digitalhealth

AI + DATA

AI & Data spotlight: diagnostics transformed

Dr Jaymin Patel

Radiologist
Co-founder & COO
Hexarad

Hadley Mahon

Head of Commercial & Product Strategy
Mendelian

Dr Tim Jobson

Medical Director
Predictive Health Intelligence

Dr Lucrezia Cester

Co-Founder and CEO
LightHearted AI

Chair: Karla Richards

Senior Innovation Project Manager, Health Innovation Network and NHS Navigator
DigitalHealth.London

Headline sponsor

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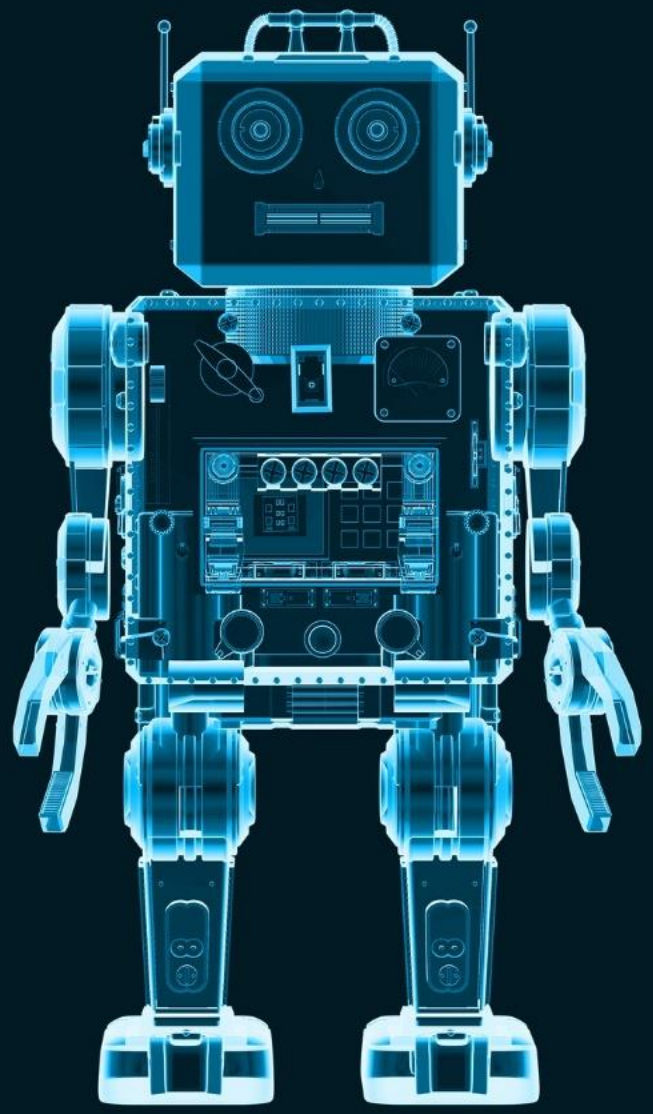
Harnessing data

with the Hexarad Platform



The Mission:

Fast and Accurate Diagnosis for Everyone, Everywhere

Harnessing data

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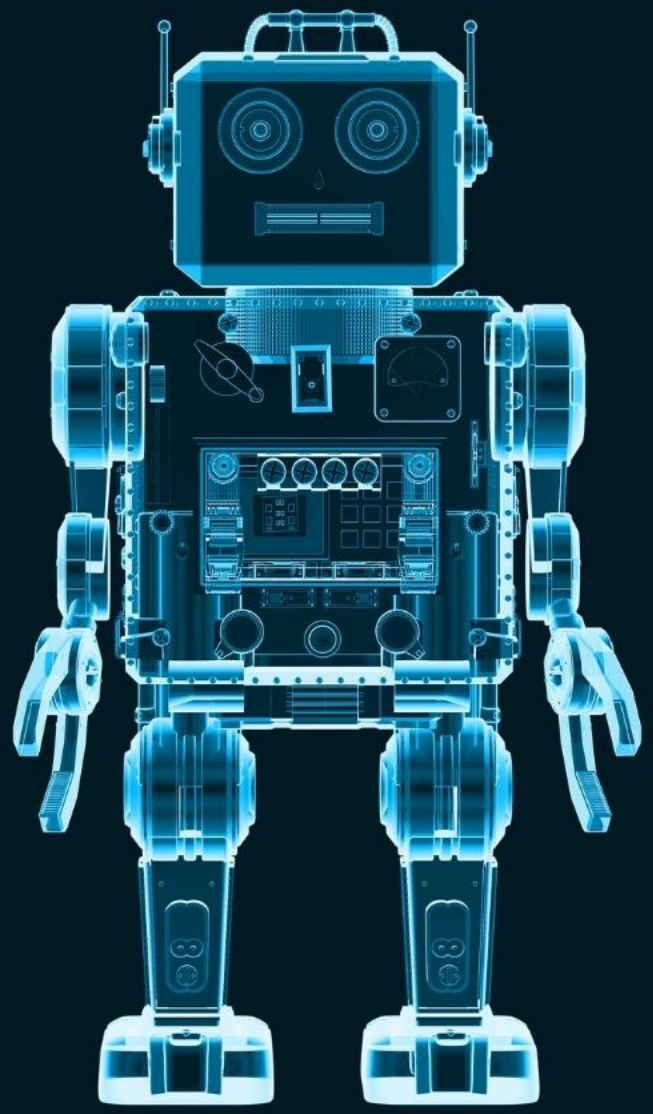


The Mission:

Fast and Accurate Diagnosis for Everyone, Everywhere

The Crisis In Radiology

Without a diagnosis there is no treatment

The Observer

Patients forced to wait months for vital NHS diagnostic tests

Doctors warn that some services are 'close to failure' as tens of thousands endure delays beyond 13 weeks

THE TIMES

HEALTH

Worst-ever NHS waiting times are costing lives, say doctors' leaders

Backlog grows to record 7.1m people

CANCER RESEARCH UK

Home · About us · Cancer news · The rise of the 'long-waiter' – why cancer waiting times are showing the pressure more than ever before

