

Rewired 2022

# Delivering better healthcare using artificial intelligence

Dr Christopher Kelly  
16 March 2022

Use AI to enable  
significantly **better and**  
**more equitable care**

SANTHI



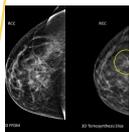
# Working across many areas in imaging AI...

## Radiology



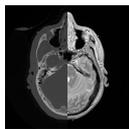
### X-ray

Lung Cancer Screening  
Tuberculosis  
Triaging for abnormal scans



### Mammography

Breast Cancer Screening



### CT

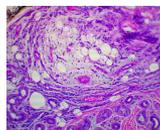
Lung cancer screening and diagnostics

## Ophthalmology



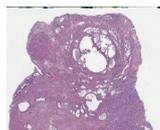
Diabetic retinopathy  
Diabetic macular edema  
Glaucoma  
Age-related macular degeneration  
Hypertensive retinopathy

## Digital pathology



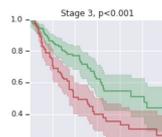
### Histopathology

Cancer biopsies  
Lymph node metastasis



### Cancer grading

Gleason grading in prostate cancer biopsies



### Outcome prediction

Identifying unknown signals in existing diagnostic techniques.  
ER/PR/HER2 from H&E stains without immunohistochemistry

## Novel signals



Gender

Actual: Female  
Predicted: Female

### Detecting hidden signals

CV risk, sex etc from retinal photos  
System disease from external eye photos  
Kidney disease / diabetes from retinal photographs

