

Transforming Clinical Research with Federated AI

Blaise Thomson - May 2023

The problem:
Clinical research is unable to leverage
data and AI because of privacy concerns

An example - Clinical trial recruitment



Patients are missing out on potentially life saving drugs



50% of sites enrol ≤ 1 patient¹



Up to \$8m lost revenue per day of delay for pharma¹



Pre-screening takes significant time and effort



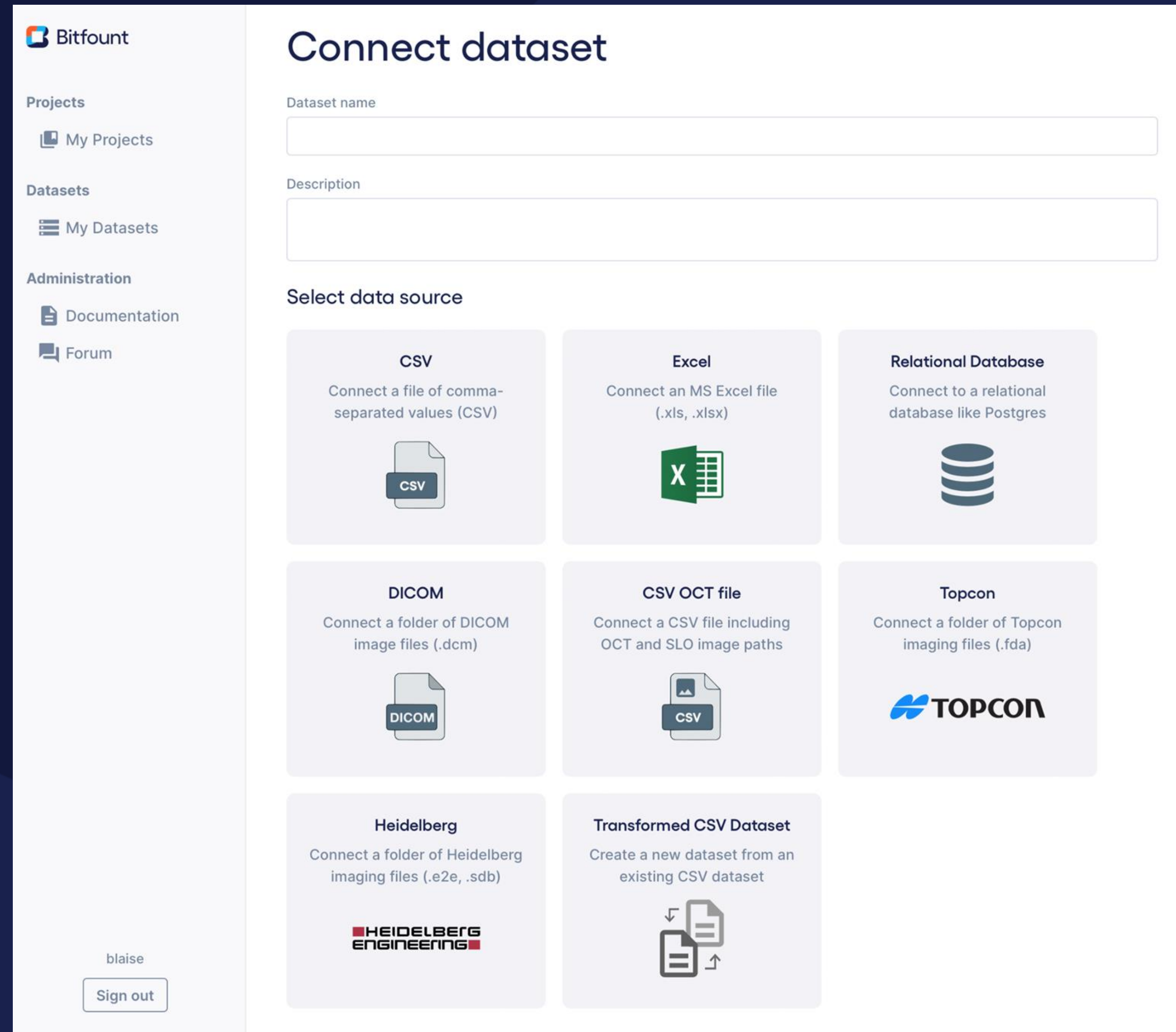
Clinicians have to remember which trials are running and complex recruitment criteria



Bitfount's solution:
An app for clinicians that makes using
AI (on private data) easy

Bitfount Clinician App

- Clinicians connect the Bitfount app to their local data
- Support for image standards like DICOM, or proprietary like Heidelberg, Topcon
- Tabular data connected via CSV or SQL
- Data is connected, but never leaves the site!