The rise of the 'long-waiter' – why cancer waiting times are showing the pressure more than ever before

thebmj

News

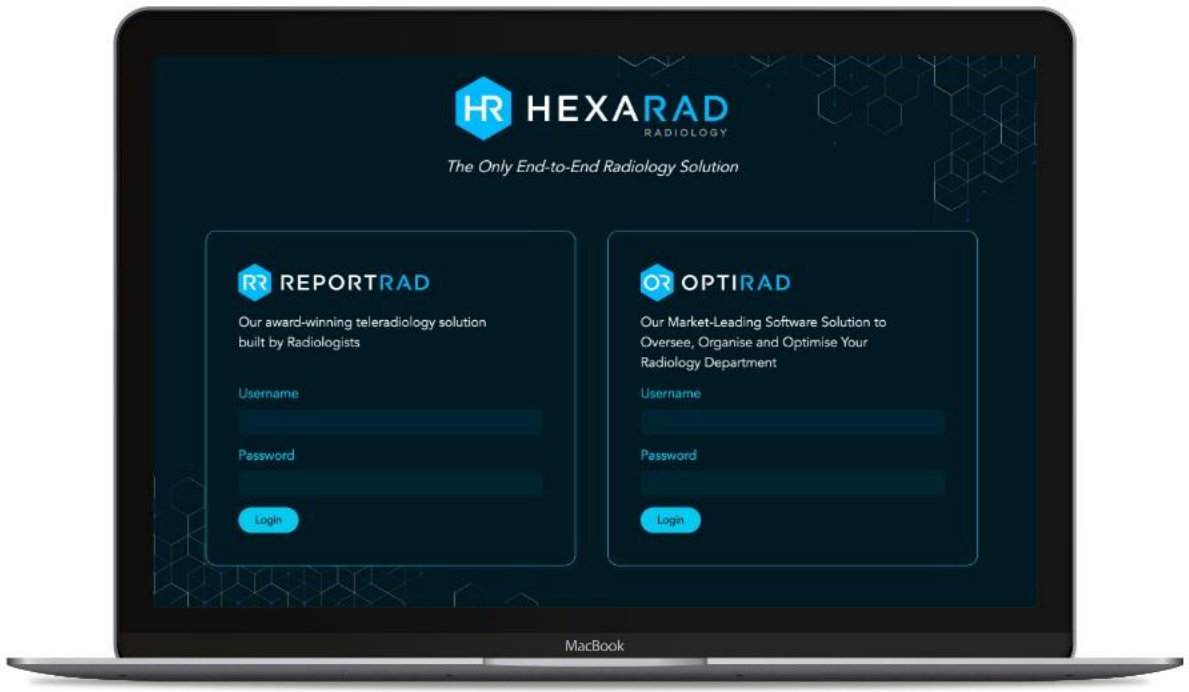
NHS "under pressure from all sides" as waiting list reaches seven million

BMJ 2022 ; 379 doi: https://doi.org/10.1136/bmj.o2471 (Published 14 October 2022)
Cite this as: BMJ 2022;379:o2471

Scanning in the UK

- 75 scans performed every minute in the UK
- 42m radiology exams performed each year
- 10x increase in imaging waiting lists
- 10% CAGR in total no of scans
- 3,300 unfulfilled radiologist jobs by 2024 - the worst shortfall in NHS history
- Only 1% of hospitals can get their scans reported with the radiologists they currently have

The Hexarad Platform



End-to-End Platform

A suite of solutions to revolutionize radiology

OptiRad

Bespoke radiology workflow software to oversee, organize and optimize radiology departments. Proven to increase productivity by nearly 20%

ReportRad

Industry leading tech-enabled teleradiology supporting patients 24/7 with a global network of radiologists

OptiRad

Reporter Profiling

Provides transparency across the department

Capacity and Demand Forecasting

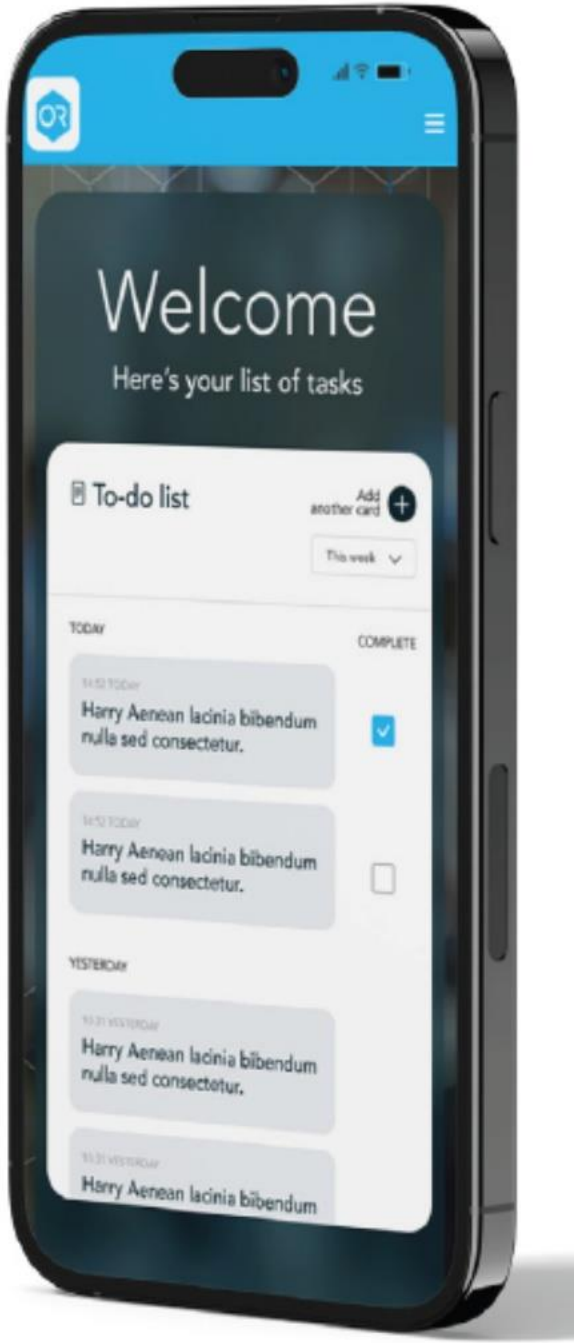
Helps you stay proactive

Performance Analytics

Provides practical insights

Auto-Allocation

Accurate and fast scan allocation



Optirad is going to be a **gamechanger** for us. It **solves a lot of the issues** we were having within the dept, and allows us to work out our reporting capacity in real-time.

Overall, I can see that Optirad is not only going to make our **department more productive**, but it's also going to **reduce our reliance and spend** on insourcing and outsourcing.