## Other



### Dermatology

Cancer, other skin conditions

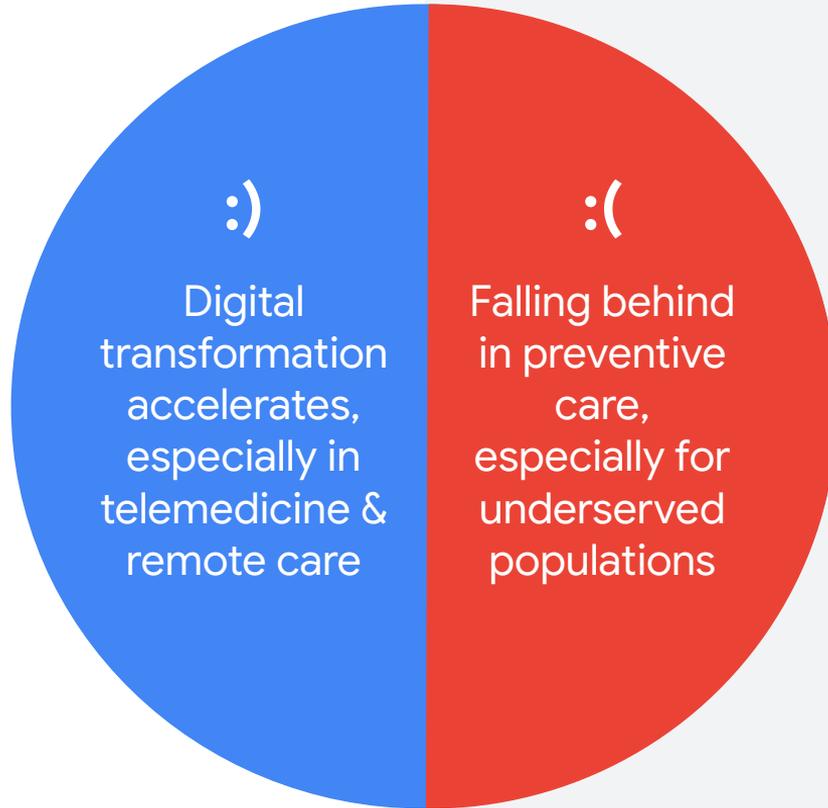


### Oscopies

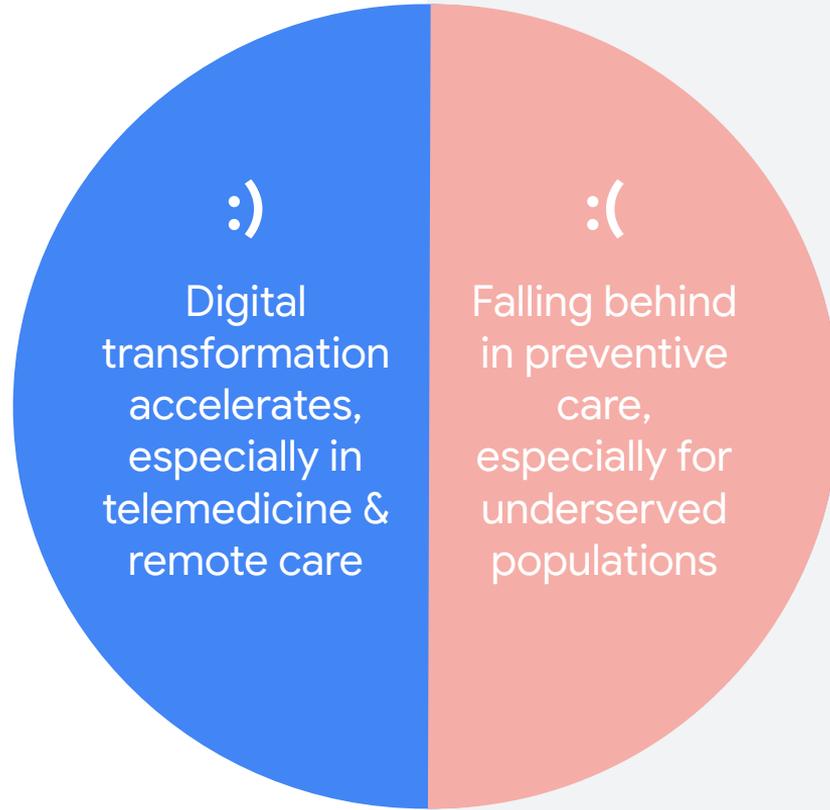
Polyp detection, endoscopy assistance

...and many other projects.

