\*. 2023 Feb 16;25\(2\):341-350.](#)
- Paper 2023 Kanagaratnam, Francis, Chamie, Coyle, ... Howard ... Shun-Shin  
**"A randomized controlled trial to investigate the use of acute coronary syndrome therapy in patients hospitalized with COVID-19: the COVID-19 Acute Coronary Syndrome trial"**  
[\*J Thromb Haemost\*. 2023 May 23](#)
- Paper 2023 Seligman, Patel, Alloula, Howard, Cook, Ahmed ... Petraco  
**"Development of artificial intelligence tools for invasive Doppler-based coronary microvascular assessment"**  
[\*Eur Heart J Digit Health\*. 2023 May 3;4\(4\):291-301.](#)
- Paper 2023 Zaman, Padayachee, Shah, Samways, Auton, Quaife, Sweeney, Howard, ... Plymen  
**"Smartphone-Based Remote Monitoring in Heart Failure With Reduced Ejection Fraction: Retrospective Cohort Study of Secondary Care Use and Costs"**  
[\*JMIR Cardio\*. 2023; 7: e45611.](#)
- Paper 2023 Foley, Rajkumar, Ahmed-Jushuf, Nour, ... Howard ... Shin-Shin, Al-Lamee  
**"The ability of contemporary cardiologists to judge the ischemic impact of a coronary lesion visually"**  
[\*Cardiovasc Revasc Med\*. 2024 Feb;59:60-66.](#)
- Paper 2023 Warisawa, Cook, Ahmad, Howard, Seligman, Rajkumar, ... Davies  
**"Deferred Versus Performed Revascularization for Left Main Coronary Disease With Hemodynamic Significance"**  
[\*Circ Cardiovasc Interv\*. 2023 Jun;16\(6\):e012700.](#)
- Paper 2023 Keene, Kaza, Arnold, Howard, Tanner, Foley, ... Whinnett, Shun-Shin  
**"Predictors of the efficacy of AV-optimised His bundle pacing in patients with a prolonged PR interval: a stratified analysis of the HOPE-HF clinical trial"**  
[\*Europace\*. 2023 Jun; 25\(Suppl 1\): euad122.456.](#)
- Paper 2023 Zaman, Vimalasvaran, Howard, Chappell, Varela, Peters, Francis, Bharath, Linton, Cole  
**"Efficient labelling for efficient deep learning: the benefit of a multiple-image-ranking method to generate high volume training data applied to ventricular slice level classification in cardiac MRI"**  
[\*J Med Artif Intell\*. 2023 Apr;6:4. doi: 10.21037/jmai-22-55.](#)
- Paper 2023 Arnold, Shun-Shin, Ali, Keene, Howard, Francis, Whinnett  
**"Contributions of Atrioventricular Delay Shortening and Ventricular Resynchronization to Hemodynamic Benefits of Biventricular Pacing"**  
[\*JACC Clin Electrophysiol\*. 2023 Jan;9\(1\):117-119.](#)
- Paper 2023 Kaza, Htun, Miyazawa, Simader, Porter, Howard, ... Keene  
**"Upgrading right ventricular pacemakers to biventricular pacing or conduction**

**system pacing: a systematic review and meta-analysis”**

[\*Europace\*. 2023 Mar 30;25\(3\):1077-1086](#)

- Paper  
2023 Warisawa, Cook, Kawase, [Howard](#), ... Davies  
**“Physiology-guided PCI versus CABG for left main coronary artery disease: insights from the DEFINE-LM registry”**  
[\*Cardiovasc Interv Ther\*. 2023 Apr 5.](#)
- Paper  
2023 Madhavan, [Howard](#), Brener ... Leon, Ahmad  
**“Long-Term Outcomes of Randomized Controlled Trials Comparing Percutaneous Left Atrial Appendage Closure to Oral Anticoagulation for Nonvalvular Atrial Fibrillation: A Meta-Analysis”**  
[\*Structural Heart\*. 7\(1\). 100096](#)
- Paper  
2022 Padayachee, Shah, Auton, ... [Howard](#) ... Zaman  
**“Smartphone-based remote monitoring (RM) in chronic heart failure reduces emergency hospital attendances, unplanned admissions and secondary care costs: a retrospective cohort study”**  
[\*Eur Heart J Digit Health\*. 2022 Dec; 3\(4\): 726076.2816](#)
- Paper  
2022 [Howard](#), Rajasundaram  
**“Role of Blinding in N-of-1 Trials”**  
[\*Circ Cardiovasc Qual Outcomes\*. 2022 Jun;15\(6\):e008914.](#)
- Paper  
2022 Tayal, Verdonchot, Hazebroek, [Howard](#), Gregson, ... Prasad  
**“Precision Phenotyping of Dilated Cardiomyopathy Using Multidimensional Data”**  
[\*J Am Coll Cardiol\*. 2022 Jun, 79 \(22\) 2219–2232](#)
- Paper  
2022 Nowbar, [Howard](#), Shun-Shin, Rajkumar, Foley, Basu, Goel, Patel, Adnan, ... Al-Lamee  
**“Daily angina documentation versus subsequent recall: development of a symptom smartphone app”**  
[\*European Heart Journal - Digital Health\*. 3;2:276–283](#)
- Paper  
2022 Ribeiro, Arnold, [Howard](#), Shun-Shin, Zhang, Francis, Lim, Whinnett, Zolgharni  
**“ECG-based real-time arrhythmia monitoring using quantized deep neural networks: A feasibility study”**  
[\*Comput Biol Med\*. 2022 Jan 22;143:105249](#)
- Paper  
2022 Ahmad, [Howard](#), ... Leon  
**“Early Surgery for Patients With Asymptomatic Severe Aortic Stenosis: A Meta-Analysis of Randomized Controlled Trials”**  
[\*Journal of the Society for Cardiovascular Angiography & Interventions\*; 1;4 100383](#)
- Paper  
2022 M Foley, Hall, [Howard](#), Ahmad ... Sen  
**“Aortic Valve Calcium Score Is Associated With Acute Stroke in Transcatheter Aortic Valve Replacement Patients”**  
[\*Journal of Society of Cardiovascular Angiography and Interventions\* 2022; 1;4:100349](#)
- Paper  
2021 Kellman, Xue, Chow, [Howard](#), Chacko, Cole, Fontana.  
**“Bright-blood and dark-blood phase sensitive inversion recovery late gadolinium**

enhancement and T1 and T2 maps in a single free-breathing scan: an all-in-one approach.”