Dr Sandeep Upile, Consultant Chest Radiologist, Clinical Director for Body Radiology, Northern Care Alliance NHS Foundation Trust

ReportRad - On-call

Long delays on the phone banished with **online referrals**

Unacceptable level of **reporting discrepancy** improved through **better reporting hygiene**

Discrepant written **account** of events avoided through **online referrals an instant chat**

Limited clinical engagement improved through **secure and instant communication** channels

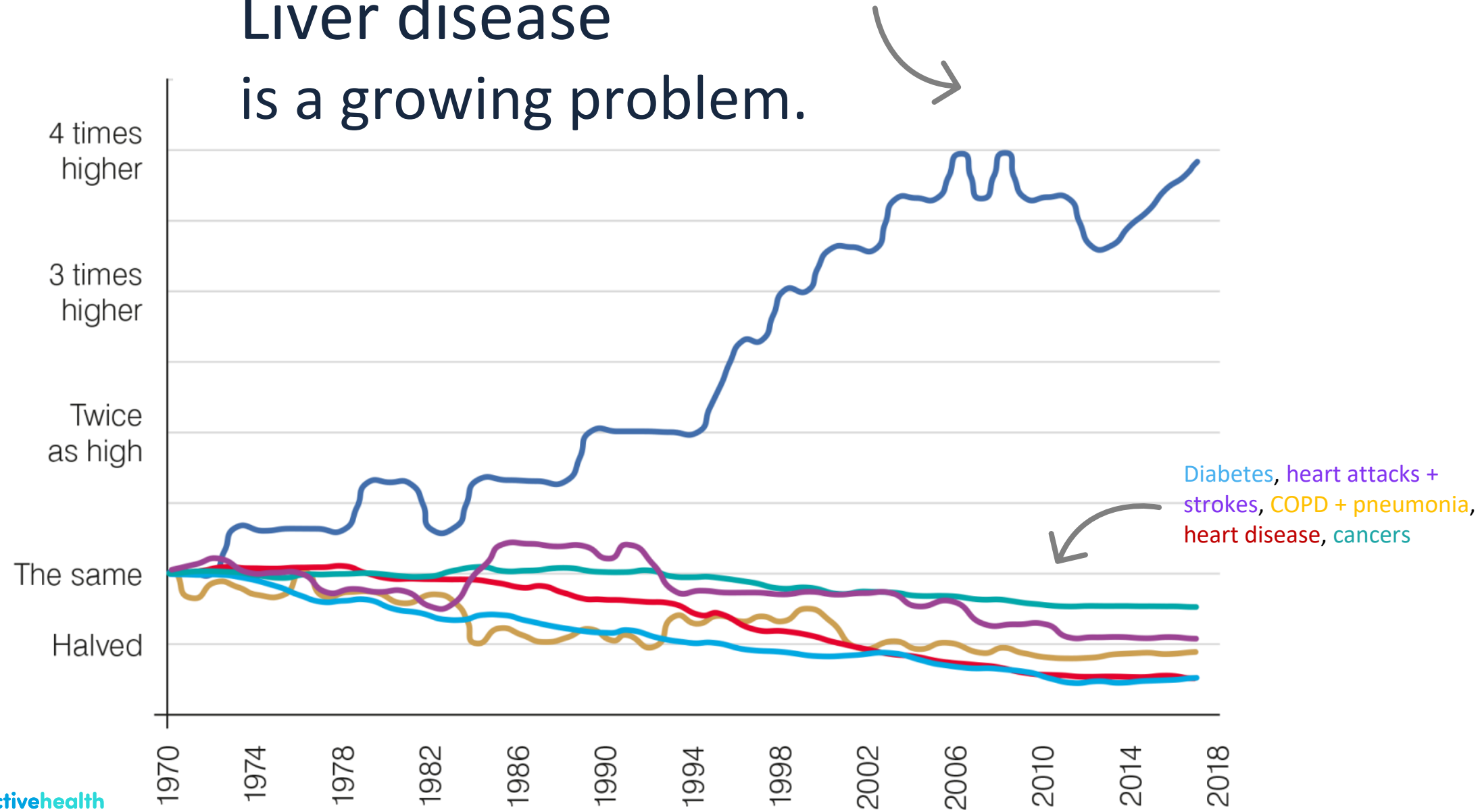
predictivehealth intelligence.

Making data matter.

Deploying a case-finding approach to identify individuals at risk of liver and metabolic disease.

Dr Tim Jobson – Medical Director

Liver disease is a growing problem.



predictivehealth intelligence.

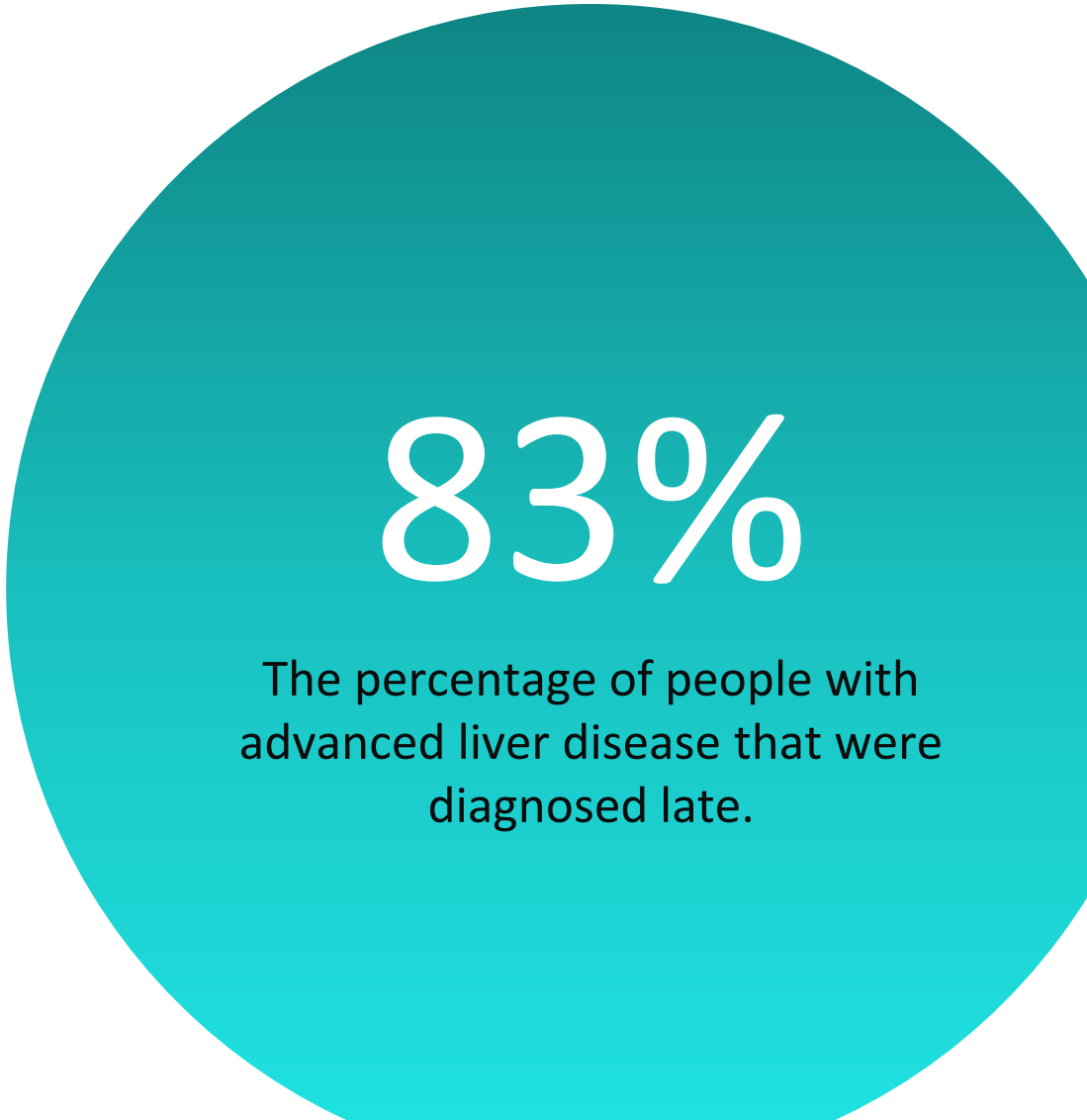
Characteristics of liver disease.