The screenshot shows the Bitfount web interface for connecting a dataset. On the left is a sidebar with navigation options: Projects (My Projects), Datasets (My Datasets), and Administration (Documentation, Forum). The main area is titled 'Connect dataset' and contains a form for 'Dataset name' and 'Description'. Below the form is a 'Select data source' section with nine options:

- CSV**: Connect a file of comma-separated values (CSV). Icon: CSV file.
- Excel**: Connect an MS Excel file (.xls, .xlsx). Icon: Excel spreadsheet.
- Relational Database**: Connect to a relational database like Postgres. Icon: Database cylinder.
- DICOM**: Connect a folder of DICOM image files (.dcm). Icon: DICOM file.
- CSV OCT file**: Connect a CSV file including OCT and SLO image paths. Icon: CSV file with image.
- Topcon**: Connect a folder of Topcon imaging files (.fda). Icon: TOPCON logo.
- Heidelberg**: Connect a folder of Heidelberg imaging files (.e2e, .sdb). Icon: HEIDELBERG ENGINEERING logo.
- Transformed CSV Dataset**: Create a new dataset from an existing CSV dataset. Icon: CSV file with arrows.

At the bottom left of the sidebar, the user name 'blaise' and a 'Sign out' button are visible.

Bitfount Clinician App

- When running AI, a report is generated to show the model's outputs
- No health data leaves the site

Bitfount

ace & tate
johnsmith

Projects

My datasets

Settings

Projects > Geographic Atropy Segmentation and Quantification > Task Results > 005536

Patient 005536 OCT Report

Laterality Left	Manufacturer Heidelberg Engineering / Spectralis	
GA Area (1mm) 1.6mm ²	Fluid Volume (1mm) 200mm ³	
Patient Name Joe Bloggs	Date of Scan 21/06/2021	
Date of Analysis 29/09/2022	Clinician Email john@smiths.com	

PRD

HTR

RPE

GA

Geographic Atropy Metrics

Measure	Area (3mm)	Area (6mm)
Hypertransmission (HTR)	0.6mm ²	0.8mm ²
Photoreceptor Degeneration	0.4mm ²	0.7mm ²
RPE loss	1.2mm ²	1.4mm ²
Geographic Atropy (GA)	1.6mm ²	2.3mm ²

Fluid Metrics

Measure	Vol (3mm)	Vol (6mm)
IRF	0mm ³	0mm ³
SRF	0mm ³	0mm ³
RPE	0mm ³	0mm ³
PRD	0mm ³	0mm ³