[\*Journal of cardiovascular magnetic resonance\* 2021;23\(1\):126.](#)

Paper  
2021 Kelshiker, Seligman, Howard, Rahman, Foley ... Ahmad, Sen, Al-Lamee, Petraco  
**“Coronary flow reserve and cardiovascular outcomes: a systematic review and meta-analysis”**

[\*European Heart Journal\*, 2021; ehab775, <https://doi.org/10.1093/eurheartj/ehab775>](#)

Paper  
2021 Zaman, Petri, Vimalasvaran, Howard, Bharath, Francis, Peters, Cole, Linton  
**“Automatic Diagnosis Labeling of Cardiovascular MRI Using Semisupervised Natural Language Processing of Text Reports”**

[\*Radiology Artificial Intelligence\* 2021; <https://doi.org/10.1148/ryai.210085>](#)

Paper  
2021 Ahmad, Francis, Bhatt , Howard  
**“Renal denervation for the treatment of hypertension: a systematic review and meta-analysis of randomized, blinded, placebo-controlled trials”**

[\*JACC: Cardiovascular Interventions\*. 2021 \(in press\)](#)

Paper  
2021 Ahmad Y, Madhavan, ... Howard  
**“Sodium-glucose cotransporter 2 inhibitors in patients with heart failure: a systematic review and meta-analysis of randomized trials.”**

[\*Eur Hear J - Qual Care Clin Outcomes\* 2021](#)

Paper  
2021 Howard, Francis  
**“Machine learning with convolutional neural networks for clinical cardiologists”**

[\*Heart\*. 2021 Jul 23;heartjnl-2020-318686.](#)

Paper  
2021 Seligman, Nijjer, ... Howard, ... Petraco  
**“Phasic Flow Patterns of Right versus Left Coronary Arteries in Patients Undergoing Clinical Physiological Assessment”**

[\*EuroIntervention\*. 2021 Aug 3;EIJ-D-21-00189.](#)

Paper  
2021 Cook, Howard, Ahmad, ... Davies  
**“Comparing invasive hemodynamic responses in adenosine hyperemia versus physical exercise stress in chronic coronary syndromes”**

[\*Int J Cardiol\*. 2021 Aug 4;S0167-5273\(21\)01209-2.](#)

Paper  
2021 Arnold, Shun-Shin, Ali, Keene, Howard, ... Whinnett  
**“Left ventricular activation time and pattern are preserved with both selective and nonselective His bundle pacing”**

[\*Heart Rhythm O2\*, Aug 11, \[doi.org/10.1016/j.hroo.2021.08.001\]\(https://doi.org/10.1016/j.hroo.2021.08.001\)](#)

Paper  
2021 Lane, Azarmehr, Jevsikov, Howard, Shun-Shin, Cole, Francis, Zolgharni  
**“Multibeat echocardiographic phase detection using deep neural networks”**

[\*Comput Biol Med\*. 2021 Jun;133:104373. doi: 10.1016/j.combiomed.2021.104373.](#)

Paper  
2021 Madhavan, Howard, Naqvi, ... Bangalore, Stone, Ahmad  
**“Long-term follow-up after ultrathin vs. conventional 2nd-generation drug-eluting stents: a systematic review and meta-analysis of randomized controlled trials”**



[Eur Heart J. 2021 May 18;ehab280. doi: 10.1093/eurheartj/ehab280.](#)

- Paper  
2021 Mann, Linton, Coyle, [Howard](#), ... Kanagaratnam  
**“RETRO-MAPPING: A New Approach to Activation Mapping in Persistent Atrial Fibrillation Reveals Evidence of Spatiotemporal Stability.”**  
[Circ Arrhythm Electrophysiol. 2021 May 17. doi: 10.1161/CIRCEP.121.009602.](#)
- Paper  
2021 Rajkumar, Shun-Shin, ... [Howard](#), ... Al-Lamee  
**“Placebo-Controlled Efficacy of Percutaneous Coronary Intervention for Focal and Diffuse Patterns of Stable Coronary Artery Disease”**  
[Circ Cardiovasc Interv. 2021 Aug;14\(8\):e009891.](#)
- Paper  
2021 [Howard](#), Stowell, Cole, ... Francis, Shun-Shin  
**Automated Left Ventricular Dimension Assessment Using Artificial Intelligence Developed and Validated by a UK-Wide Collaborative**  
[Circ Cardiovasc Imaging. 2021 May;14\(5\). doi: 10.1161/circimaging.120.011951.](#)
- Paper  
2021 Patel, Thong, Batta, Bharath, Francis, [Howard](#)  
**“Automated Identification of Orthopedic Implants in Radiographs Using Deep Learning”**  
[Radiol Art Int. 2021 Mar 2021 doi: 10.1148/ryai.2021200183](#)
- Paper  
2021 Foley, Rajkumar, Shun-Shin, ... [Howard](#) ... Al-Lamee  
**“Achieving Optimal Medical Therapy: Insights From the ORBITA Trial”**  
[J Am Heart Assoc. 2021 Feb 2;10\(3\):e017381. doi: 10.1161/JAHA.120.017381.](#)
- Paper  
2021 Ahmad, [Howard](#)  
**“Meta-Analysis of Usefulness of Cerebral Embolic Protection During Transcatheter Aortic Valve Implantation”**  
[Am J Cardiol. 2021 Feb 5:S0002-9149\(21\)00094-1.](#)
- Paper  
2021 Ahmad, Kane, Arnold, Cook, Keene, Shun-Shin, ... [Howard](#)  
**“Randomized blinded placebo-controlled trials of renal sympathetic denervation for hypertension: a meta-analysis”**  
[Cardiovasc Revasc Med. 2021 Jan 30;S1553-8389\(21\)00082-8.](#)
- Paper  
2020 Arnold, Shun-Shin, Keene, [Howard](#), ... Whinnett  
**“Electrocardiographic predictors of successful resynchronization of left bundle branch block by His bundle pacing”**  
[J Cardiovasc Electrophysiol. 2020 Dec 20.](#)
- Paper  
2020 Ahmad, [Howard](#), Madhavan, Leon, Makkar  
**“Single versus dual antiplatelet therapy after transcatheter aortic valve replacement: a meta-analysis of randomized clinical trials”**  
[Cardiovasc Revasc Med. 2021 Jan 22;S1553-8389\(21\)00045-2.](#)
- Research letter  
2020 [Wood & Howard](#), Finegold, ... Francis  
**“N-of-1 Trial of a Statin, Placebo, or No Treatment to Assess Side Effects”**  
[N. Engl J. Med 2020; DOI: 10.1056/NEJMc2031173](#)