Liver disease is **progressive, silent, treatable**.

Difficult to diagnose in our current clinical settings.

Not all liver disease is alcohol-related.

1 in 9 of adult population has undiagnosed, treatable liver disease.



predictivehealth intelligence.

The data exists.

The past 20 years has seen huge progress towards the digitization of health records. With the goal of saving money, increasing efficiency and improving patient outcomes. We now have a wealth of data.

Is this the end of the journey?

predictivehealth intelligence.

Making data matter.

For data to matter we need to **extract clinical meaning** to improve everyone's health.

Clinicians need to be able to find patterns and identify groups of people that need them most urgently.

Data driven prevention, risk-stratification and recalls should be as easily as viewing an X-rays or blood results.

predictivehealth intelligence.

What did we do?

Created an
easy-to-use interface

Selected + cleaned + curated **large datasets**

Which now provides **clinical value**

predictivehealth intelligence.

Introducing hepatoSIGHT™.

A case finding search engine that enables quick identification of those at risk of liver disease using existing blood test results.

Enables **clinicians** to search for patients who **match a specific criteria.**

→ Intuitive

→ Fast

→ Customisable

Thanks to funding from:

predictivehealth intelligence.

The impact so far…

Our customer Somerset NHS Foundation Trust has already felt the benefit of hepatoSIGHT™.

>100
patients with rare and viral liver diseases

500+
patients with progressive liver disease

9000
previously not adequately assessed (out of 500,000)

predictivehealth intelligence.

"This is a very exciting opportunity to **change the way that healthcare is delivered**. By finding people earlier in their disease pathway we are making a huge difference to their lives and the NHS. At a time of intense pressure such as this, **using technology that empowers clinicians to get ahead is critical**."

Prof. Daniel Meron, Chief Medical Officer, Somerset ICS

predictivehealth intelligence.

predictivehealth intelligence.

See hepatoSIGHT for yourself.

LightHearted AI

AI-POWERED PRECISION HEART MONITORING PLATFORM

Lucrezia Cester
Co-founder & CEO

lu@lighthearted.ai

www.lighthearted.ai

1 in 3 people die because of a heart disease

150k
UK individuals
diagnosed in critical conditions during a hospital admission or at autopsy

3M
wasted hours per day
by physicians triaging normal patients

200k
wasted heart scans
due to GPs lacking objective metrics to assess patients

Harnessing laser-based Tech and AI to Revolutionise Cardiovascular Diagnosis and Monitoring

Early Diagnosis

using Novel Biomarkers

enabling management with pharmaceutical intervention

£1.1B+

savings in NHS alone

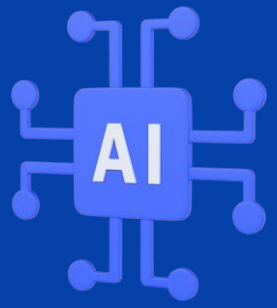
from community-level screening and diagnosis, saving £3000 per patient in later hospitalisation cost

Triaging

lowering wait time

Better patient stratification, reducing the need for Echocardiogram & saving

The new patient pathway will involve low cost patient management



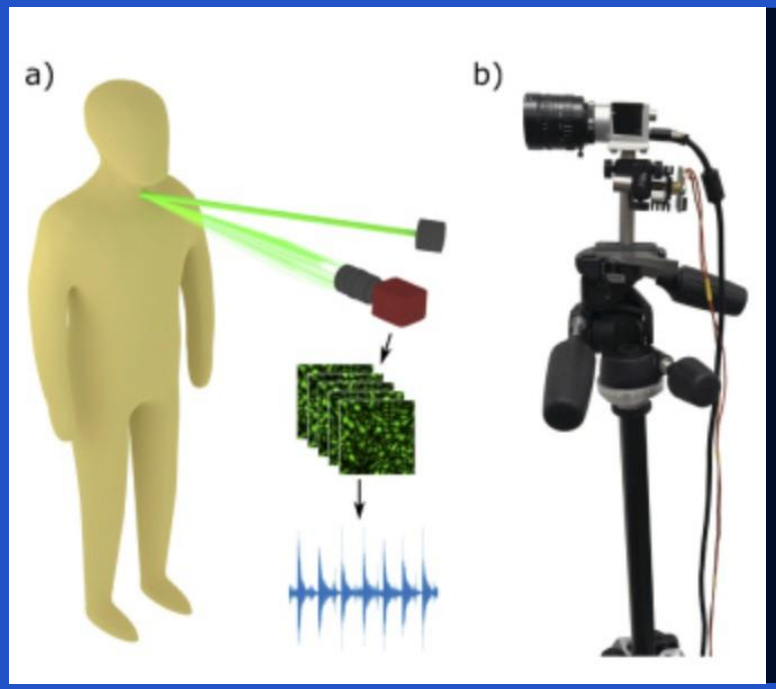
Triaging in the community diagnostic centers, digital health villages, GP practices