Sign out

Value

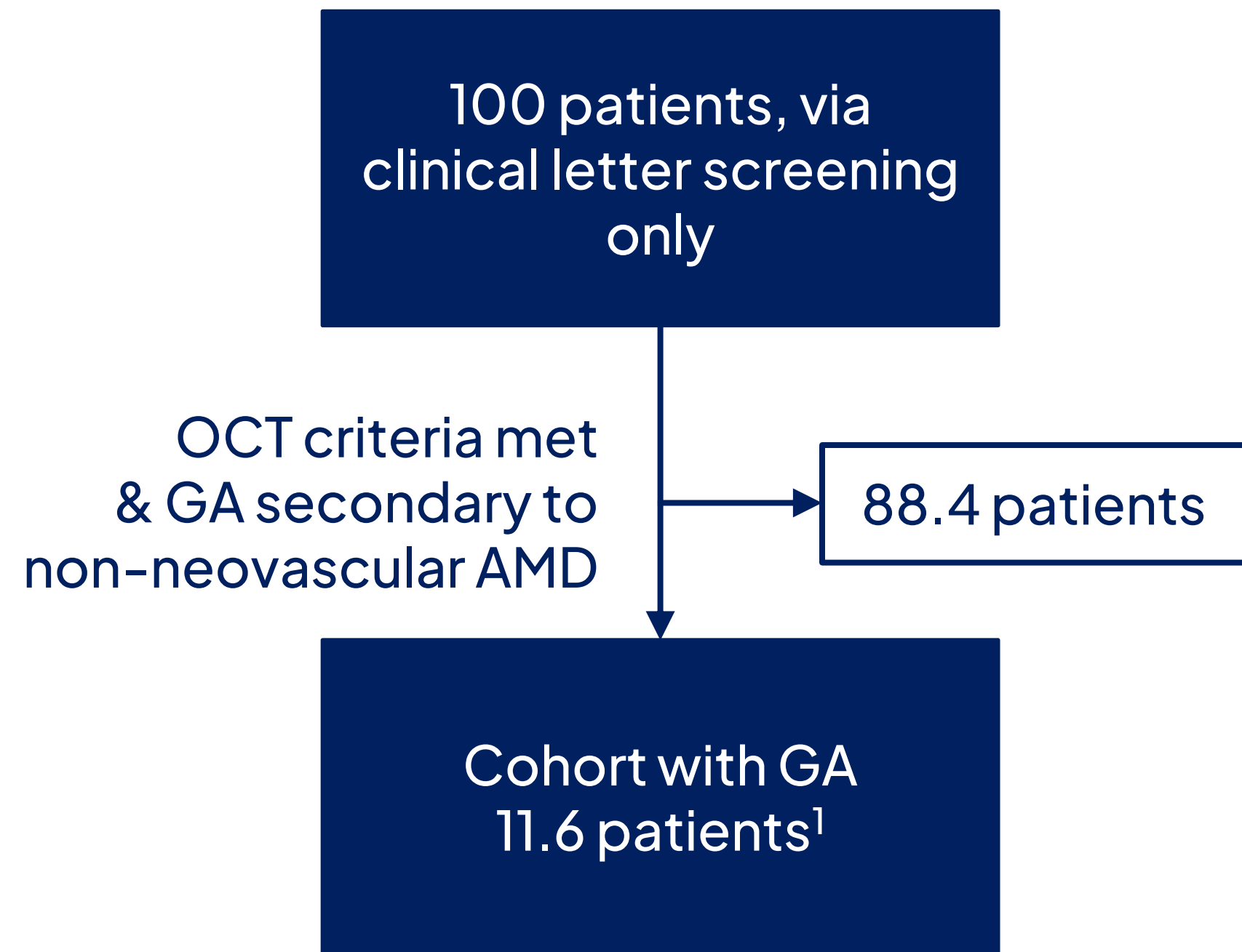
1. Find more
patients for trials
faster

2. Facilitate