- Paper  
2020      Howard, Zaman, Ragavan ... Cole  
**"Automated analysis and detection of abnormalities in transaxial anatomical cardiovascular magnetic resonance images: a proof of concept study with potential to optimize image acquisition"**  
[\*Int J Cardiovasc Imaging\*. 2020 Oct 29. doi: 10.1007/s10554-020-02050-w.](#)
- Paper  
2020      Howard, Tan, Shun-Shin... Francis  
**"Improving ultrasound video classification: an evaluation of novel deep learning methods in echocardiography"**  
[\*J Med Artif Intell\*. 2020;3:4](#)
- Paper  
2020      Howard & Arnold, Gopi, Cheng...Whinnet  
**"Discriminating electrocardiographic responses to His-bundle pacing using machine learning"**  
[\*Cardiovasc. Dig. Health J\*. 2020;1:1:11-12](#)
- Paper  
2020      Ahmad, Howard, ... Karmpaliotis  
**"Mortality after drug-eluting stents vs. coronary artery bypass grafting for left main coronary artery disease: a meta-analysis of randomized controlled trials"**  
[\*Eur Heart J\*. 2020 Mar 2. pii: ehaa135.](#)
- Paper  
2020      Ziff, Samra, Howard, ... Kotecha  
**"Beta-blocker Efficacy Across Different Cardiovascular Indications: An Umbrella Review and Meta-Analytic Assessment"**  
[\*BMC Med\*. 2020 May 5;18\(1\):103.](#)
- Paper  
2020      Ahmad, Howard, ... Karmpaliotis  
**"Complete Revascularization by Percutaneous Coronary Intervention for Patients With ST-Segment-Elevation Myocardial Infarction and Multivessel Coronary Artery Disease: An Updated Meta-Analysis of Randomized Trials"**  
[\*J Am Heart Assoc\*. 2020 Jun 1:e015263.](#)
- Paper  
2020      Cook, Howard, ... Davies  
**"How Do Fractional Flow Reserve, Whole-Cycle PdPa, and Instantaneous Wave-Free Ratio Correlate With Exercise Coronary Flow Velocity During Exercise-Induced Angina?"**  
[\*Circ Cardiovasc Interv\*. 2020 Apr;13\(4\):e008460](#)
- Paper  
2020      Chacko, Howard, ... Ahmad  
**"Effects of Percutaneous Coronary Intervention on Death and Myocardial Infarction Stratified by Stable and Unstable Coronary Artery Disease: A Meta-Analysis of Randomized Controlled Trials"**  
[\*Circ Cardiovasc Qual Outcomes\*. 2020 Feb;13\(2\):e006363.](#)
- Paper  
2020      De Marvao, Dawes, Howard, O'Regan  
**"Artificial intelligence and the cardiologist: what you need to know for 2020"**  
[\*Heart\*. 2020 Mar;106\(5\):399-400.](#)
- Paper  
2020      Warisawa, Cook, Rajkumar, Howard, ... Davies  
**"Safety of Revascularization Deferral of Left Main Stenosis Based on Instantaneous Wave-Free Ratio Evaluation"**

- Paper  
2020 Vendrik, Ahmad, Eftekhari, [Howard](#), ... Baan  
**“Long-Term Effects of Transcatheter Aortic Valve Implantation on Coronary Hemodynamics in Patients With Concomitant Coronary Artery Disease and Severe Aortic Stenosis”**  
[J Am Heart Assoc. 2020 Mar 3;9\(5\):e015133.](#)
- Paper  
2020 Cook, Ahmad, [Howard](#), ... Davies  
**“Association Between Physiological Stenosis Severity and Angina-Limited Exercise Time in Patients With Stable Coronary Artery Disease”**  
[JAMA Cardiol. 2019 Jun 1;4\(6\):569-574.](#)
- Paper  
2020 Azarmehr, Ye, ... Howard, Francis, Zolgharni  
**“An optimisation-based iterative approach for speckle tracking echocardiography”**  
[Med Biol Eng Comput. 2020 Jun;58\(6\):1309-1323.](#)
- Paper  
2019 [Howard](#), Cook, ... Davies  
**“Artificial Intelligence for Aortic Pressure Waveform Analysis During Coronary Angiography: Machine Learning for Patient Safety”**  
[JACC Cardiovasc Interv. 2019 Sep 20. pii: S1936-8798\(19\)31421-9](#)
- Paper  
2019 [Howard](#), Fisher, ... Francis  
**“Cardiac Rhythm Device Identification Using Neural Networks”**  
[JACC Clin Electrophysiol. 2019 May;5\(5\):576-586.](#)
- Paper  
2019 Al-Lamee, Shun-Shin, [Howard](#), ... Francis  
**“Dobutamine Stress Echocardiography Ischemia as a Predictor of the Placebo-Controlled Efficacy of Percutaneous Coronary Intervention in Stable Coronary Artery Disease: The Stress Echocardiography-Stratified Analysis of ORBITA”**  
[Circulation. 2019 Nov 11](#)
- Paper  
2019 Ahmad, Vendrik, Eftekhari, [Howard](#), ... Sen  
**“Determining the Predominant Lesion in Patients With Severe Aortic Stenosis and Coronary Stenoses: A Multicenter Study Using Intracoronary Pressure and Flow”**  
[Circ Cardiovasc Interv. 2019 Dec;12\(12\):e008263.](#)
- Paper  
2019 [Howard](#)  
**“Renal denervation: the three stages of academic grief”**  
[Trends Cardiovasc Med. 2019 Oct 22. pii: S1050-1738\(19\)30141-0.](#)
- Paper  
2019 Cook, Warisawa, [Howard](#), ... Davies  
**“Algorithmic versus expert human interpretation of instantaneous wave-free ratio coronary pressure-wire pull back data”**  
[JACC Cardiovasc Interv. 2019 Jul 22;12\(14\):1315-1324.](#)
- Paper  
2019 Warisawa, Cook, [Howard](#), ... Davies  
**“Physiological Pattern of Disease Assessed by Pressure-Wire Pullback Has an Influence on Fractional Flow Reserve/Instantaneous Wave-Free Ratio**