The patient won't need to see a doctor for an ECG and an heart echo scan

Patients will be managed cheaply, saving time and resources

LightHearted AI

NON-CONTACT LASER-BASED STETHOSCOPE
AND AI DRIVEN PLATFORM



LightHearted AI Demo

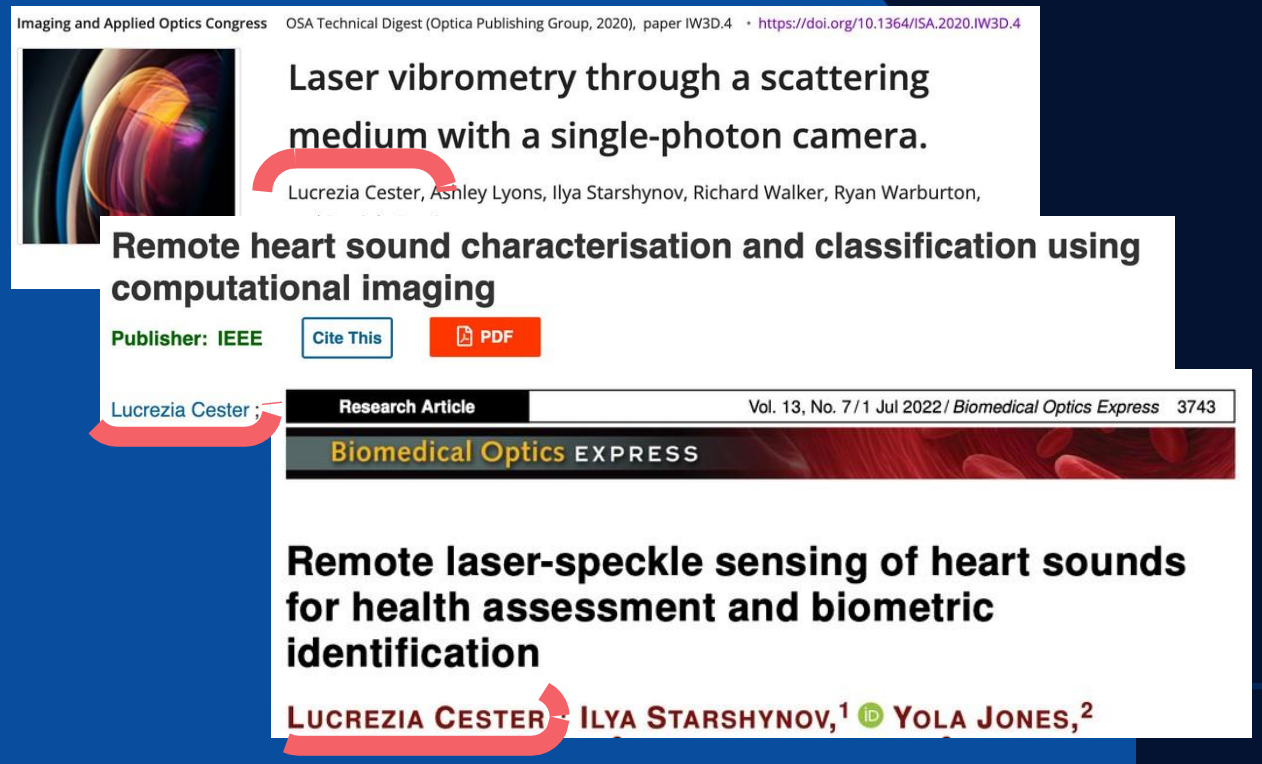
Click here

What is LightHearted AI?

An advanced **laser-based** digital stethoscope. The device automatically acquires data from the patient from a distance, non-invasively, and without the need for patient or clinician input.

Our AI platform reads the data to produce diagnostic report in 1 minute and send it to the relevant clinicias.

LightHearted AI's Technology



Imaging and Applied Optics Congress OSA Technical Digest (Optica Publishing Group, 2020), paper IW3D.4 • https://doi.org/10.1364/ISA.2020.IW3D.4

Laser vibrometry through a scattering medium with a single-photon camera.

Lucrezia Cester, Ashley Lyons, Ilya Starshynov, Richard Walker, Ryan Warburton,

Remote heart sound characterisation and classification using computational imaging

Publisher: IEEE Cite This PDF

Lucrezia Cester ;

Research Article Vol. 13, No. 7 / 1 Jul 2022 / Biomedical Optics Express 3743

Biomedical Optics EXPRESS

Remote laser-speckle sensing of heart sounds for health assessment and biometric identification

LUCREZIA CESTER,[1] ILYA STARSHYNOV,[1] YOLA JONES,[2]

How are we better?

Never before captured digital bio-markers

Better sensitivity than the digital stethoscope and can acquire cardiovascular sounds up to 800+ Hz (compared to digital stethoscope max 300 Hz) even from

Easier Diagnosis

Can acquire data from up to 15 meters distance from the patient, even through clothing without requiring patient or clinician input, making it easy for non-tech literate staff to operate.

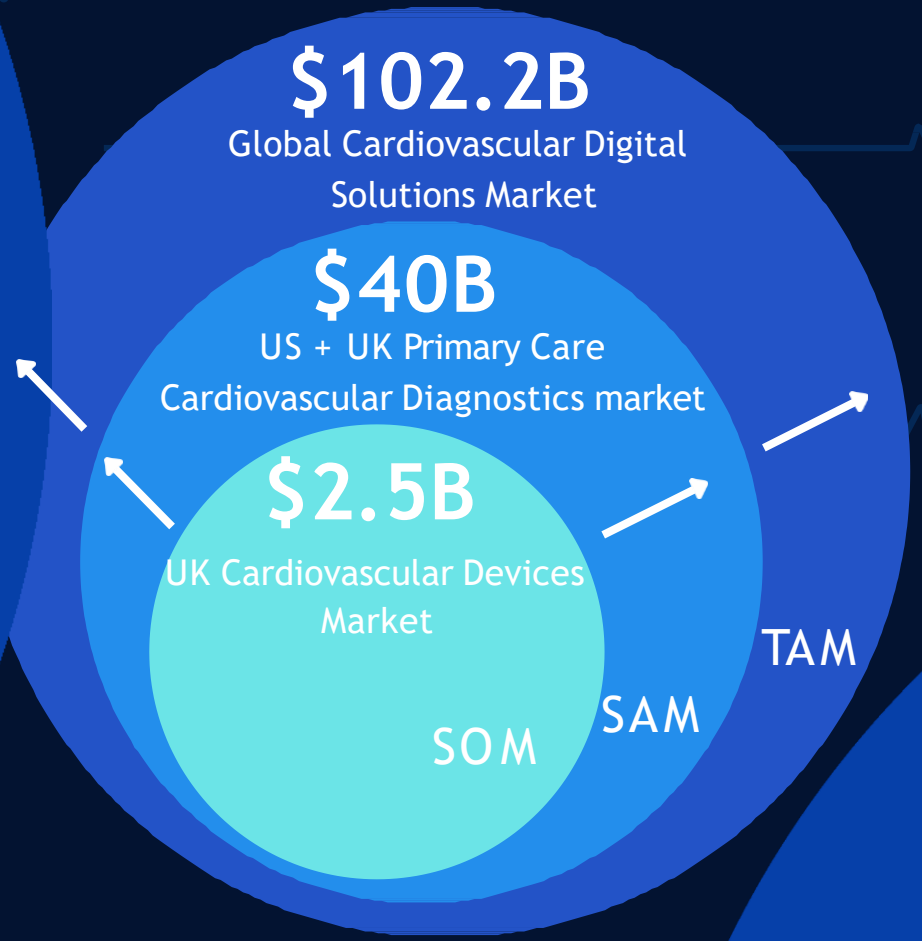
AI trainable Data

LightHearted AI's nanometer-level precision and non-contact approach allows to capture reproducible and high SNR data which is optimally suited for AI training with small data amounts.