# The effect of the pandemic

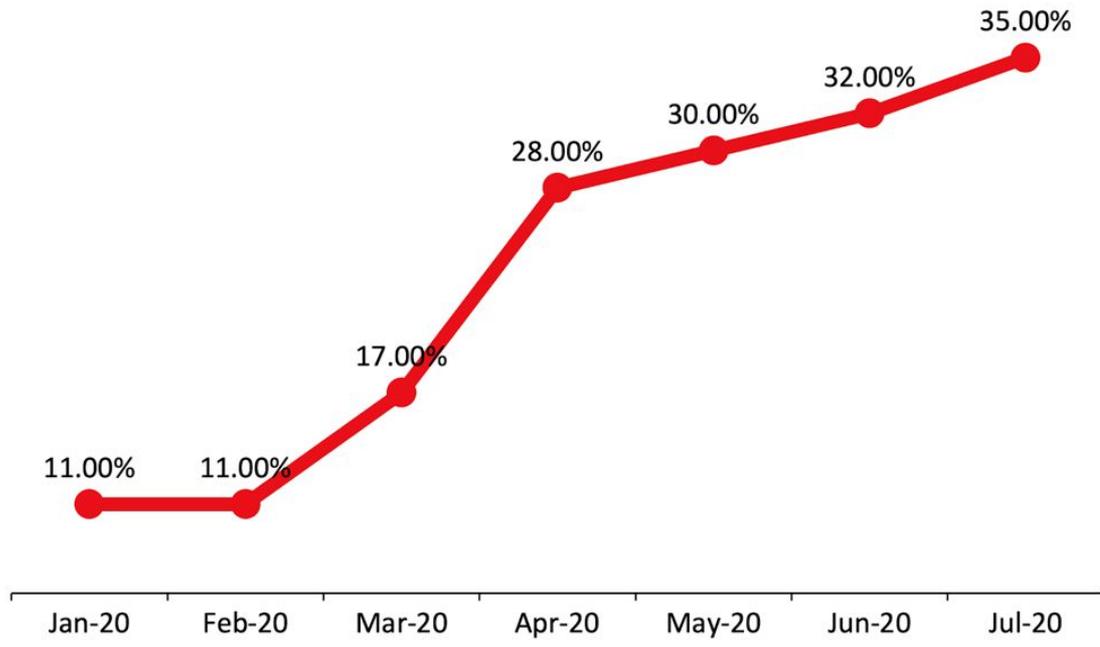


# The effect of the pandemic



## Telemedicine Use During the COVID-19 Pandemic

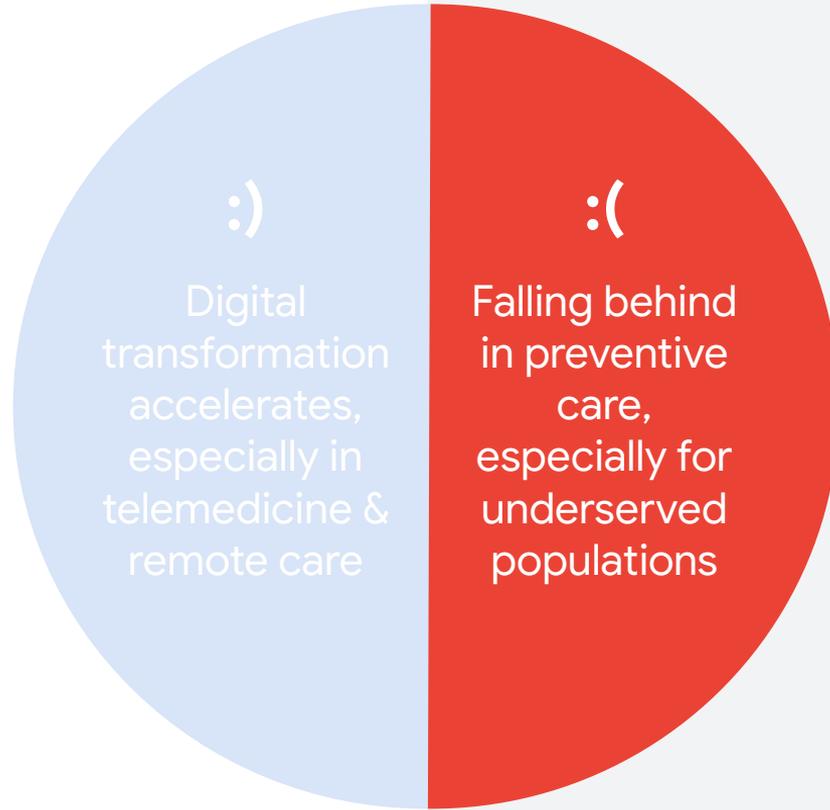
Telemedicine use has been on a steady incline since the onset of the pandemic.



Source: CivicScience, 2020

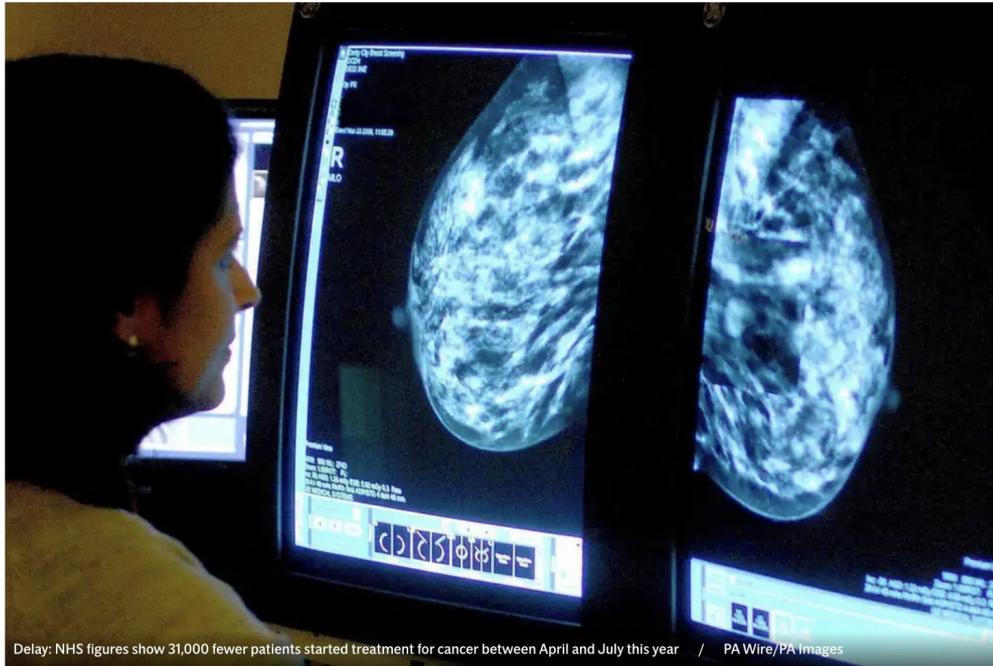
Methodology: Data collected by CivicScience's survey of 195,466 responses, conducted from 01/02/2020 to 07/27/2020. Responses were weighted by US Census (18+)