## Discordance

[\*Circ Cardiovasc Interv.\* 2019 May;12\(5\):e007494.](#)

- Paper 2019 Sau, [Howard](#), ... Francis  
**"Meta-Analysis of Randomized Controlled Trials of Atrial Fibrillation Ablation With Pulmonary Vein Isolation Versus Without"**  
[\*JACC Clin Electrophysiol.\* 2019 Aug;5\(8\):968-976](#)
- Paper 2019 Nowbar, Gitto, [Howard](#), Francis, Al-Lamee  
**"Mortality From Ischemic Heart Disease"**  
[\*Circ Cardiovasc Qual Outcomes.\* 2019 Jun;12\(6\)](#)
- Paper 2019 Cook, Ahmad, [Howard](#), ... Davies  
**"Association Between Physiological Stenosis Severity and Angina-Limited Exercise Time in Patients with Stable Coronary Artery Disease"**  
[\*JAMA Cardiol.\* 2019 May 1.](#)
- Paper 2019 Keene, Shun-Shin, ... [Howard](#), ... Whinnett  
**"Quantification of Electromechanical Coupling to Prevent Inappropriate Implantable Cardioverter-Defibrillator Shocks"**  
[\*JACC Clin Electrophysiol.\* 2019 Jun;5\(6\):705-715.](#)
- Paper 2019 Arnold, [Howard](#), ... Whinnett  
**"Right Ventricular Pacing for Hypertrophic Obstructive Cardiomyopathy: Meta-Analysis and Meta-Regression of Clinical Trials."**  
[\*Eur Heart J Qual Care Clin Outcomes.\* 2019 Jan 31.](#)
- Paper 2019 Sau, Al-Aidarous, [Howard](#), ... Sikkell  
**"Optimum lesion set and predictors of outcome in persistent atrial fibrillation ablation: a meta-regression analysis"**  
[\*Europace.\* 2019 May 9. pii: eu3108.](#)
- Paper 2019 Seligman, Shun-Shin, ... [Howard](#), ... Petraco  
**"Fractional flow reserve derived from microcatheters versus standard pressure wires: a stenosis-level meta-analysis"**  
[\*Open Heart.\* 2019 Mar 25;6\(1\):e000971.](#)
- Paper 2019 Sen, Ahmad, Dehbi, [Howard](#), ... Davies  
**"Clinical Events After Deferral of LAD Revascularization Following Physiological Coronary Assessment"**  
[\*J Am Coll Cardiol.\* 2019 Feb 5;73\(4\):444-453.](#)
- Paper 2018 Hartley, ... [Howard](#), Francis  
**"Key opinion leaders' guide to spinning a disappointing clinical trial result"**  
[\*BMJ\* 2018; 363](#)
- Paper 2018 Al-Lamee, [Howard](#), ... Francis  
**"Fractional Flow Reserve and Instantaneous Wave-Free Ratio as Predictors of the Placebo-Controlled Response to Percutaneous Coronary Intervention in Stable Single-Vessel Coronary Artery Disease."**  
[\*Circulation.\* 2018 Oct 23;138\(17\):1780-1792.](#)

- Paper  
2018 Arnold, Shun-Shin, ... Howard..., Whinnett  
**"His resynchronization versus biventricular pacing in patients with heart failure and left bundle branch block"**  
[\*J Am Coll Cardiol\*. 2018 Dec 18;72\(24\):3112-3122.](#)
- Paper  
2018 Warisawa, Cook, Howard, ... Davies  
**"Physiological Pattern of Disease Assessed by Pressure-Wire Pullback Has an Influence on Fractional Flow Reserve/Instantaneous Wave-Free Ratio Discordance."**  
[\*Circ Cardiovasc Interv\*. 2019 May;12\(5\):e007494.](#)
- Paper  
2018 Ferreira-Martins, Howard, Al-Khayatt, ... Sikkell  
**"Outcomes of Paroxysmal AF ablation Studies are Affected more by Study Design and Patient Mix than Ablation Technique."**  
[\*J Cardiovasc Electrophysiol\*. 2018 Sep 19. doi: 10.1111/jce.13745.](#)
- Paper  
2018 Ahmad, Gotberg, Cook, Howard, ... Sen  
**"Coronary Hemodynamics in Patients With Severe Aortic Stenosis and Coronary Artery Disease Undergoing Transcatheter Aortic Valve Replacement"**  
[\*JACC Cardiovasc Interv\*. 2018 Aug 20. pii: S1936-8798\(18\)31521-8](#)
- Paper  
2018 Cook, Ahmad, Howard, ... Davies  
**"Impact of Percutaneous Revascularization on Exercise Hemodynamics in Patients With Stable Coronary Disease"**  
[\*J Am Coll Cardiol\*. 2018 Aug 28;72\(9\):970-983. doi: 10.1016/j.jacc.2018.06.033.](#)
- Paper  
2018 Keene, ... Howard, ... Francis  
**"Rationale and design of the randomized multicentre His Optimized Pacing Evaluated for Heart Failure (HOPE - HF) trial"**  
[\*ESC Heart Fail\*. 2018 Jul 9. doi: 10.1002/ehf2.12315](#)
- Paper  
2018 Howard, Murthy  
**"A Song of Pressure and Flow, or There and Back Again"**  
[\*JACC Cardiovasc Interv\*. 2018 Apr 23;11\(8\):754-756.](#)
- Paper  
2018 Whinnett, Sohaib, ... Howard, ... Francis  
**"Multicenter Randomized Controlled Crossover Trial Comparing Hemodynamic Optimization Against Echocardiographic Optimization of AV and VV Delay of Cardiac Resynchronization Therapy: The BRAVO Trial"**  
[\*JACC Cardiovasc Imaging\*. 2018 May 11.](#)
- Paper  
2018 Ahmad, Howard, ... Sen  
**"Patent foramen ovale closure vs. medical therapy for cryptogenic stroke: a meta-analysis of randomized controlled trials"**  
[\*Eur Heart J\*. 2018 Mar 24.](#)
- Paper  
2018 Ahmad, Demir, Rajkumar, Howard, ... Sen  
**"Optimal antiplatelet strategy after transcatheter aortic valve implantation: a meta-analysis"**