A $102.2B opportunity starts with NHS ICB Digital Health Villages

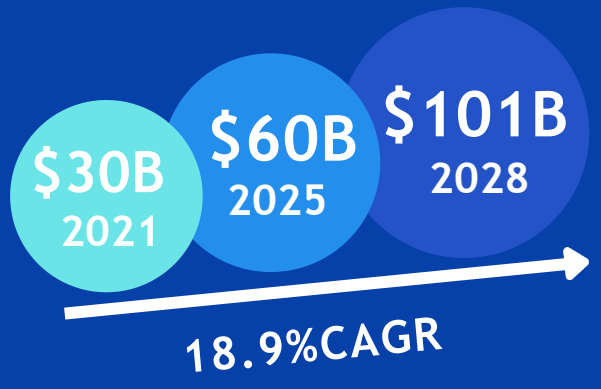
Just capturing 50% of our beachhead client, the NHS Community Diagnostic centres nets us an ARR of £40M

We aim to expand globally, targeting private providers and Pharma/BioTech and netting ARR > £10B



Further Opportunities for LightHearted AI in Adjacent Markets

REMOTE PATIENT MONITORING MARKET



OTHER MARKETS

$211B (18.6% CAGR)
Digital health

$18B (21.9% CAGR)
Software as a medical device

$42B (29.5% CAGR)
Internet-of-medical-things (IoMT)

BioPhotonics & NHS AI Clinical Scientist meets Precision Medicine & Biomedical Data Engineer

Lucrezia Cester

Co-founder & CEO

- PhD in AI and Biomedical Devices
- AI Clinical Scientist at NHS GSTT
- Topol Digital Fellow at NHS
- NHS Clinical Entrepreneur
- NHS Health Innovator

Dilip Rajeswari

Co-founder & CTO

- 1x Founder & CTO of an AI-driven HealthTech startup, Numinous AI Inc.
- Research consultant at Columbia University on Signal processing
- Led technical R&D team at a MedTech startup, BrainSight AI, Inc., working on advanced imaging & precision medicine
- Over 9+ patent & article publications

We are supported by industry, clinical, and tech world leading experts

Cardiology Specialist Advisor

Dr Sandosh Padmanabhan

PROFESSOR OF CARDIOVASCULAR GENOMICS AND THERAPEUTICS

Strategy & Product Advisor

Laurence Bargery

CO-FOUNDER AND CHIEF TECHNICAL OFFICER OF ACCURX

Technology Advisor

Prof Daniele Faccio

PROFESSOR OF QUANTUM TECHNOLOGIES

Collaborators and partners

NHS Dorset

University of Glasgow

British Heart Foundation

NHS Mid and South Essex NHS Foundation Trust

HSH The Harley Street Hospital

Backed by

SOSV HAX

LightHearted AI's B2B Precision Cardiology Platform

Primary route to market - NHS ICB Digital Health Villages and Community Diagnostic Centres

Starting with the Pay-per-test model at £10 per patient

(ICB centres - 200k patient in-flow per year per centre)

Subscription model for GP practices and pharmacies

US Route

Integrated payer-providers

Kaiser and Walmart Health

Reproducible longitudinal biomarkers for early diagnosis, no expert required, results in <1min

DIFFERENTIATING FACTORS	LightHearted AI	Phone Algorithm	Portable Ultrasound	Digital Stethoscope	Cardiology Platform
		CardioSignal	Butterfly™	eko	IDOVEN
Early Diagnosis	✓		✓		✓
Multi-modality longitudinal data	✓				✓
AI trainable reproducible biomarkers	✓				✓
No input from patient or clinician	✓	✓			
Less than 1 minute test	✓	✓		✓	

Achievements so far

Technology Progress

Technology Validated
pilot studies with 3 published papers and 1 under revision with John Cleland, top 10 most cited cardiologists in the world

Patent Filed
systems and method patent for our novel cardiology device and diagnostic algorithm

Ongoing Clinical Trial
won a £1M grant from the Healthcare 2050 challenge and now running a trial with Digital Health Validation Labs, University of Glasgow

Commercial Progress

NHS ICB Pilot
won competitions with >50 companies to work with NHS ICB Dorset (£4B budget)

Collaboration w/ clincians
pilot studies planned with NHS St George's Hospital, Harley Street Clinic, and Basildon Cardiothoracic Centre

Collaborations with Heart Disease Charities
collaborations with British Heart Foundation and Heart Valve Voices

Partnerships & Regulation

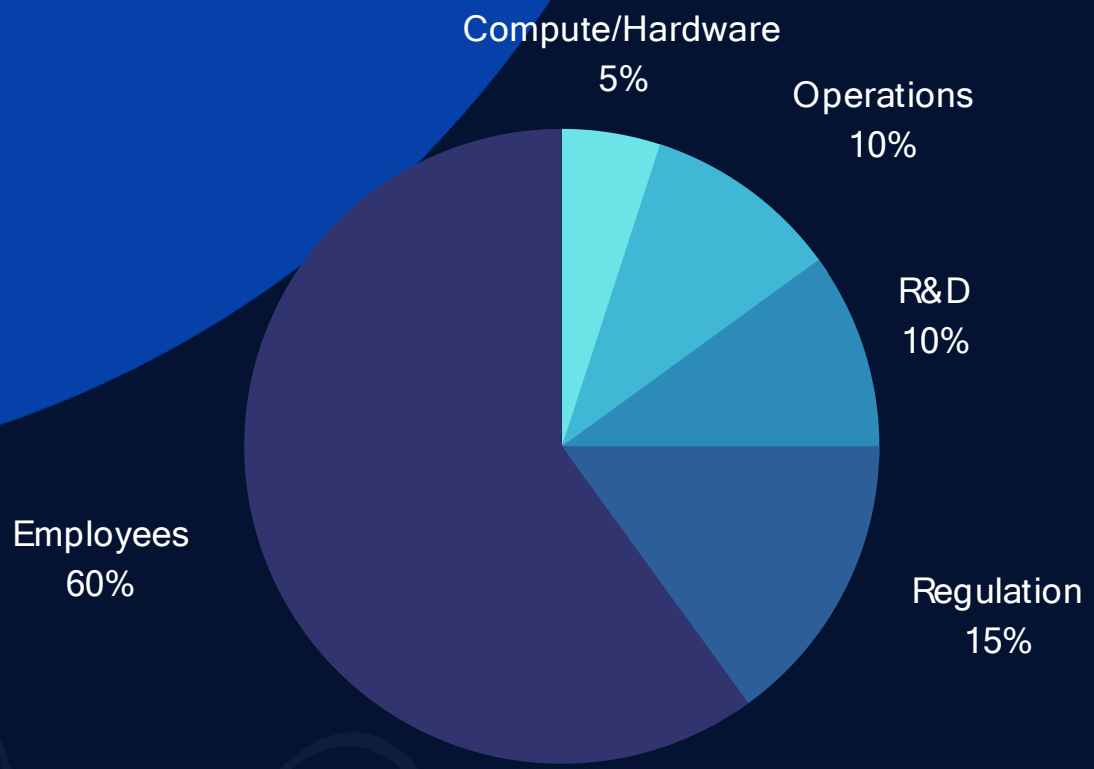
NHS Innovation Service
partnerships with AHSNs, NHS Procurers, MHRA, HRA