collaborative
research

3. Many more...

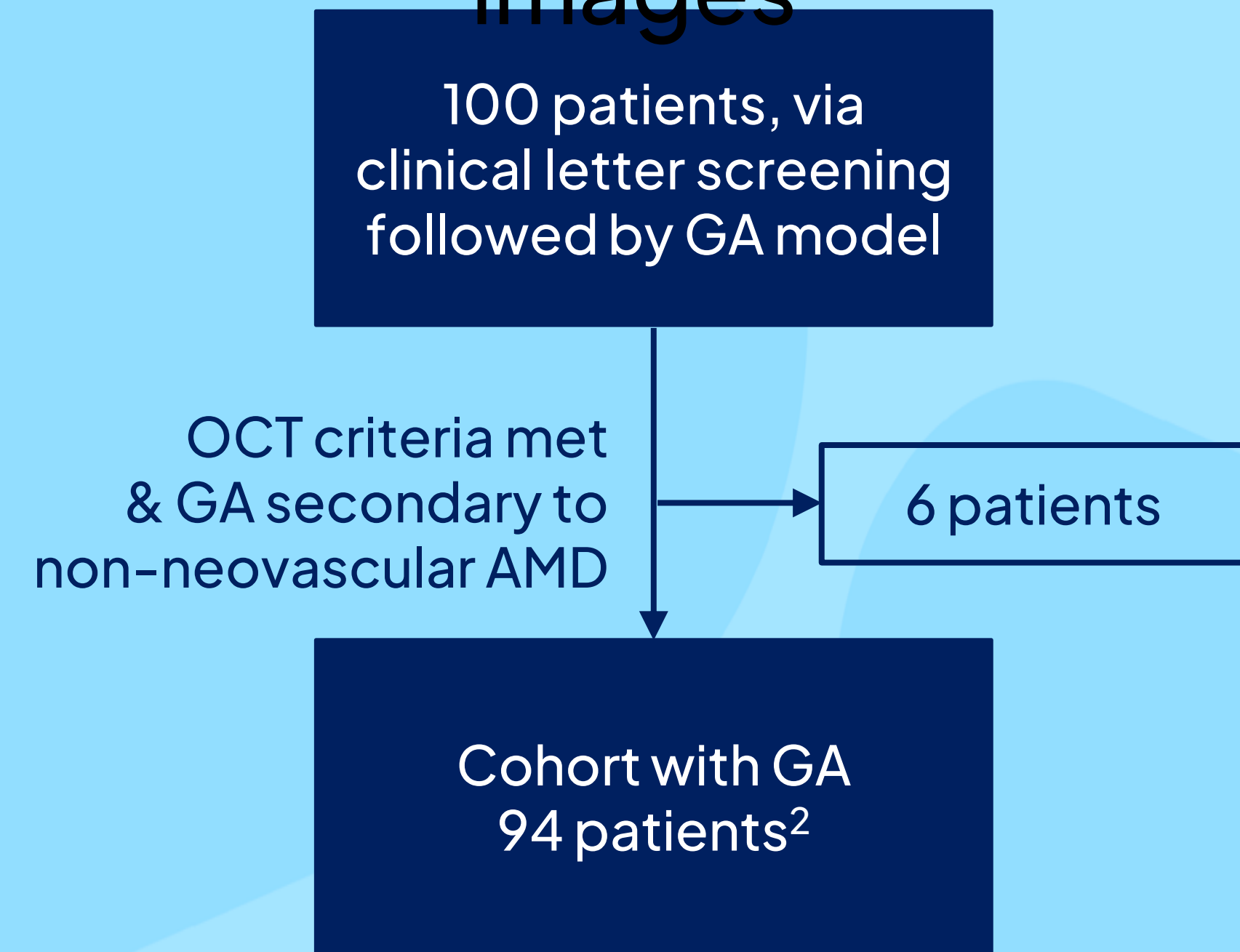
Benefit 1: Improved