- Paper  
2018 Petraco, Dehbi, Howard ... Francis  
**"Effects of disease severity distribution on the performance of quantitative diagnostic methods and proposal of a novel 'V-plot'methodology to display accuracy values"**  
[Open Heart. 2018 Jan 20;5\(1\)](#)
- Paper  
2018 Al-Lamee, Thompson, Dehbi , Sen ... Howard ... Francis  
**"Percutaneous coronary intervention in stable angina (ORBITA): a double-blind, randomised controlled trial"**  
[Lancet. 2018 Jan 6;391\(10115\):31-40](#)
- Paper  
2017 Sikkell, Francis, Howard, Gordon, Rowlands, Peters, Lyon, Harding, MacLeod  
**"Hierarchical statistical techniques are necessary to draw reliable conclusions from analysis of isolated cardiomyocyte studies"**  
[Cardiovascular Research, cvx151, https://doi.org/10.1093/cvr/cvx151](#)
- Paper  
2017 Shun-Shin, Zheng, Cole, Howard, Whinnett, Francis  
**"Implantable cardioverter defibrillators for primary prevention of death in left ventricular dysfunction with and without ischaemic heart disease: a meta-analysis of 8567 patients in the 11 trials"**  
[Eur Heart J. 2017 Jun 7;38\(22\):1738-1746.](#)
- Paper  
2016 Howard, Shun-Shin, Hartley, Bhatt, Krum, Francis  
**"Quantifying the three biases that lead to unintentional overestimation of the blood-pressure lowering effect of renal denervation: meta-analysis of 148 trials of 6114 patients and implications for design of future trials"**  
[Circ Cardiovasc Qual Outcomes. 2016 Jan;9\(1\):14-22](#)
- Paper  
2016 Maznyczka, Howard, Banning, Gershlick  
**"A Propensity Matched Comparison of Return to Work and Quality of Life after Stenting or Coronary Artery Bypass Surgery"**  
[Open Heart. 2016 Jan 13;3\(1\):e000322.](#)
- Paper  
2015 Patel, Hayward, Vassiliou, Patel, Howard, Di Mario  
**"Renal denervation for the management of resistant hypertension"**  
[Integr Blood Press Control. 2015; 8: 57-69.](#)
- Paper  
2015 Howard, Patel, Shun-Shin, Mourad, Blacher, Mahfoud, Zeller, Weber, Francis  
**"Impact of number of prescribed medications on visit-to-visit variability of blood pressure: implications for design of future trials of renal denervation"**  
[J Hypertens. 2015 Nov;33\(11\):2359-67](#)
- Paper  
2015 Jones, Howard, Rathod, Gallagher, Knight, Jain, Mathur, Mohiddin, Timmis, Mills, Archbold, Wragg  
**"The impact of socioeconomic status on all-cause mortality after percutaneous coronary intervention: an observational cohort study of 13,770 patients"**  
[EuroIntervention. 2015 Feb 22;10\(11\):e1-8.](#)

- Book chapter     Howard, Shun-Shin, Francis  
**"Great Myths of Blood Pressure Effect Size in Renal Denervation"**  
[\*Renal Denervation\*, 2015, 175-180](#)
- Paper  
2014     Howard, Francis  
**"Overcoming the 3 biases obscuring the science of renal denervation in humans: big day bias, check-once-more bias and I'll-take-it-now bias."**  
[\*Trends CV Med\*, 2014. doi:10.1016/j.tcm.2014.10.011](#)
- Paper  
2014     Howard, Antoniou, Jones, Wragg  
**"Recent advances in antithrombotic treatment for acute coronary syndromes."**  
[\*Expert Rev Clin Pharmacol\*, 2014 May 31:1-15.](#)
- Paper  
2014     Howard, Jones, Gallagher, Rathod, Antoniou, Wright, Knight, Mathur, Weerackody, Wragg  
**"Glycoprotein IIb/IIIa inhibitors use and outcome after Percutaneous Coronary Intervention for Non-ST-elevation myocardial infarction"**  
[\*BioMed Research International\* 2014. doi: 10.1155/2014/643981](#)
- Paper  
2014     Nowbar, Mielewczik, Karavassilis, Dehbi, Shun-Shin, Jones, Howard, Cole, Francis  
**"Discrepancies in autologous bone marrow stem cell trials and enhancement of ejection fraction (DAMASCENE): weighted regression and meta-analysis"**  
[\*BMJ\*, 2014 Apr 28;348:g2688. doi: 10.1136/bmj.g2688.](#)
- Paper  
2014     Nowbar, Howard, Finegold, Asaria, Francis  
**"2014 Global geographic analysis of mortality from ischaemic heart disease by country, age and income: Statistics from World Health Organisation and United Nations"**  
[\*Int J Cardio\* 2014; doi: 10.1016/j.ijcard.2014.04.096](#)
- Paper  
2014     Shun-shin, Howard, Francis  
**"Removing the hype from hypertension"**  
[\*BMJ\*, 2014 Mar 6;348:g1937. doi: 10.1136/bmj.g1937.](#)
- Paper  
2014     Howard, Cole, Sievert, Bhatt, Papademetriou, Kandzari, Davies, Francis  
**"Unintentional overestimation of an expected antihypertensive effect in drug and device trials: Mechanisms and solutions"**  
[\*Int J Cardiol\* 2014; doi: 10.1016/j.ijcard.2013.12.183](#)
- Paper  
2013     Howard, Nowbar, Francis  
**"Size of blood pressure reduction from renal denervation: insights from meta-analysis of antihypertensive drug trials of 4,121 patients with focus on trial design - the CONVERGE report"**  
[\*Heart\*, 2013 Nov;99\(21\):1579-87. doi: 10.1136/heartjnl-2013-304238](#)
- Paper  
2012     Jones, Rathod, Howard, ... Wragg  
**"Safety and Feasibility of Hospital Discharge 2 days following Primary Percutaneous Intervention for ST Segment Elevation Myocardial Infarction"**  
[\*Heart\* 2012;98:1722-1727 doi:10.1136/heartjnl-2012-302414](#)