Patient Engagement (PPIE)
clinicians and patients focused product validation

Regulatory Roadmap Developed
route to CE mark approval extensively mapped out

Raising £1.2M to build and integrate our Cardiology Platform, and obtain CE Marking & FDA

(18 month runway, £500k already raised from EF, SOSV HAX, and angels)



Hires

9 hires

3 Hardware & AI/MI
3 Tech scale-up & Trial Management
3 Product, Regulation, & BD

Milestones

Cardiology Platform

Hardware and Software Platform and Clinical Integration

Regulatory Compliance

CE Marking and FDA

Get in touch

Lucrezia Cester
Co-founder & CEO

lu@lighthearted.ai

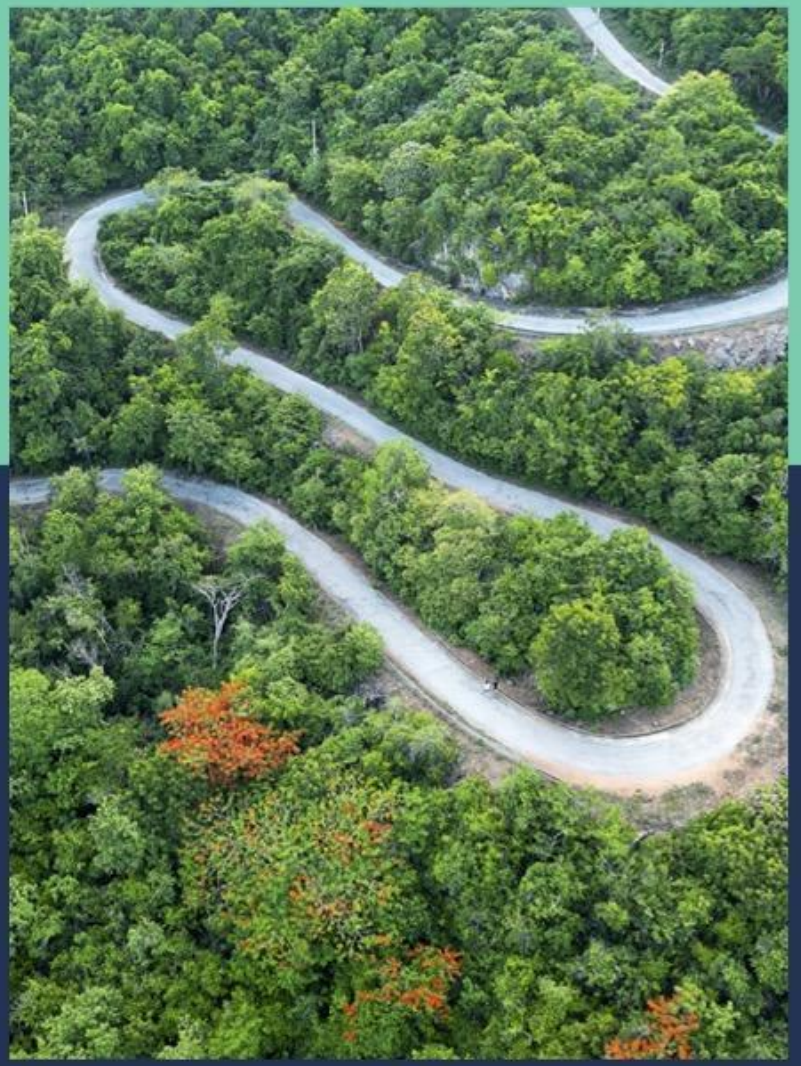
www.lighthearted.ai

Accelerating Rare Disease Diagnosis

A data-driven approach to early disease detection

mendelian

Hundreds of Millions of People Are on a Diagnostic Odyssey



5+ YEARS

7+ SPECIALIST APPOINTMENTS

2x COST OF CARE

A diagnosis is essential for treatment, research, peer support

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A data-driven approach to early disease detection

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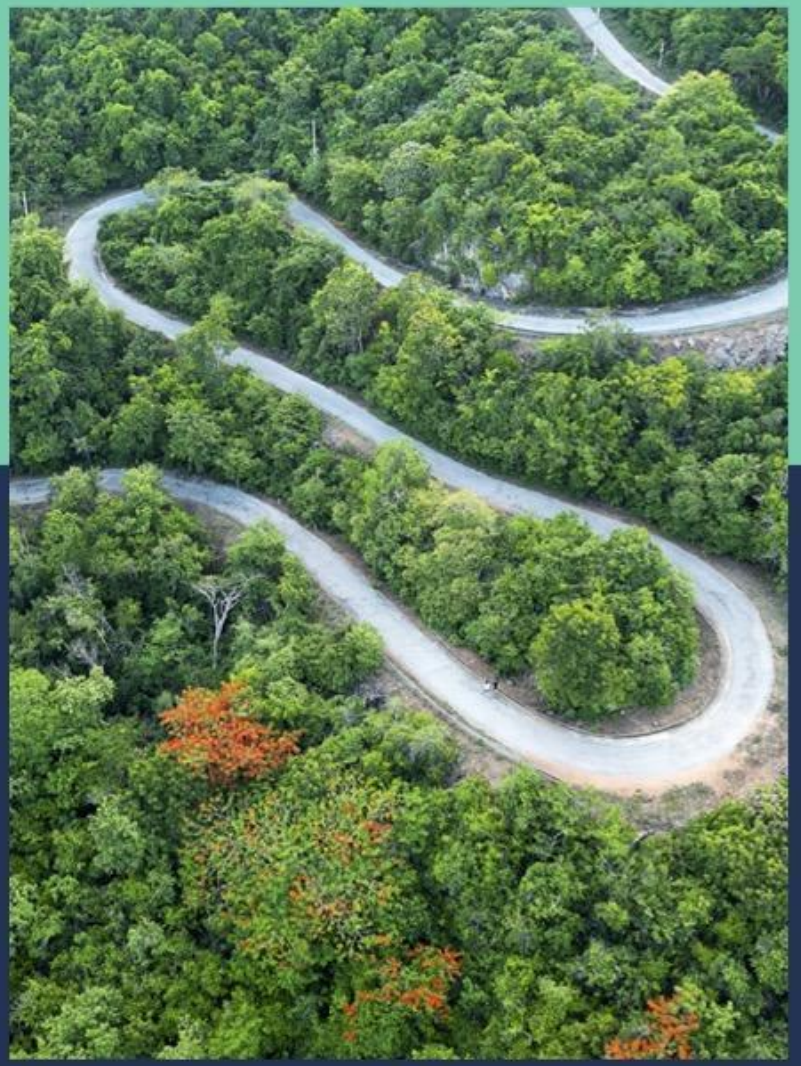