# The effect of the pandemic



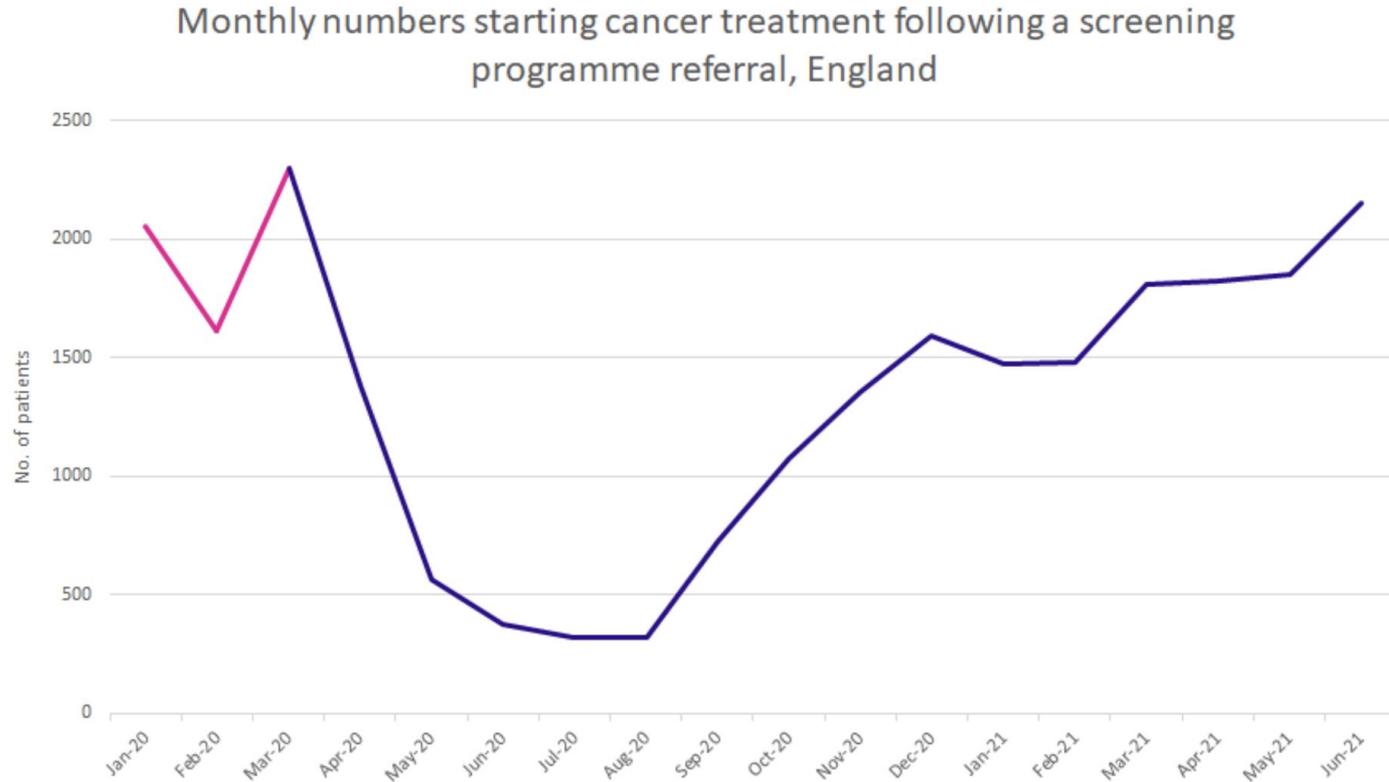
## Three million missed out on cancer checks after coronavirus put screening on hold