## Invited conference presentations and faculty positions

- SCMR (2024) – Automated planning (session moderator)
- AsiaPCR (2023) – Artificial intelligence in medical writing
- BCS Annual Conference (2023) – How to be successful as a clinician researcher - a cardiologist's perspective
- Imperial College Cardiology Society (2023) – Artificial intelligence - how it works, and what it means for doctors
- British Junior Cardiologists Association (2021) – Understanding cardiopulmonary exercise testing
- CVPR (2020) – The Deepfake Detection Challenge – Winners Presentation

## Professional memberships and qualifications

BHF CRC CoNNeCT Cardiology – Inaugural Chair

Radiology: AI – Associate Editor

European Heart Journal: Digital Health - Associate Editor

General Medical Council – Certificate of Completion of Training in Cardiology

European Association of Cardiovascular Imaging – Cardiovascular Magnetic Resonance – Level 3

Society of Cardiovascular Computed Tomography – Level 2

British Society of Echocardiography – Adult transthoracic echocardiography

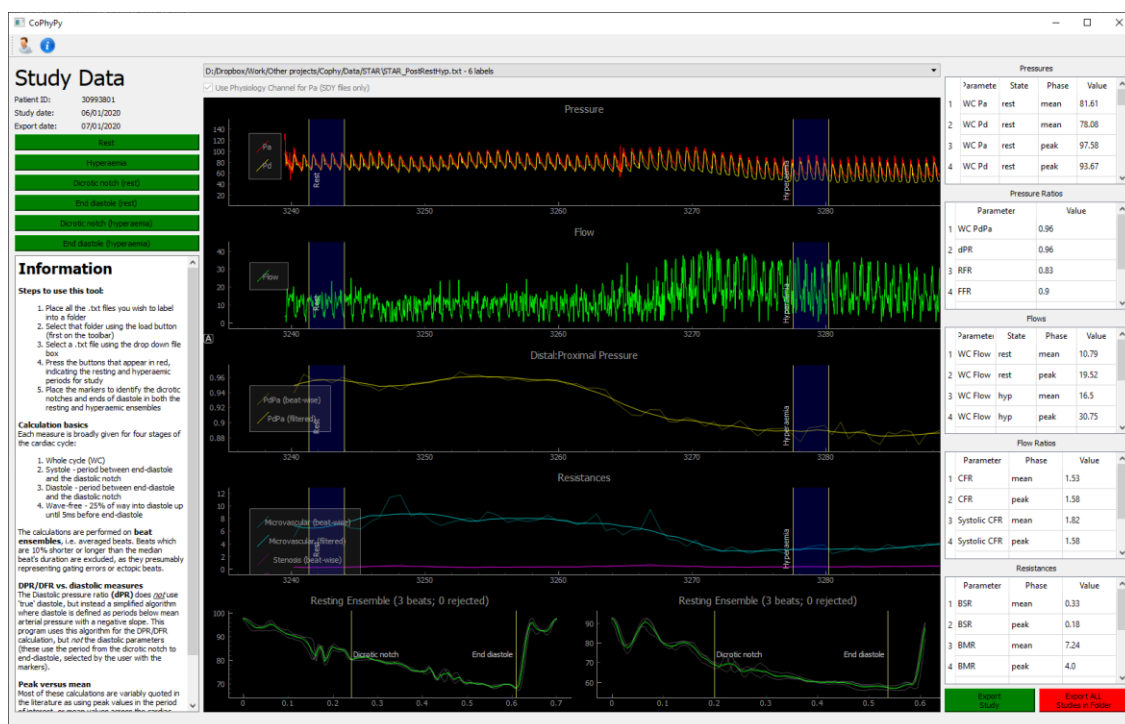
Membership of the Royal College of Physicians of London

## Other key projects

Desktop app

### CophyPy – Coronary physiology in Python

Current coronary physiology analysis packages typically require many steps, such as segmenting out SDY files and exporting them as TXT files before analysis can even begin. I developed a free to use coronary physiology package that can calculate the common coronary physiology parameters including FFR, iFR, DFR, RFR, CFR, BSR, BMR and HMR. Parameters are given for full cycle, diastole, systole and the wave-free period. The software can read directly from SDY files, without requiring pre-processing.