clinical trials

Only using EHR



8.6 patients pre-screened by clinician per eligible participant

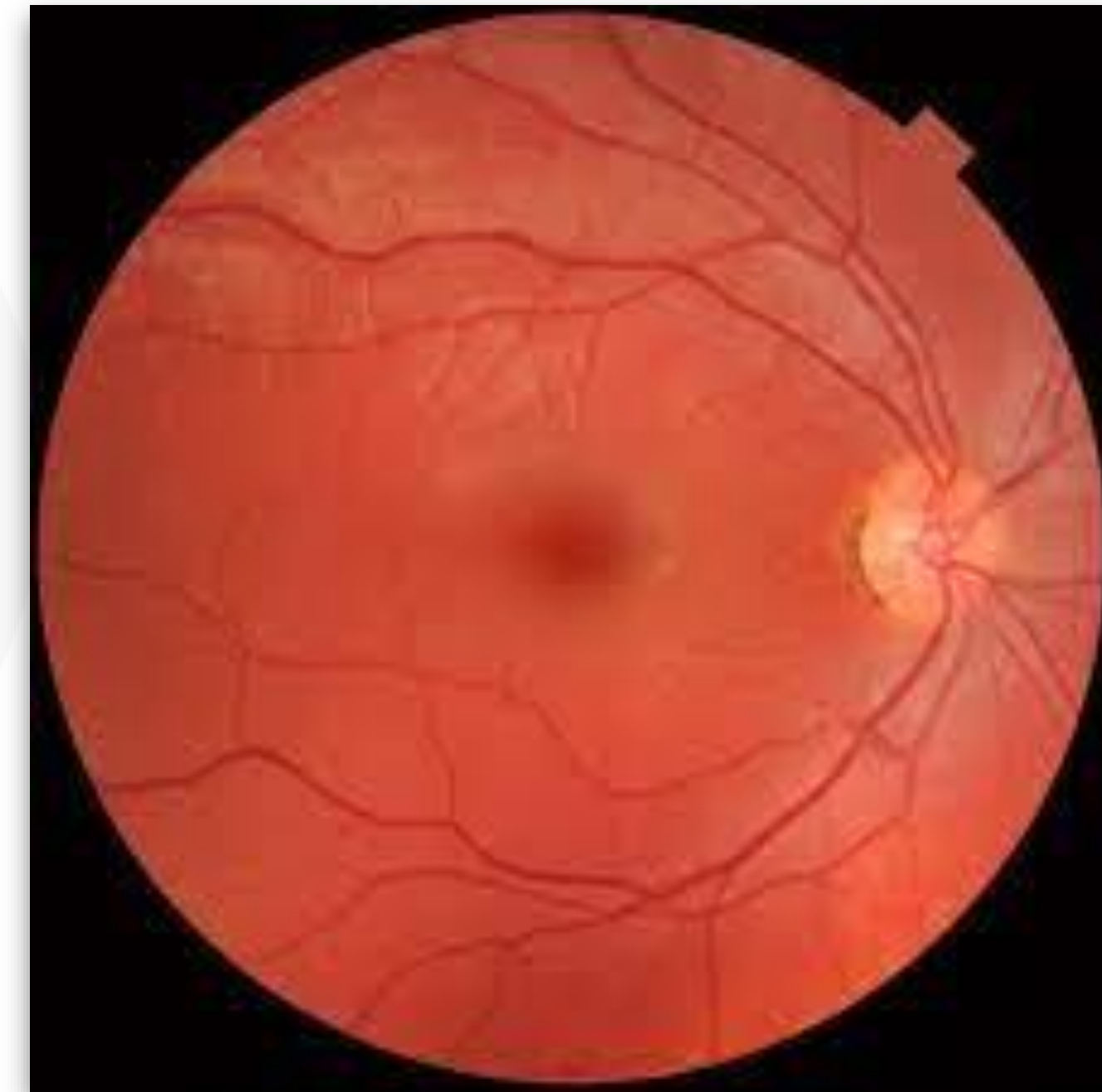
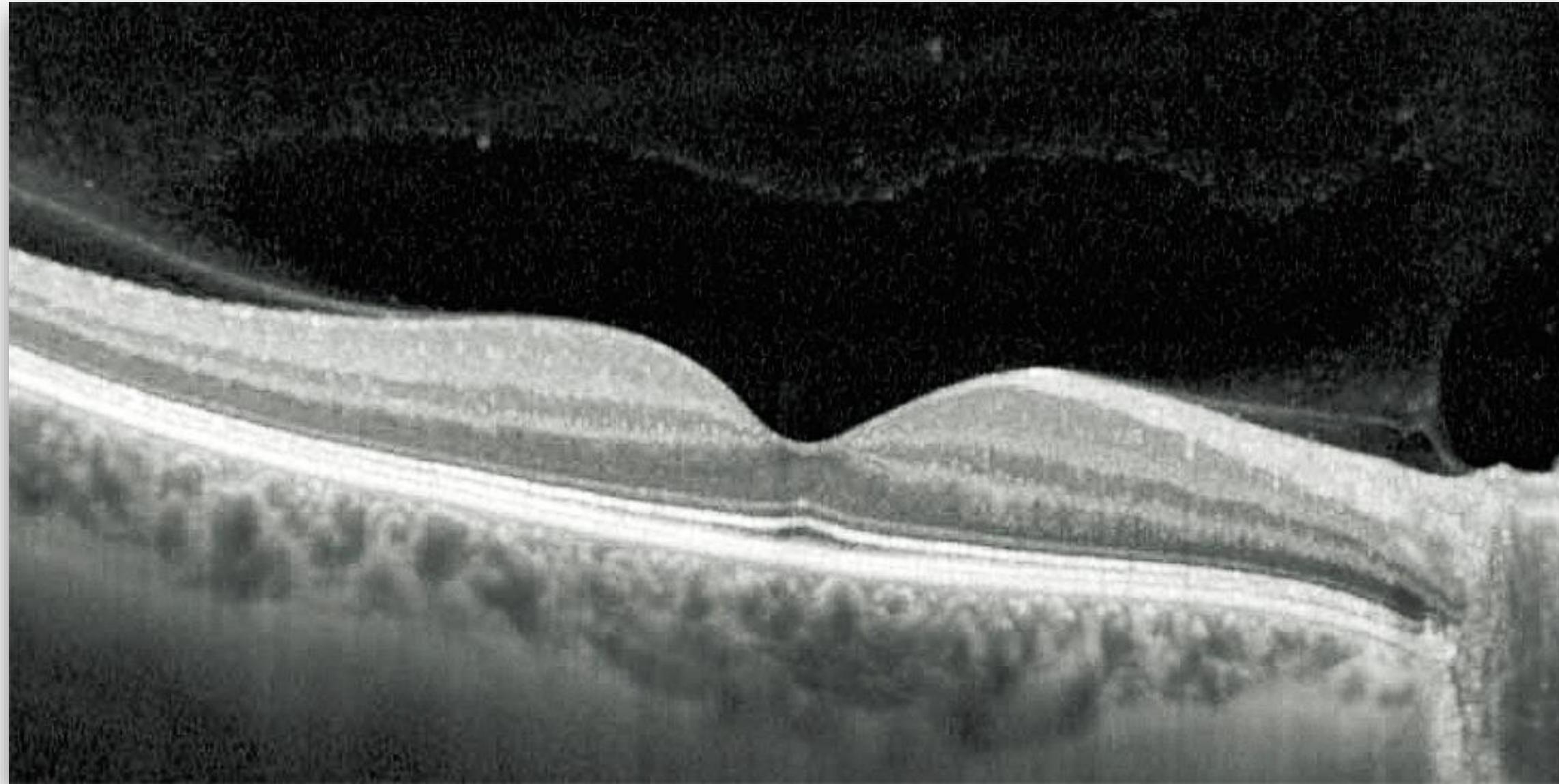
Using GA model on images