VIEW COMMENTS



Delay: NHS figures show 31,000 fewer patients started treatment for cancer between April and July this year / PA Wire/PA Images

# 42% fewer patients started cancer treatment following screening in April 2020 - March 2021 compared to pre-pandemic



## Nearly 11,000 people in Britain could be living with undiagnosed breast cancer due to Covid upheaval

In worst cases some women could die due to having their cancer diagnosis postponed

Maya Oppenheim Women's Correspondent | @mayaoppenheim | 1 day ago | comments



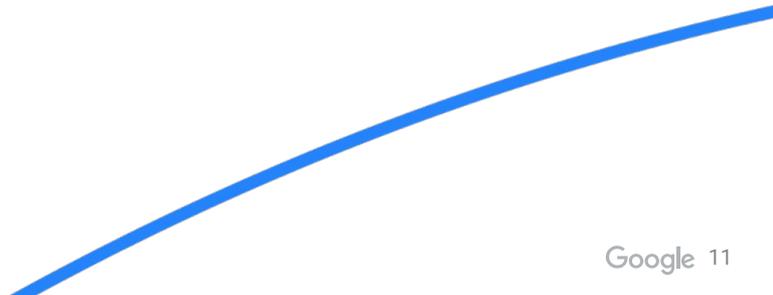
## U.K. staffing crisis deepens, RCR asserts

By Philip Ward, AuntMinnieEurope.com staff writer

April 21, 2020 -- Workforce shortages in clinical radiology are increasing year-on-year, resulting in delayed diagnoses and lower-quality patient care, according to the latest annual census from the U.K. Royal College of Radiologists (RCR). Shortages of interventional and breast radiologists are an area of particular concern.

It warned of a forthcoming "perfect storm", with health workers in imaging and diagnostic services under unprecedented pressure due to the pandemic, having already been "chronically under-resourced" beforehand.

Breast Cancer Now, March 2021



How can artificial  
intelligence help deliver  
better healthcare?

# Clinical applications of AI to deliver better healthcare

1

## Improve accuracy / efficiency

Faster, cheaper, higher quality care through use of AI-enabled tools in screening and diagnostic pathways

2

## Enable new models of care

Bring care closer to the patient, with faster feedback loops, and easier adherence to onward investigations and treatment.

3

## Personalised screening

Maximising the efficiency of healthcare by prioritising our limited resources to those who are at highest risk.

# Clinical applications of AI to deliver better healthcare

1

## Improve accuracy / efficiency

Faster, cheaper, higher quality care through use of AI-enabled tools in screening and diagnostic pathways