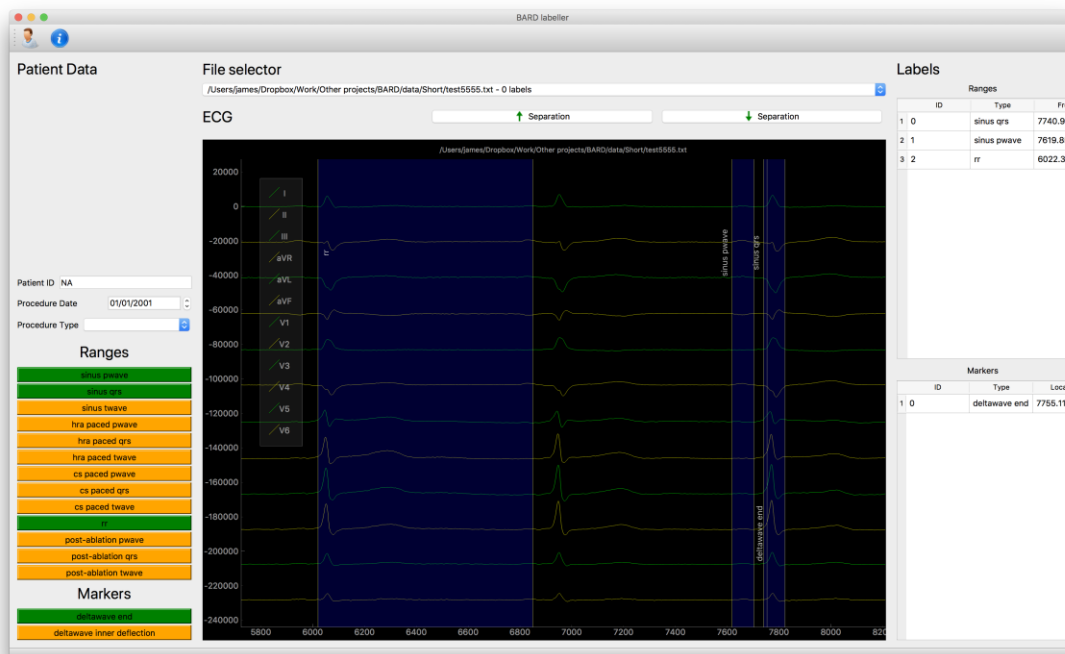




Desktop app

## ECG waveform processing application to allow machine learning of signals

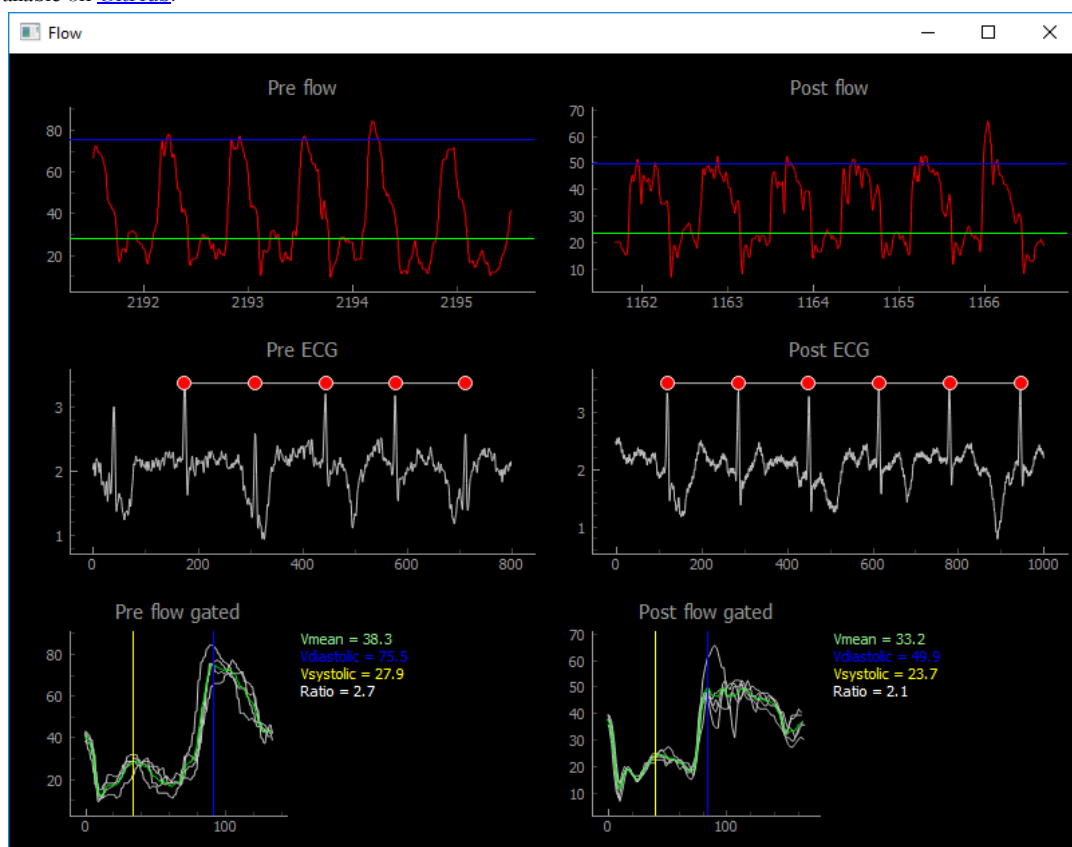
I created an open-source program to allow exporting of ECGs from the proprietary 'BARD' electrophysiology application. The program allows labelling of ECG waveforms and batch exporting, and is fully configurable via config files. This system has been used by multiple research groups within the University for machine learning projects, and is cited in several publications.