5+ YEARS

7+ SPECIALIST APPOINTMENTS

2x COST OF CARE

A diagnosis is essential for treatment, research, peer support

WINNER NHS AI in HEALTH AND CARE AWARD

MendelScan

a class 1 medical device

Analysing Primary Care EHR to Detect Undiagnosed Rare Diseases

01

- Data Processing Pipelines
- Algorithm-Builder UI
- Deployment UI
- NHS Single Sign On

02

- Self-Scaling Infrastructure
- NHS Data Protection Gold Standard
- Fully Auditable

Case Finding - How do we approach the algorithm?

Retrospective Validation of DiGeorge Algorithm

Data Set	OPCRD 23M Routinely Collected Primary Care EHR Records
Cases	1,051
Controls	1,981,079
Adjustments	Removed: • current age filter • exclusion for genetic testing

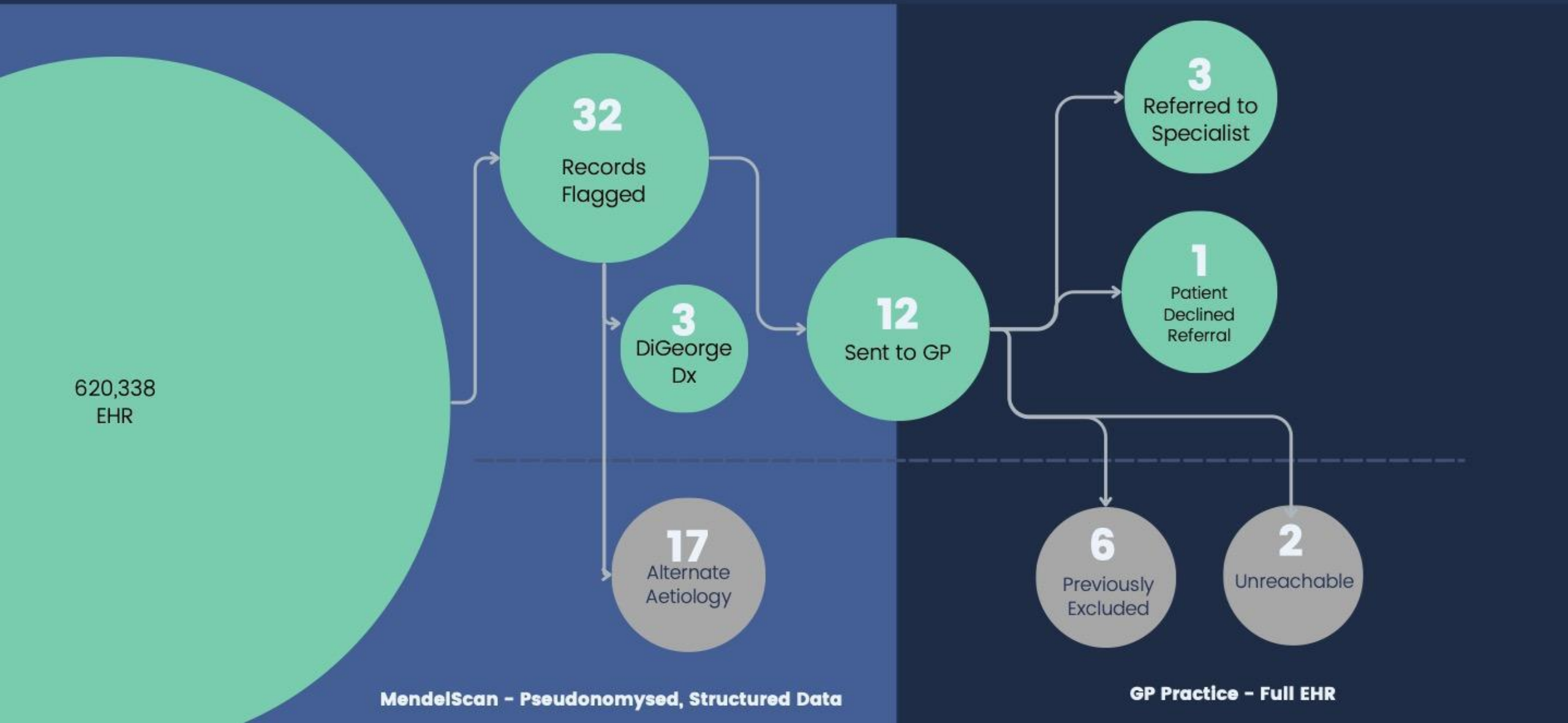
7/10 Expected Diagnosed Cases are 'Missing'

	CASES	CONTROLS
FLAGGED	263	470
NOT FLAGGED	788	1,980,609

Sensitivty	25.02%
Specificity	99.98%

PPV (unadjusted)	35.88%
PPV (coded)	4.68% (4.10-5.34)
PPV (literature)	13.27% (11.75 - 14.94)

Prospective Deployment of DiGeorge Algorithm



Supervised Learning uses Clinician - Validated Features

Prevalence estimated to be 12-13 per 1M

Prevalence in data set 8 per 1M following data cleaning

- Combination of under diagnosis and under recording

Literature suggests that a portion (40%) of diagnoses are made within 1 years of symptom onset, but that roughly a quarter (24%) take more than 5 years.

Build Clinical Features

Literatures and Guidelines

Cytopenias
Lethargy/Asthenia/Tiredness
Abdominal pain
Multiple thromboses
Abdominal thromboses
Anaemia
Haemolytic anaemia

Patient Registry

Haematology referrals
Oncology referrals
Hospitalisations
Blood tests
Bone marrow
Blood transfusions

Dx Case Analysis

Urology referrals
Urinary tract infections
Skin infections
Index age
Event volume

Investigate Feature Importance

Clinical Feature	Cases N = 182	Control N = 339,454	p-value
Thromboses, count (%)	14 (7.69)	6554 (1.93)	< .00001
Anaemia, count (%)	51 (28.02)	8584 (2.53)	< .00001
Haemolytic anaemia, count (%)	13 (7.14)	95 (0.03)	< .00001
Pancytopenia, count (%)	33 (18.13)	82 (0.02)	< .00001

Over 40 Models Trained

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