1.06 patients pre-screened by clinician per eligible participant

87.8% reduction in clinician pre-screening costs

1. Calculated as $177 / 374 * 3,512 / 14,301$ based on <https://www.nature.com/articles/s41598-022-19413-z>
2. Calculated from [https://www.thelancet.com/journals/landig/article/PIIS2589-7500\(21\)00134-5/fulltext](https://www.thelancet.com/journals/landig/article/PIIS2589-7500(21)00134-5/fulltext)



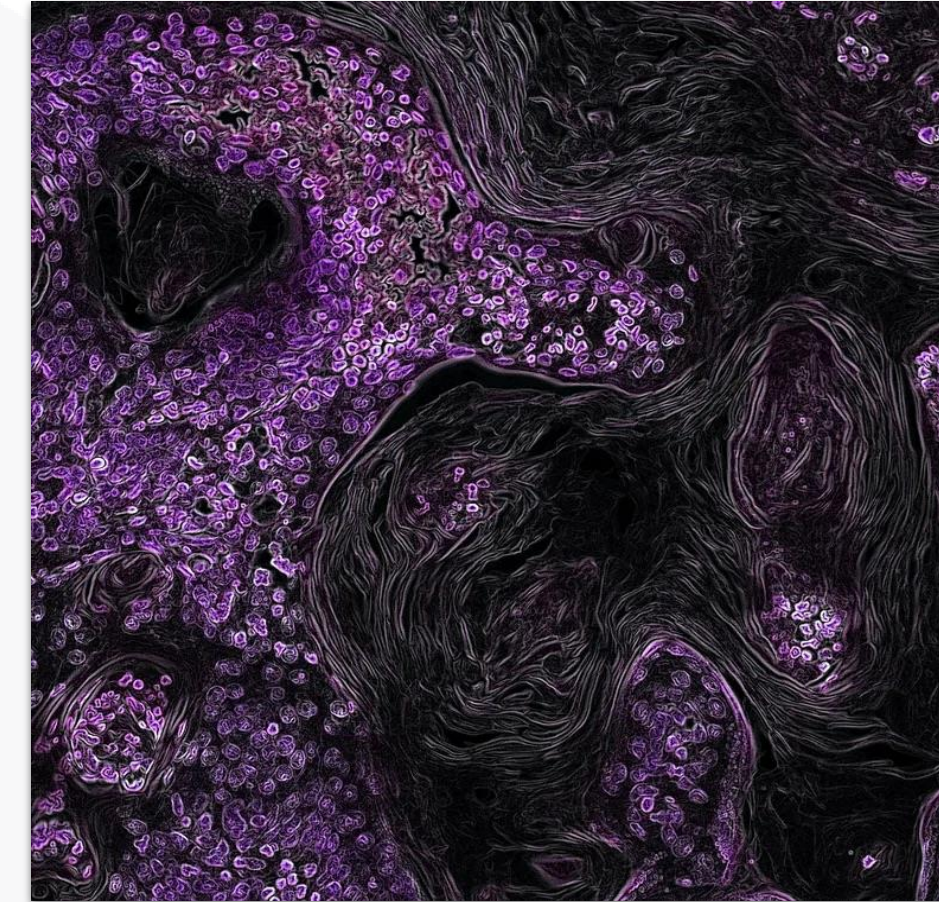
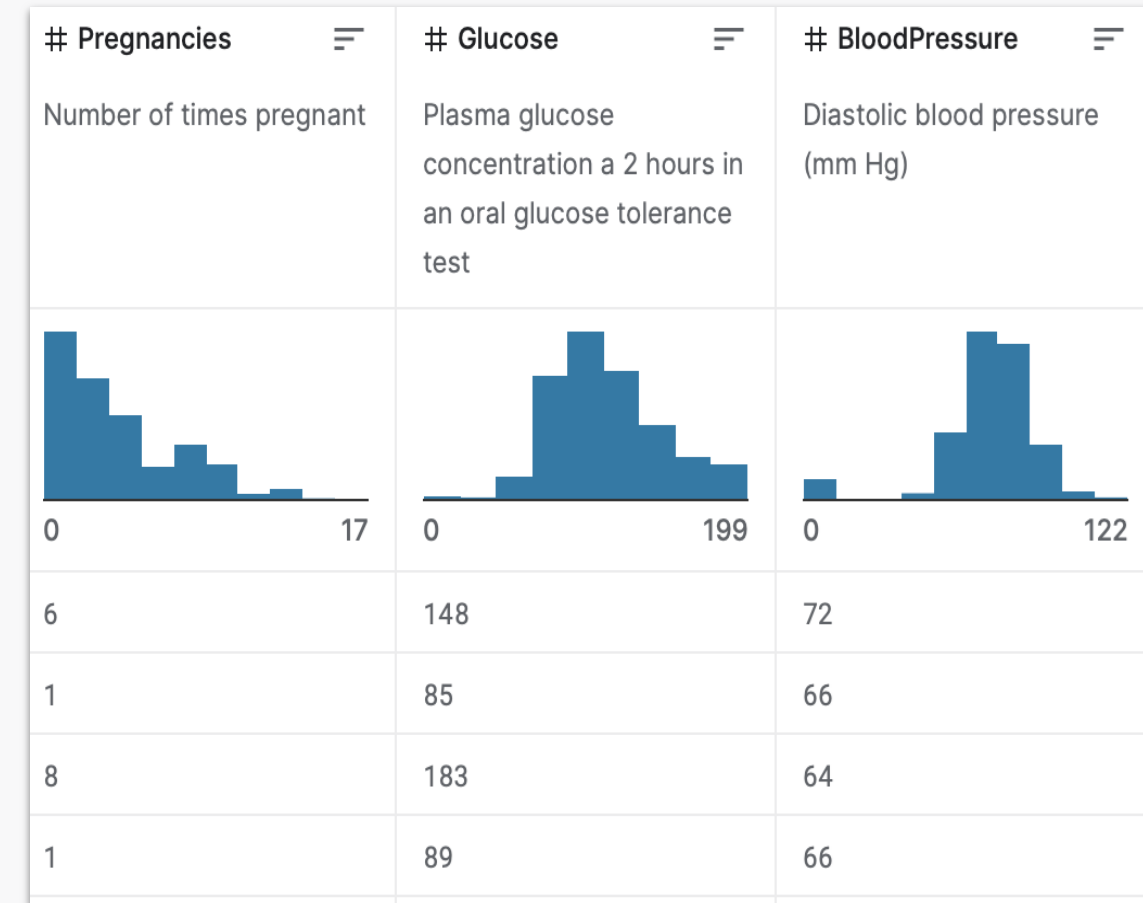
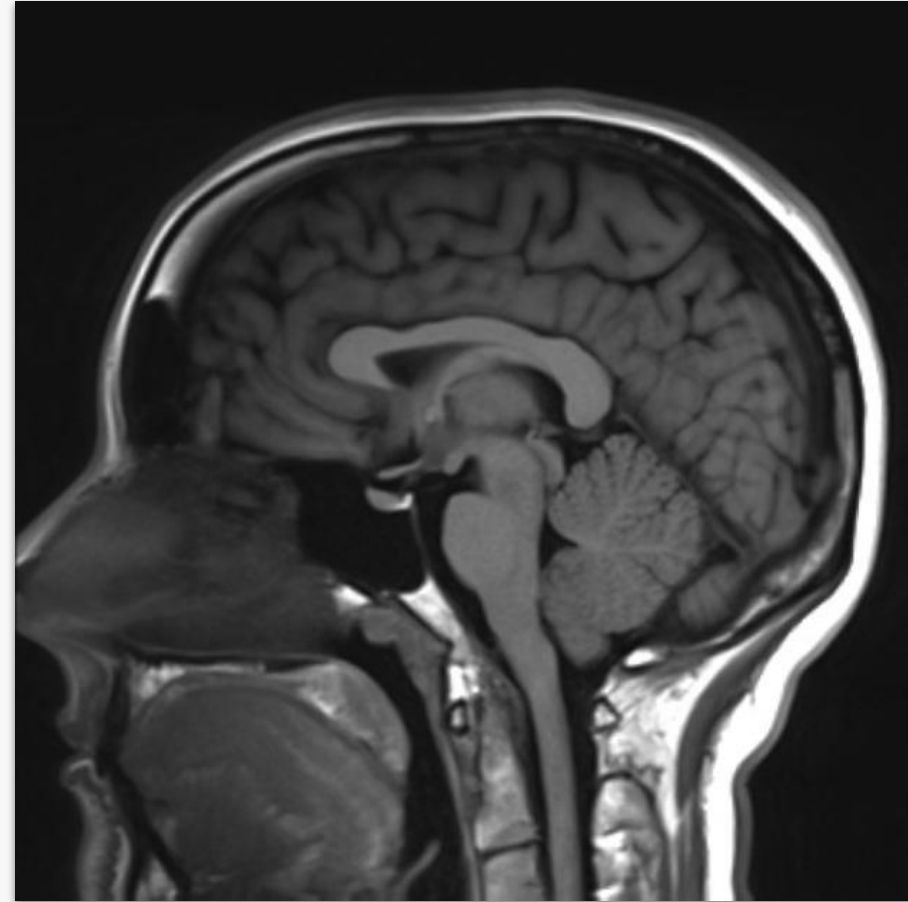
An example experimental setup (Retinal OCT Kaggle)

Task: Detect eye disease (Drusen, CNV, DME) from images (OCT)
... split into different sets with different distributions of disease

Benefit 2: Error rates

Training Setup	Test on Mostly Drusen	Test on Mostly DME	Test on Mostly CNV
Train on Mostly Drusen	5.3%	7.9%	11.4%
Train on Mostly DME	11.1%	5.1%	9.5%
Train on Mostly CNV	14.5%	8.9%	5.2%
Federated Learning	4.6%	3.9%	3.1%
% Error Reduction on matched data	13%	24%	40%

Benefit 3: Many more



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