Desktop app

## Coronary physiology analysis package

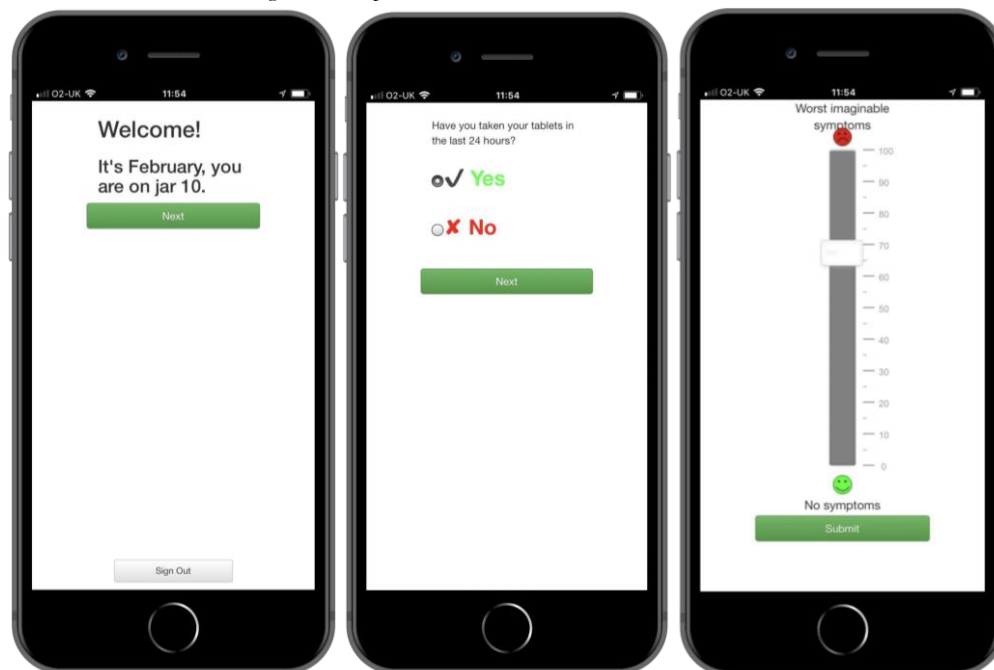
A recent publication by our group required complex coronary waveform analysis. I created an open source python program for this. The work has been published in [The Journal of the American College of Cardiology](#) and the code is available on [GitHub](#).



## Mobile app

### **SAMSON Trial Quality of life**

At Imperial College London we are running a one-year trial which allows people to determine what proportion of their symptoms are truly statin related. For this I have developed an HTML5/JavaScript application which allows trial participants to upload daily Quality of Life scores which can be reviewed in real-time by the study team. This ensures all recorded data are timely, cannot be retrospectively amended, and allows flairs of side effects to be picked up earlier. The app is also able to cache data when an internet connection is not available, to ensure data are not lost when participants are overseas without roaming, for example.



## Online database

### **The Cardiology Trials Database – [cardiologytrials.org](http://cardiologytrials.org)**

During my FY1 rotation in cardiology I became aware of the importance of a good understanding of the evidence base. For example, I learned how the treatment of heart failure had been revolutionised by showing prognostic benefits from drugs acting via the renin-angiotensin-aldosterone system and beta-blockers, whilst digoxin had shown symptomatic yet no prognostic benefits. I tried to further my understanding online, yet found no easily accessible source of consolidated information. Some covered only sub-specialties, others compiled data into PowerPoint files that were impractical to quickly reference and often required registration.

I set out to construct a free database with the key trials trainees needed to be aware of and formatted in a fashion where it can be easily viewed 'on the run', *e.g.* on a smartphone.

See [cardiologytrials.org](http://cardiologytrials.org). The site currently receives over 6000 visits per month and has received a third of a million page views since its inception.

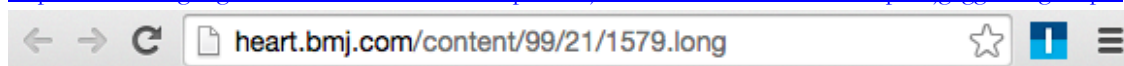


Chrome  
Extension

## Imperial eJournals for Chrome

This small Chrome Extension allows easy access, via Imperial College Library, to journal articles, which would otherwise be behind a premium pay-wall. This small button to the right of the address bar will try to use the Imperial proxy to allow members of Imperial College to access premium content such as journals. It does this by simply altering the page URL. No user data is stored.

<https://chrome.google.com/webstore/detail/imperial-ejournals-for-ch/infolkakifickpdmigcggmhkglgkbbpid>



Mobile app

## FMCalc – The Free Medical Calculator

On acquiring a Windows Phone 7-based smartphone, I noticed there were no free medical calculators for the operating system, with only two highly priced options. I therefore worked to create a free alternative, FMCalc. The application is now on the official Windows Phone 7 marketplace and has been downloaded by over four thousand unique users in fifteen different countries. It includes over 40 medical criteria and calculators, including anion gap, CHADS2 score, Child-Pugh score, Duke criteria, Rockall score and more. Feedback has been very positive, and I've continued adding scores such as the CHIP prediction rule following requests from users.

## Teaching & Supervision experience

I have regularly supervised students from Imperial College BSc programs, with an emphasis on machine learning and neural networks.

2021 – 2024 **PhD Co-supervisor (35% credit) – National Heart and Lung Institute student**

2021 – 2024 **PhD Assistant Supervisor –Department of bioengineering student**

2021 – 2022 **BSc Student Supervisor – Within-patient echo- and CMR-derived LV strain**

2020 – 2021 **BSc Student Supervisor – MRI view recognition with neural networks**

2019 – 2020 **BSc Student Supervisor – ECG classification with neural networks**

2018 – 2019 **BSc Student Supervisor – ECG classification with neural networks**

2017 – 2018 **BSc Student Supervisor – Pacemakers in neural networks**

2017 – 2021 **Lecturer in “Machine Learning for Image Analysis”**

I deliver an annual lecture on machine learning to the Cardiovascular BSc students with an emphasis on medical image analysis.

2016 - 2017 **Imperial College Teaching Hero**

For my “organisation and delivery of undergraduate teaching to Year 6 Cardiology students” I was designated a Teaching Hero by Imperial College London.

2011 - 2012 **Junior Clinical Teaching Fellow – Colchester Hospital University NHS Foundation Trust**

2011	<b>“Cardiology for Finals” – Barts and the London School of Medicine</b>
2010 - 2011	<b>PBL Facilitator - Barts and The London School of Medicine</b>
2010	<b>Practice OSCE examiner – The Royal London Hospital</b>
2009	<b>Associate clinical supervisor – Cambridge University Medical School</b>