2

## Enable new models of care

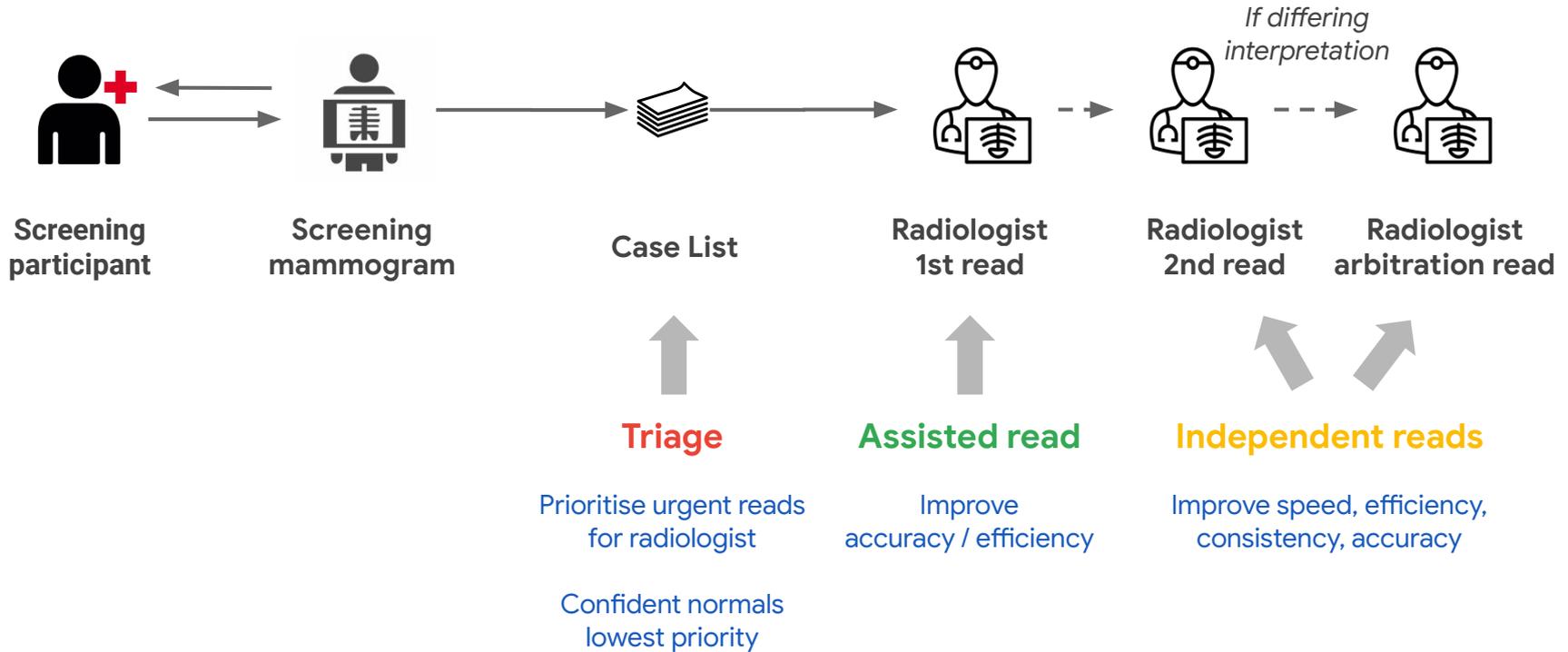
Bring care closer to the patient, with faster feedback loops, and easier adherence to onward investigations and treatment.

3

## Personalised screening

Maximising the efficiency of healthcare by prioritising our limited resources to those who are at highest risk.

# Improving efficiency in breast cancer screening using AI



# Clinical applications of AI to deliver better healthcare

1

## Improve accuracy / efficiency

Faster, cheaper, higher quality care through use of AI-enabled tools in screening and diagnostic pathways

2

## Enable new models of care

Bring care closer to the patient, with faster feedback loops, and easier adherence to onward investigations and treatment.

3

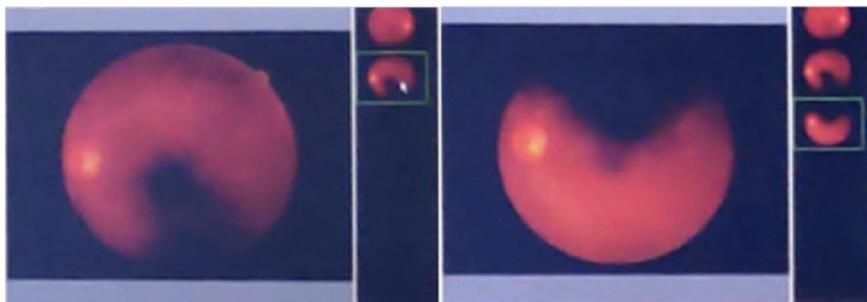
## Personalised screening

Maximising the efficiency of healthcare by prioritising the resources to those who are at highest risk.

# AI-enabled models of care to increase access to screening

Can we use AI to provide instantaneous decisions with expert-level accuracy into national screening programmes?

2020: it's harder than we anticipated...



**Figure 5. A nurse attempts to form a composite image of one eye by taking two images of the same eye, with varied lighting.**





# Same-visit results boost adherence rates & health equity

Redesigning clinical pathways for immediate diabetic retinopathy screening results in greater adherence among patients who need to see a specialist

**35%**

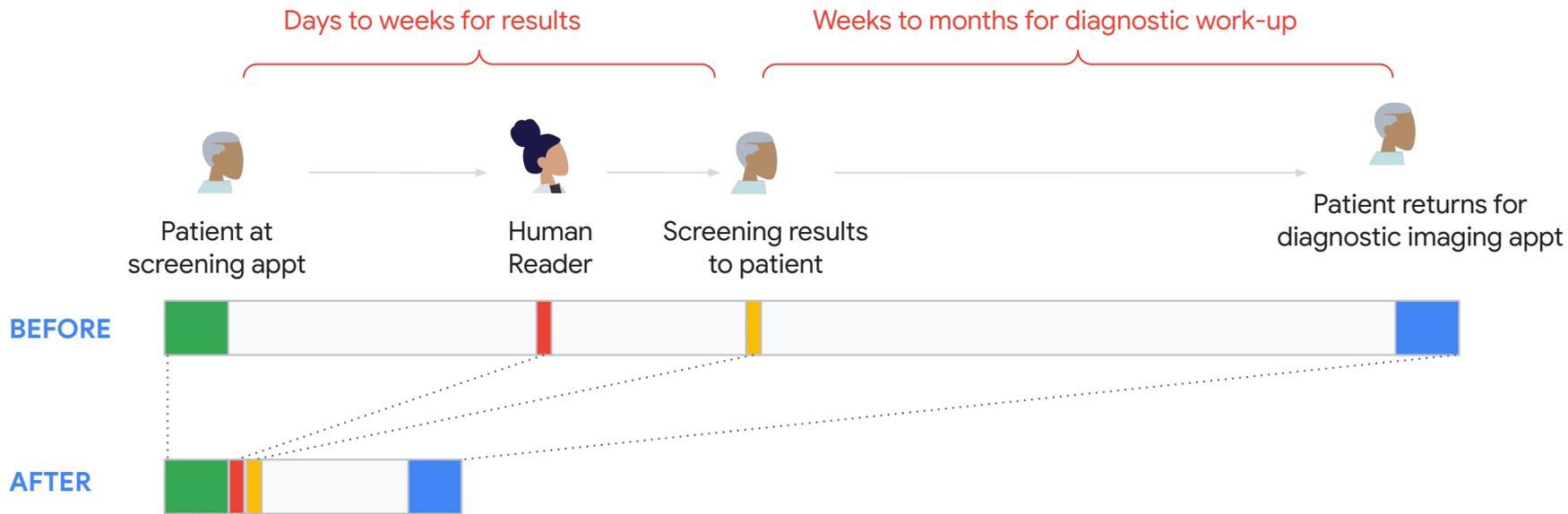
Pre-intervention  
follow-up rate

**72%**

Post-intervention  
follow-up rate

Pedersen et al, NEJM Catalyst, Vol. 2 No. 8, August 2021

# Realtime results for breast cancer screening



Abnormal studies flagged for rapid review. Screening results returned **realtime** and **same-visit** diagnostic work-up offered

<https://blog.google/technology/health/artificial-intelligence/e-breast-cancer-screening/>

# Clinical applications of AI to deliver better healthcare

1

## Improve accuracy / efficiency

Faster, cheaper, higher quality care through use of AI-enabled tools in screening and diagnostic pathways

2

## Enable new models of care

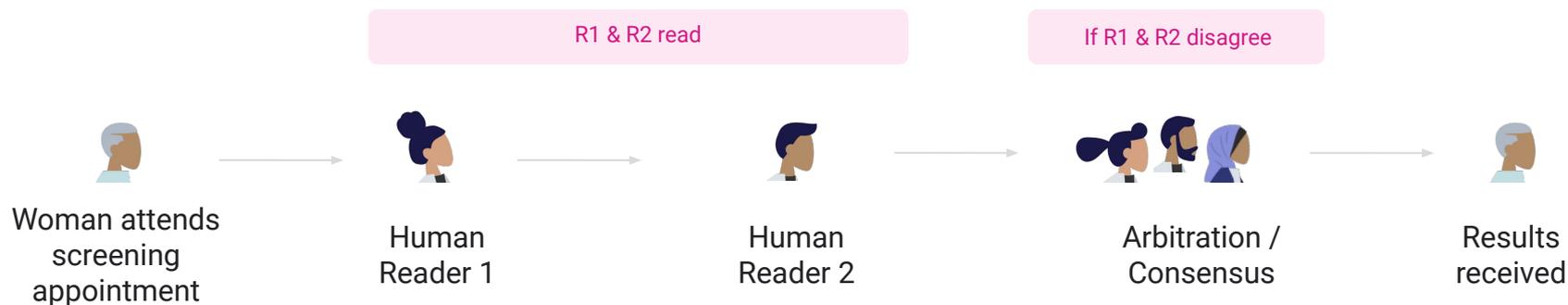
Bring care closer to the patient, with faster feedback loops, and easier adherence to onward investigations and treatment.

3

## Personalised screening

Maximising the efficiency of healthcare by prioritising the resources to those who are at highest risk.

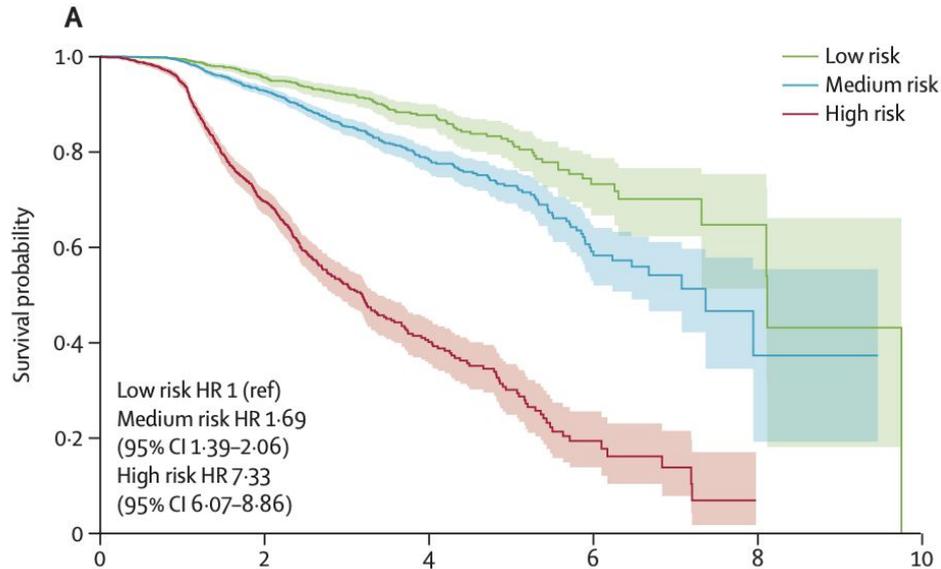
# We screen for breast cancer every 3 years in the UK



Could we use risk calculated by AI tools to optimise screening intervals?

Could we ease the backlog, starting with those at greatest risk?

# Diabetic retinopathy progression risk score could help focus screening on those at highest risk



Early results with our DR progression risk model suggest that we can get **~85%** of those who progress even at **50%** screening capacity

# Artificial intelligence has the potential to deliver better healthcare in many different ways

1

## Improve accuracy / efficiency

Faster, cheaper, higher quality care through use of AI-enabled tools in screening and diagnostic pathways

2

## Enable new models of care

Bring care closer to the patient, with faster feedback loops, and easier adherence to onward investigations and treatment.

3

## Personalised screening

Maximising the efficiency of healthcare by prioritising the resources to those who are at highest risk.

# Thank you

[cjkelly@google.com](mailto:cjkelly@google.com)

Google Health